# Mariana Islands Training and Testing

## Draft Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement

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**March 2026**

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| **Lead Agency:** | United States Department of the Navy |
| **Joint Lead Agencies:** | United States Air Force, United States Army, United States Coast Guard |
| **Cooperating Agency:** | National Marine Fisheries Service |
| **Title of the Proposed Action:** | Mariana Islands Training and Testing |

## Abstract

The United States Department of the Navy (Navy) (including both the U.S. Navy and the U.S. Marine Corps) jointly with the U.S. Air Force, U.S. Army, and U.S. Coast Guard (collectively referred to as the Action Proponents) prepared this Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (SEIS/OEIS) to comply with the National Environmental Policy Act and Executive Order 12114. This SEIS/OEIS evaluates the potential environmental impacts of conducting training, testing, and range modernization and sustainment activities (referred to as military readiness activities) in the Mariana Islands Training and Testing Study Area (Study Area). The Study Area includes the at-sea areas of the Mariana Islands Range Complex (MIRC); additional areas on the high seas north and west of the MIRC; the transit corridor between the MIRC and the Hawaii Range Complex; pierside locations on Guam in Apra Harbor; nearshore areas of Guam and the Commonwealth of the Northern Mariana Islands; and the land-based training area on Farallon de Medinilla. This SEIS/OEIS analyzes three alternatives:

- Under the No Action Alternative, the Action Proponents would not conduct the military readiness activities associated with the Proposed Action within the Study Area.
- Alternative 1 (Preferred Alternative) reflects a representative level of training, testing, and range modernization and sustainment activities to account for the fluctuation of training and testing cycles and deployment schedules that generally limit the maximum level of activities from occurring year after year in any seven-year period.
- Alternative 2 reflects the maximum number of training, testing, and range modernization and sustainment activities that could occur within a given year and assumes that the maximum level of activity would occur every year over a seven-year period. This allows for the greatest flexibility for the Action Proponents to maintain readiness.

The resources evaluated include sediments and water quality, air resources, marine habitats, marine mammals, sea turtles, sea birds, marine vegetation, marine invertebrates, fishes, terrestrial species and habitats, cultural resources, socioeconomic resources, and public health and safety.

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# Executive Summary

## ES.1 Introduction

The United States (U.S.) Department of the Navy (Navy) (including both the U.S. Navy and the U.S. Marine Corps) jointly with the U.S. Air Force, U.S. Army, and U.S. Coast Guard , has prepared this Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (SEIS/OEIS) pursuant to the National Environmental Policy Act (NEPA) and the Department of Defense Implementing Procedures. For this SEIS/OEIS, Action Proponents within the Navy include Commander, U.S. Pacific Fleet, the U.S. Marine Corps, Naval Air Systems Command, Naval Sea Systems Command, and the Office of Naval Research. As the lead federal agency, the Navy has coordinated closely with the joint lead agencies, and any commitments made in this SEIS/OEIS are applicable to the joint lead agencies.

### ES.1.1 Proposed Action

The Proposed Action is to continue military readiness activities, comprised of training, testing, and modernization and sustainment in the Mariana Islands Training and Testing (MITT) Study Area, as represented in Figure ES-1. The National Marine Fisheries Service's (NMFS') Proposed Action is to promulgate regulations and issue a Letter of Authorization under the Marine Mammal Protection Act (MMPA) authorizing take of marine mammals incidental to proposed military readiness activities.

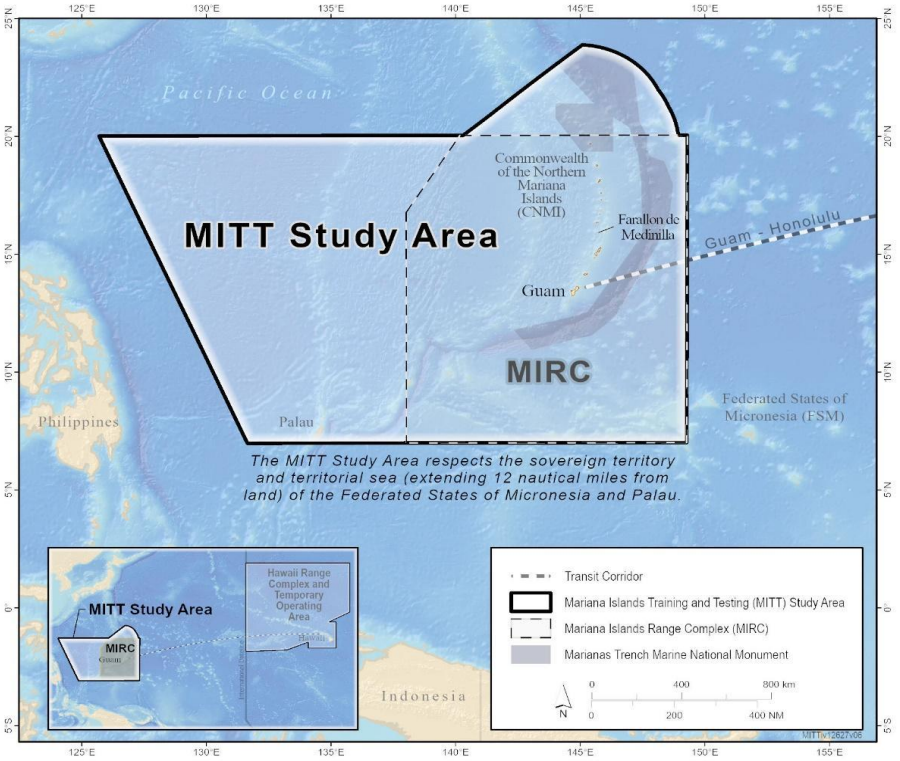


**Figure ES-1: Mariana Islands Training and Testing Study Area**

### ES.1.2 Purpose and Need

The purpose of the Proposed Action is to conduct military readiness activities within the MITT Study Area to ensure the Action Proponents are organized, trained, and equipped to meet their Congressionally mandated national defense missions (10 United States Code [U.S.C.] sections 7062, 8062, 8063, 9062; 14 U.S.C. sections 101, 102). In alignment with the National Defense Strategy, these activities are essential for maintaining a continuous presence in the Indo-Pacific and ensuring U.S. forces can respond to contingencies ranging from humanitarian assistance to armed conflict.

The need for the Proposed Action is driven by the requirement for realistic training and rigorous testing in a marine environment. The MITT Study Area—incorporating the Mariana Islands Range Complex—provides the unique sea space, airspace, and island infrastructure necessary for joint and combined activities in the Western Pacific. This SEIS/OEIS builds upon the foundational analysis of the MITT 2015 EIS/OEIS and 2020 SEIS/OEIS to ensure personnel remain proficient in current tactics and advanced technological systems.

Complementary to the Action Proponents' mission, NMFS must render a decision on the request for reauthorization of marine mammal "takes" under the MMPA (16 U.S.C. section 1371(a)(5)(A)). The purpose of NMFS' action is to evaluate whether the proposed activities meet statutory mandates for mitigation and monitoring. This document analyzes the efficacy and practicability of mitigation measures to support the requirements of a potential Incidental Take Authorization.

## ES.2 Scope And Content of the Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

The Action Proponents analyzed military readiness activities that could potentially impact human (e.g., socioeconomic) and natural resources, including marine mammals, sea turtles, and fishes, and other marine and human resources. The range of alternatives includes the No Action Alternative and two action alternatives. In this SEIS/OEIS, the Action Proponents revaluated potential effects, only carrying forward those stressors that are reasonably foreseeable and sufficiently likely to occur such that a person or ordinary prudence would take it into account in reaching a decision. This SEIS/OEIS supplements from prior 2015 and 2020 MITT documents to focus analysis on changes to effects on stressors from continuing activities (both which may increase or decrease) as per Executive Order 12114 and, more specifically, new activities that require authorization to take marine mammals.

## ES.3 Proposed Action and Alternatives

As the lead agency, the Navy proposes to continue military readiness activities in the Study Area. Military readiness activities prepare the Action Proponents to fulfill their missions to protect and defend the United States and its allies but have the potential to affect the environment. Proposed activities remain fundamentally consistent with at-sea and Farallon de Medinilla activities analyzed in both the 2015 EIS/OEIS and 2020 SEIS/OEIS and are representative of activities that the Action Proponents have conducted off Guam and the Commonwealth of the Northern Mariana Islands for decades. This SEIS/OEIS updates the types, frequency, duration, and intensity of military readiness activities from previous MITT documents.

### ES.3.1 No Action Alternative

Under the No Action Alternative, the Action Proponents would not conduct the proposed training and testing activities or the modernization and sustainment in the Study Area. The No Action Alternative is inherently unreasonable in that it does not meet the purpose and need. However, the No Action Alternative is carried forward to serve as a baseline for comparing the potential effects on the action alternatives. For NMFS, denial of the Action Proponent's application for incidental take authorization constitutes the NMFS No Action Alternative.

### ES.3.2 Alternative 1

Alternative 1 is the Preferred Alternative. In addition to implementation of 10 new proposed military readiness activities, Alternative 1 reflects a representative year of training and testing activity that accounts for natural fluctuations in deployment schedules and testing programs. The majority of training and testing activities that would be conducted are the same as, or similar to, those conducted currently or in the past.

### ES.3.3 Alternative 2

Similar to Alternative 1, Alternative 2 encompasses both new and ongoing activities but assumes a higher annual tempo of systems evaluation to meet the highest levels of military readiness activities. Alternative 2 reflects the maximum number of training activities that could occur within a given year and assumes the maximum level of activity would occur every year over a seven-year period.

## ES.4 Summary of Environmental Effects

Environmental effects which might result from implementing the Proposed Action or alternatives have been analyzed in this SEIS/OEIS. Resource areas analyzed include sediments and water quality, air resources, marine habitats, marine mammals, sea turtles, seabirds, marine vegetation, marine invertebrates, fishes, terrestrial species and habitats, cultural resources, socioeconomic resources, and public health and safety. Table ES-1 provides a comparison of the potential environmental impacts of the No Action Alternative, Alternative 1 (Preferred Alternative), and Alternative 2.

## ES.5 Mitigation

For over two decades, the Action Proponents have mitigated the environmental impacts of military readiness activities through a comprehensive suite of activity-based and geographic measures. These protections, detailed in Chapter 4, are designed to reduce the overlap between stressors—such as acoustic, explosive, and physical disturbance and strike—and sensitive marine species, specifically aiming to prevent injury to marine mammals and sea turtles.

Activity-based measures utilize observational mitigation zones to protect species in real-time during training and testing activities. These protocols, specified in Tables 4.6-1 through 4.6-4, include requirements for power-downs or shutdowns of active sonar, cease-fire zones for explosive and non-explosive ordnance, and strict vessel following distances. While these measures are fundamentally consistent, they include activity-specific variations to account for different platform configurations and stressor types. Complementing activity-based protocols, the Action Proponents implement year-round and seasonal geographic mitigation areas to protect high-value seafloor habitats and critical biological regions, as detailed in Tables 4.7-1 through 4.7-5. Should national security requirements necessitate an exception to these geographic constraints, a formal approval process through the chain of command and advance notification to NMFS is required.

## Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2

| Stressor | No Action Alternative | Alternative 1 (Preferred Alternative) | Alternative 2 |
|---|---|---|---|
| **Section 3.1 Sediments and Water Quality** | | | |
| Explosives and explosives byproducts/Metals/Chemicals and other materials not associated with explosives | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.1 (Sediments and Water Quality) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from these stressors would not be reasonably foreseeable. | |
| **Section 3.2 Air Resources** | | | |
| Criteria air pollutants | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | The emission of criteria pollutants resulting from activities in the Study Area would not cause a violation or contribute to an ongoing violation of the National Ambient Air Quality Standards. | |
| Hazardous air pollutants | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Emissions from the action alternatives would produce ambient hazardous air pollutant effects that are not expected to cause any discernable increase to human health risks from HAP exposure in areas where public presence is expected. | |
| [1]As of April 11, 2025, the Council on Environmental Quality implementing regulations (40 Code of Federal Regulations 1500–1508) for the National Environmental Policy Act (NEPA) 42 United States Code 4321 et seq., are no longer in effect. In light of this change, the Navy's analyses of greenhouse gas emissions are included in this document to comply with applicable federal case law. | | | |
| **Section 3.3 Marine Habitats** | | | |
| Explosives | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Most of the high-explosive MEM would detonate at or near the water surface. Seafloor detonations would be infrequent, and the surface area of bottom substrate affected would be marginal to the total training and testing area available in the Study Area. Any impacts to soft bottom habitat would be temporary to short-term. | |
| Physical Disturbances and Strike | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Most seafloor devices would be placed in areas that would result in minor and temporary bottom substrate effects. Once on the seafloor and over time, MEM would be buried by sediment, corroded from exposure to the marine environment, or colonized by benthic organisms. The surface area of bottom substrate affected over the short term would be a tiny fraction of the total Study Area. | |

**Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (continued)**

| Stressor | No Action Alternative | Alternative 1 (Preferred Alternative) | Alternative 2 |
|---|---|---|---|
| **Section 3.4 Marine Mammals** | | | |
| Acoustics | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Predicted effects from sonars on marine mammals vary depending on the species and stock, but would include auditory injuries, temporary hearing loss, masking, stress, and behavioral responses. Behaviors including communication, foraging, or breeding, are likely to be temporarily disrupted. Individuals or groups may avoid areas around sonar activities and be temporarily displaced from a preferred habitat, and other acoustic stressors such as vessel noise and weapons noise may contribute to behavioral responses. Displacement may be brief or extended during multi-day events. Sensitive species, like beaked whales, may avoid for farther distances and for longer durations. While effects vary for individuals and stocks, the overall degree of effect would be less than significant, because effects are not expected to interfere with biologically important functions such that the continued viability of the population or stock would be threatened. | |
| Explosives | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Effects on individual marine mammals may be permanent (auditory or non-auditory injury) or temporary (temporary hearing loss, masking, stress, or behavioral response). The behavioral patterns of a limited number of individuals may be interrupted. Individuals or groups may temporarily avoid areas where multiple detonations occur. Activities using explosives would be relatively brief and occur over small areas relative to the ranges of most marine mammals. Permanent effects would be present in low enough numbers; total effects (including both temporary and permanent effects) are not expected to interfere with feeding, reproduction, or other biologically important functions such that the continued viability of the population would be threatened. | |
| Energy | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.4 (Marine Mammals) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from energy stressors would not be reasonably foreseeable. | |
| Physical Disturbance and Strike | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | There have been no reported vessel strikes between Navy or U.S. Coast Guard vessels and marine mammals in the Study Area. Since vessel use would remain similar to vessel use over the past decade, the potential for striking a marine mammal remains similarly low. Behavioral reactions by marine mammals to physical disturbances from vessels and in-water devices and MEM would be brief, and could include alerting, temporary change in behavior, or no reaction. Long-term effects on an individual or population are not expected, because occasional responses to physical disturbance would not interfere with feeding, reproduction, or other biologically important functions such that the continued viability of the population | |

**Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (continued)**

| Stressor | No Action Alternative | Alternative 1 (Preferred Alternative) | Alternative 2 |
|---|---|---|---|
| | | would be threatened. Consistent with previous analyses, effects from seafloor devices are not reasonably foreseeable. | |
| Entanglement | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.4 (Marine Mammals) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from entanglement stressors would not be reasonably foreseeable. | |
| Ingestion | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.4 (Marine Mammals) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from ingestion stressors would not be reasonably foreseeable. | |
| Secondary | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.4 (Marine Mammals) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from secondary stressors would not be reasonably foreseeable. | |
| **Section 3.5 Sea Turtles** | | | |
| Acoustics | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Sea turtles could be affected by a limited number of acoustic stressors where frequencies overlap with sea turtles' lower frequency hearing. Exposures to sound-producing activities present risks that could include hearing loss, auditory masking, physiological stress, and changes in behavior; however, no effects from sonars were predicted by the Navy's acoustic effects model. | |
| Explosives | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Explosions close to a sea turtle present a risk because the shock waves produced by explosives could cause injury or mortality. If farther away from the explosion, impulsive, broadband sounds introduced into the marine environment could cause hearing loss, masking, physiological stress, or behavioral responses. The Navy's acoustic effects model predicted 25 auditory and one non-auditory injury to sea turtles per year. | |
| Energy | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.5 (Sea Turtles) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from energy stressors would not be reasonably foreseeable. | |
| Physical Disturbance and Strike | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Vessels and in-water devices present a risk for collision with sea turtles, particularly in coastal areas where densities are higher. Strike potential by expended materials is statistically small. Because of the low numbers of sea turtles potentially affected by activities that may cause a physical disturbance and strike, population-level effects are unlikely. | |
| Entanglement | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.5 (Sea Turtles) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from entanglement stressors would not be reasonably foreseeable. | |

**Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (continued)**

| Stressor | No Action Alternative | Alternative 1 (Preferred Alternative) | Alternative 2 |
|---|---|---|---|
| Ingestion | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.5 (Sea Turtles) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from ingestion stressors would not be reasonably foreseeable. | |
| Secondary | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.5 (Sea Turtles) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from secondary stressors would not be reasonably foreseeable. | |
| **Section 3.6 Seabirds** | | | |
| Acoustics | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Unless very close to an intense sound source, responses by birds to acoustic stressors would likely be limited to short-term behavioral responses. Some birds may be temporarily displaced, and there may be temporary increases in stress levels. Although individual birds may be affected, population-level effects would not occur. | |
| Explosives | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Birds could be exposed to in-air explosions. Sounds generated by most small underwater explosions are unlikely to disturb birds above the water surface. However, if a detonation is sufficiently large or is near the water surface, birds above the water surface could be injured or killed. Detonations in air could injure birds either while in flight or at the water surface. An explosive detonation would likely cause a startle reaction, as the exposure would be brief, and any reactions are expected to be short term. Although a few individuals may experience long-term effects and potential mortality, population-level effects would not occur. | |
| Energy | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.6 (Seabirds) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from energy stressors would not be reasonably foreseeable. | |
| Physical Disturbance and Strike | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.6 (Seabirds) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from physical disturbance and strike stressors would not be reasonably foreseeable. | |
| Entanglement | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Consistent with the analysis presented in Section 3.6 (Seabirds) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from entanglement stressors would not be reasonably foreseeable. | |
| Ingestion | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Consistent with the analysis presented in Section 3.6 (Seabirds) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from ingestion stressors would not be reasonably foreseeable. | |

**Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (continued)**

| Stressor | No Action Alternative | Alternative 1 (Preferred Alternative) | Alternative 2 |
|---|---|---|---|
| Secondary | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.6 (Seabirds) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from secondary stressors would not be reasonably foreseeable. | |
| **Section 3.7 Marine Vegetation** | | | |
| Explosives | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Explosives could affect vegetation by destroying individuals or damaging parts of individuals; however, there would be no persistent or large-scale effects on the growth, survival, distribution, or structure of vegetation, primarily due to the avoidance of sensitive habitats and recovery of relatively small areas of disturbed vegetation. | |
| Physical Disturbance and Strike | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Physical disturbance and strike could affect vegetation by destroying individuals or damaging parts of individuals; however, there would be no persistent or large-scale effects on the growth, survival, distribution, or structure of vegetation. | |
| Secondary | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.7 (Marine Vegetation) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from secondary stressors would not be reasonably foreseeable. | |
| **Section 3.8 Marine Invertebrates** | | | |
| Acoustics | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.8 (Marine Invertebrates) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from acoustic stressors would not be reasonably foreseeable. | |
| Explosives | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Explosives produce pressure waves that can harm invertebrates in the vicinity of where they typically occur; mostly offshore surface waters where zooplankton, squid, and jellyfish are prevalent mostly at night when military readiness activities with explosives do not typically occur. Invertebrate populations are generally smaller offshore than inshore due to the scarcity of habitat structure and comparatively lower nutrient levels. | |
| Physical Disturbance and Strike | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Most risk exists offshore where invertebrates are less abundant and near the surface during the day when actions are typically occurring, there is more interaction risk, but to smaller populations of invertebrates. Invertebrate communities in affected soft bottom areas are naturally resilient to occasional disturbances. Accordingly, population-level effects are unlikely. | |

**Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (continued)**

| Stressor | No Action Alternative | Alternative 1 (Preferred Alternative) | Alternative 2 |
|---|---|---|---|
| Entanglement | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.8 (Marine Invertebrates) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from entanglement stressors would not be reasonably foreseeable. | |
| Ingestion | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.8 (Marine Invertebrates) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from ingestion stressors would not be reasonably foreseeable. | |
| Secondary | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Secondary or indirect effects on marine invertebrates via habitat (e.g., sediment, and water quality) and prey availability could come from (1) explosives and explosion byproducts; (2) metals; (3) chemicals; and (4) other materials such as targets, chaff, and plastics. Effects on sediments and water quality (Section 3.1) were determined to not be reasonably foreseeable and therefore would not indirectly affects marine invertebrates. | |
| **Section 3.9 Fishes** | | | |
| Acoustics | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Some sonar, vessel and weapons noise could result in masking, physiological responses, or behavioral reactions. Aircraft noise would not likely result in effects other than brief, mild behavioral responses in fish that are close to the surface. Most effects are expected to be temporary and infrequent as most activities involving acoustic stressors would be temporary, localized, and infrequent resulting in short-term and mild to moderate effects. More severe effects (e.g., mortality) could lead to permanent effects for individuals but, overall, long-term consequences for fish populations are not expected. | |
| Explosives | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Sound and energy from explosions can cause mortality, injury, hearing loss, masking, physiological stress, or behavioral responses. The time scale of individual explosions is very limited and repeated exposure of individuals is unlikely. Most effects such as hearing loss or behavioral responses are expected to be short term and localized. More severe effects (e.g., mortality) could lead to permanent effects for individuals but, overall, long-term consequences for fish populations are not expected. | |
| Energy | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Consistent with the analysis presented in Section 3.9 (Fishes) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from energy stressors would have reasonably foreseeable effects on fishes, but the degree of the effects would be less than significant. This is primarily because electromagnetic components of these activities are limited to simulating the electromagnetic signature of a vessel as it passes through the water and the electromagnetic signal is temporary, covering only a small spatial range during each activity in the Study Area. | |

**Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (continued)**

| Stressor | No Action Alternative | Alternative 1 (Preferred Alternative) | Alternative 2 |
|---|---|---|---|
| Physical Disturbance and Strike | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | The use of vessels, in-water devices, MEM, and seafloor devices poses a risk for collision, stress response, or effects caused by sediment disturbance, particularly near coastal areas and bathymetric features where fish densities are higher. Most fish are mobile and have sensory capabilities that enable them to detect and avoid vessels and other items. | |
| Entanglement | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.9 (Fishes) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from entanglement stressors would not be reasonably foreseeable. | |
| Ingestion | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Consistent with the analysis presented in Section 3.9 (Fishes) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from ingestion stressors would have reasonably foreseeable effects on fishes, but the degree of the effects would be less than significant. This is because the likelihood of ingestion is low based on the dispersed nature of the materials and the limited exposure of those items at the surface/water column or seafloor and if ingested, a fish would temporarily take the expended material into its mouth, then spit it out. | |
| Secondary | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.9 (Fishes) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from secondary stressors would not be reasonably foreseeable. | |
| **Section 3.10 Terrestrial Species and Habitats** | | | |
| Acoustics | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Effects of noise generated during military readiness activities on FDM will continue to be introduced into terrestrial habitats on the island. The long use of FDM by breeding seabirds, ESA megapodes, and fruit bats, and the apparent stable populations of seabirds, megapodes, and fruit bats on the island suggests that the targeting restrictions that have been developed over the past few decades have minimized risk to both breeding seabirds and the ESA-listed megapode, allowing for populations to persist on the island. | |
| Explosives | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Explosives effects on FDM, because of targeting restrictions, are limited to designated impact zones on the island. The long use of FDM by breeding seabirds and the apparent stable populations of seabirds on the island suggests that limiting explosive impacts to designated impact zones allows for continued use of nesting habitats by several regionally important seabird species. Continued systematic monitoring of terrestrial habitats outside of the impact zones suggests that ESA-listed megapode numbers are remaining steady. | |

**Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (continued)**

| Stressor | No Action Alternative | Alternative 1 (Preferred Alternative) | Alternative 2 |
|---|---|---|---|
| Physical Disturbance and Strike | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Physical disturbance and strike by seabirds and ESA-listed megapodes continues to be limited by targeting restrictions and impact zone use. Wildfires induced by munitions use continues to be a threat; however, the low successional state of vegetation within the impact zones limits the ability of wildfires to carry into habitats outside of the impact zones. | |
| **Section 3.11 Cultural Resources** | | | |
| Explosives | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.11 (Cultural Resources) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from explosive stressors would not be reasonably foreseeable. | |
| Physical Disturbance and Strike | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Vessels and in-water devices are operated in a manner to avoid known obstructions, including submerged historic and cultural resources; and the Navy's seafloor devices are placed to avoid underwater obstructions, including submerged cultural resources. Most of the anticipated MEM would be small objects and fragments that lose velocity as they descend through the water column. In addition, minimization and best management measures would be implemented to reduce or avoid effects; therefore, physical disturbance and strike stressors resulting from in-water devices, MEM, and seafloor devices would not result in adverse effects on known cultural resources. | |
| **Section 3.12 Socioeconomics** | | | |
| Accessibility | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Areas of co-use in the Study Area may be temporarily inaccessible to the public due to military readiness activities; however, the military would notify the public of closures in advance, and effects would be short term and limited to the duration of the activity. | |
| Airborne Acoustics | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Airborne acoustics would be infrequent and short-term, lasting for the duration of the activity. Noise would not be expected to deter the public from participating in recreational activities in nearshore or offshore areas. | |
| Physical Disturbance and Strike | Unchanged or slightly improved from baseline conditions | **Less than significant effects** | **Less than significant effects** |
| | | Physical disturbance and strike stressors (e.g., military expended materials) would not be expected to damage civilian equipment if encountered. The Action Proponents would continue to implement mitigation to avoid or reduce effects from physical disturbance and strike stressors on seafloor resources. | |

**Table ES-1: Summary of Environmental Impacts for the No Action Alternative, Alternative 1, and Alternative 2 (continued)**

| Stressor | No Action Alternative | Alternative 1 (Preferred Alternative) | Alternative 2 |
|---|---|---|---|
| Secondary | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.12 (Socioeconomics) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from secondary stressors would not be reasonably foreseeable. | |
| **Section 3.13 Public Health and Safety** | | | |
| Underwater Energy/ In-air Energy/ Physical Interactions/ Secondary | Unchanged or slightly improved from baseline conditions | **No reasonably foreseeable effects** | **No reasonably foreseeable effects** |
| | | Consistent with the analysis presented in Section 3.13 (Public Health and Safety) of the 2015 EIS/OEIS and 2020 SEIS/OEIS, effects from these stressors would not be reasonably foreseeable. | |

Notes: ESA = Endangered Species Act, FDM = Farallon de Medinilla, MEM = Military Expended Material; SOP = Standard Operating Procedure

## ES.6 Other Considerations

In accordance with NEPA, this SEIS/OEIS provides an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. The Proposed Action may result in both short- and long-term environmental effects. However, the Proposed Action would not be expected to result in any impacts that would reduce environmental productivity, permanently narrow the range of beneficial uses of the environment, or pose long-term risks to health, safety, or the general welfare of the public.

For both Alternative 1 and Alternative 2, most resource commitments are neither irreversible nor irretrievable. Most impacts are short term and temporary or, if long lasting, are negligible. No habitat associated with threatened or endangered species would be lost as result of implementation of the Proposed Action.

## ES.7 Public Involvement

### ES.7.1 Scoping Process

The Action Proponents held a public scoping period, from June 7 to July 22, 2025, to involve the public early in the process for the identification, definition, and prioritization of significant environmental and historic preservation issues related to the Proposed Action. Although not required for a supplemental EIS, the Action Proponents held a scoping period to promote public understanding of the proposal and receive input to bolster the accuracy and thoroughness of the analysis. Public notification was extensive, involving direct mailings to over 750 officials and individuals, newspaper advertisements, and traditional and social media engagement to ensure the public was well-informed on the project's purpose and how to provide meaningful input. The Action Proponents established a project website for the public to easily access project information, including public notices, project fact sheets, and a virtual presentation. The public was also able to request more information about participating in the National Historic Preservation Act Section 106 process.

### ES.7.2 Scoping Comments

The public was able to submit comments during the scoping period by postal mail or electronically via the project website. Federal and local elected officials and government agencies, nongovernmental organizations, individuals, and community groups submitted a total of 19 comments. A detailed summary of scoping comments can be found in Appendix G. A sampling of specific concerns includes (1) military training and testing around the Mariana Islands; (2) activities that may harm or have long-lasting impacts on marine species and marine habitat; (3) impacts from training and testing with active sonar and explosives; (4) unexploded ordnance and other debris as a result of military activities; (5) potential impacts on submerged maritime heritage resources, such as aircraft and shipwrecks; (6) noise impacts on people, local communities, marine mammals, fishes, and seabirds in the Study Area.

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# Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Mariana Islands Training and Testing

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# Acronyms and Abbreviations

| Acronym | Definition | Acronym | Definition |
|---|---|---|---|
| °C | Degrees Celsius | EFH | Essential Fish Habitat |
| AAFB | Andersen Air Force Base | EIS | Environmental Impact Statement |
| AAQS | Ambient Air Quality Standards | EO | Executive Order |
| ac. | Acre(s) | ER-M | Effects Range – Medium |
| ACT | Annual Target Catch | ESA | Endangered Species Act |
| A-G | Air-to-Ground | FAA | Federal Aviation Administration |
| AINJ | Auditory Injury | FDM | Farallon de Medinilla |
| AMNS | Airborne Mine Neutralization System | FONSI | Finding of No Significant Impact |
| | | ft. | Foot/feet |
| AMRAAM | Advanced Medium-Range Air-to-Air Missile | G-DODS | Guam Deep Ocean Disposal Site |
| | | GDP | Gross Domestic Product |
| APPS | Act to Prevent Pollution from Ships | GHG | Greenhouse Gas(es) |
| | | ha | Hectare(s) |
| Army | U.S. Army | HAP | Hazardous Air Pollutant |
| BDL | Below Detection Limits | HAPC | Habitat of Particular Concern |
| BMP | Best Management Practice | HARM | High-Speed Anti-Radiation |
| BMUS | Bottomfish Management Unit Species | HE-ET | High Explosive-Electronic Time |
| | | HF | High Frequency |
| BNM | Broadcast Notice to Mariners | HRC | Hawaii Range Complex |
| BO | Biological Opinion | Hz | Hertz |
| CAA | Clean Air Act | INRMP | Integrated Natural Resources Management Plan |
| CD | Consistency Determination | | |
| CFR | Code of Federal Regulations | ITA | Incidental Take Authorization |
| CFU | Coliform Forming Units | JRM | Joint Region Marianas |
| $CH_4$ | Methane | kg | Kilogram |
| CJMT | CNMI Joint Military Training | kHz | kilohertz |
| CNA | Center for Naval Analyses | $km^2$ | Square kilometer(s) |
| CNMI | Commonwealth of the Northern Mariana Islands | L | Liter |
| | | lb. | Pound(s) |
| CO | Carbon monoxide | LF | Low Frequency |
| $CO_2$ | Carbon dioxide | LFA | Low Frequency Active Sonar |
| $CO_2$ eq. | Carbon dioxide equivalent | LOA | Letter of Authorization |
| CV | Coefficient of Variation | m | Meter(s) |
| CWA | Clean Water Act | MA | May Affect |
| CZMA | Coastal Zone Management Act | MACS | Mariana Archipelago Cetacean Survey |
| dB | Decibel(s) | | |
| dB re 1 $\mu Pa^2s$ | Decibels referenced to 1 micropascal squared seconds | MARPOL | International Convention for the Prevention of Pollution from Ships |
| dBA re 20 µPa | A-weighted decibel(s) referenced to 20 micropascals | MBTA | Migratory Bird Treaty Act |
| | | MCM | Mine Countermeasure |
| DDTs | Dichlorodiphenyltrichloroethane | MEM | Military Expended Materials |
| DNT | 2,6-dinitrotoluene | MF | Mid-Frequency |
| DO | Dissolved Oxygen | MIRC | Mariana Islands Range Complex |
| DoD | Department of Defense | MIRC Ops | Mariana Islands Range Complex Operations |
| DPS | Distinct Population Segment | | |
| DZ | Danger Zone | MITT | Mariana Islands Training and Testing |
| EA | Environmental Assessment | | |
| eDNA | Environmental DNA | mm | Millimeter(s) |
| EEZ | Exclusive Economic Zone | | |

| Acronym | Definition |
|---|---|
| MMPA | Marine Mammal Protection Act |
| N/A | Not Applicable |
| NAAQS | National Ambient Air Quality Standards |
| NAEMO | Navy Acoustic Effects Model |
| NAVAIR | Naval Air Systems Command |
| NAVSEA | Naval Sea Systems Command |
| Navy | U.S. Department of the Navy |
| NBG | Naval Base Guam |
| NCEI | National Center for Environmental Information |
| NE | No Effect |
| NEPA | National Environmental Policy Act |
| NEPM | Non-explosive Practice Munition |
| NEW | Net Explosive Weight |
| $N_2O$ | Nitrous oxide |
| ng/L | Nanograms per liter |
| NHPA | National Historic Preservation Act |
| NM | Nautical Mile(s) |
| $NM^2$ | Square Nautical Mile(s) |
| NMFS | National Marine Fisheries Service |
| $NO_2$ | Nitrogen dioxide |
| $NO_x$ | Nitrogen oxide |
| NOAA | National Oceanic and Atmospheric Administration |
| NOTAM | Notice to Airmen |
| NTU | Nephelometric turbidity unit |
| NUWTAC | Navy Undersea Warfare Training Assessment Course |
| $O_3$ | Ozone |
| OEIS | Overseas Environmental Impact Statement |
| ONR | Office of Naval Research |
| PA | Programmatic Agreement |
| PAHs | Polychlorinated aromatic hydrocarbons |
| PATT | Programmatic Agreement Training and Testing |
| Pb | Lead |
| PCBs | Polychlorinated biphenyls |
| $PM_{10}$ | particulate matter with an aerodynamic size less than or equal to 10 microns |
| $PM_{2.5}$ | particulate matter with an aerodynamic size less than or equal to 2.5 microns |
| ppb | Parts per billion |
| ppm | Parts per million |
| R | Restricted Area Airspace |
| ROD | Record of Decision |
| SCUBA | Self-Contained Underwater Breathing Apparatus |
| SEIS | Supplemental Environmental Impact Statement |
| SINKEX | Sinking Exercise |
| $SO_2$ | Sulfur dioxide |
| SOP | Standard Operating Procedure |
| $SO_x$ | Sulfur oxides |
| SPCS | Space Control Squadron |
| SUA | Special Use Airspace |
| SURTASS | Surveillance Towed Array Sensor System |
| SWATT | Surface Warfare Advanced Tactical Training |
| SYSCOM | Systems Command |
| TCP | Traditional Cultural Place |
| THAAD | Terminal High-Altitude Area Defense |
| tpy | Tons per year |
| TTS | Temporary Threshold Shift |
| U.S. | United States |
| U.S.C. | United States Code |
| UAV | Unmanned Vehicle |
| UNDET | Underwater Detonation |
| USAF | U.S. Air Force |
| USCG | U.S. Coast Guard |
| USEPA | U.S. Environmental Protection Agency |
| USFWS | U.S. Fish and Wildlife Service |
| USMC | U.S. Marine Corps |
| USV | Unmanned Surface Vehicle |
| UUV | Unmanned Underwater Vehicle |
| VHF | Very High Frequency |
| VLF | Very Low Frequency |
| VOC | Volatile Organic Compound |
| W | Warning Area |
| WWII | World War II |
| yd. | Yard(s) |
| $\mu g/m^3$ | Micrograms per cubic meter |

# 1 Purpose and Need

## 1.1 Introduction

The United States (U.S.) Department of the Navy (Navy) (including both the U.S. Navy and the U.S. Marine Corps [USMC]) jointly with the U.S. Air Force (USAF), U.S. Army (Army), and U.S. Coast Guard (USCG), collectively referred to as the Action Proponents, have prepared this Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (SEIS/OEIS) to supplement the impact analysis contained in the 2015 Mariana Islands Training and Testing (MITT) Environmental Impact Statement (EIS)/OEIS (hereinafter referred to as the 2015 EIS/OEIS) and 2020 MITT SEIS/OEIS (hereinafter referred to as the 2020 SEIS/OEIS), consistent with the National Environmental Policy Act (NEPA), 42 U.S. Code [U.S.C.] Sections 4321 et seq, and Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*. The Navy is the lead agency for the Proposed Action and is responsible for the scope and content of this SEIS/OEIS. For this document, Action Proponents within the Navy include the Commander, U.S. Pacific Fleet, the USMC, the Office of Naval Research (ONR), the Naval Air Systems Command (NAVAIR), and Naval Sea Systems Command (NAVSEA). The latter two agencies will be referred to as the Systems Commands (SYSCOMs). In addition to the Navy Action Proponents, the USAF, Army, and USCG are participating as Joint Lead Agencies due to the inclusion of their training activities, which are similar to Navy training covered in this SEIS/OEIS. The National Marine Fisheries Service (NMFS) is also a cooperating agency.

The Action Proponents propose to continue to conduct at-sea military readiness activities in the MITT Study Area, as represented in Figure 1.1-1. Military readiness activities are comprised of training and testing activities that can include the use of active sonar and other acoustic sources, as well as the use of explosives, and range modernization and sustainment necessary to support these activities into the future.

The Study Area for the SEIS/OEIS includes the at-sea areas of the Mariana Islands Range Complex (MIRC); additional areas on the high seas north and west of the MIRC; the transit corridor between the MIRC and the Hawaii Range Complex (HRC); pierside locations on Guam in Apra Harbor; nearshore areas of Guam and the Commonwealth of the Northern Mariana Islands (CNMI); and the land-based training area on Farallon de Medinilla (traditionally called Noos in Chamorro, henceforth identified as FDM in this SEIS/OEIS). This SEIS/OEIS Study Area is consistent with the previous MITT analyses for at-sea and FDM study areas.

Military readiness activities prepare the Action Proponents to fulfill their missions to protect and defend the U.S. and its allies but have the potential to affect the environment. These proposed activities are generally consistent with those at-sea and FDM activities analyzed in previous MITT analyses and are representative of the military readiness activities that the Action Proponents have been conducting off Guam and CNMI for decades.

This SEIS/OEIS updates the types, frequency, duration, and intensity of military readiness activities from previous documents. This SEIS/OEIS's analysis focuses on those military readiness activities conducted at sea and on FDM (see Table 2.3-1 and Appendix A). For discussion and analysis of those land-based military activities conducted on the islands of Guam, Tinian, Saipan, and Rota, please refer to the 2015 EIS/OEIS and the 2025 CNMI Joint Military Training EIS.

This SEIS/OEIS considers ongoing and future activities conducted in the Study Area, updates training and testing requirements, considers range modernization and sustainment activity, incorporates new information from an updated acoustic effects model, updates marine mammal density data, and incorporates evolving and emergent best available science since the previous MITT environmental analysis. It also supports the reissuance of federal regulatory authorizations under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA), using the most current and best available science and analytical methods to assess potential environmental impacts on the species covered by these regulations.

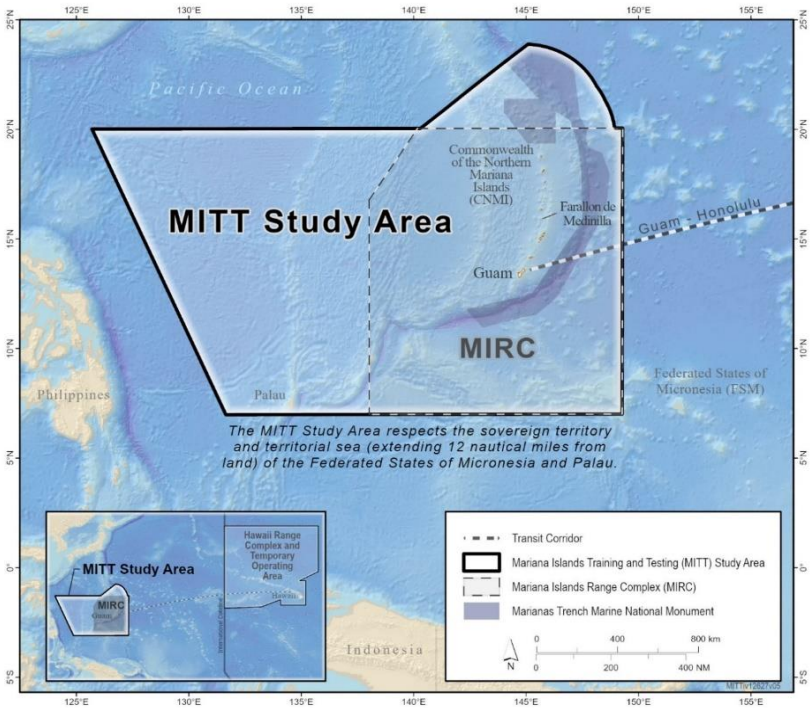


**Figure 1.1-1: Mariana Islands Training and Testing Study Area**

## 1.2 Overview and Strategic Importance of the Mariana Islands Range Complex

Building upon the foundational analysis in the 2015 EIS/OEIS and the 2020 SEIS/OEIS, the Navy continues to utilize the MIRC as a vital, controlled environment for realistic multi-domain training and systems testing. MIRC is strategically located and provides the expansive sea space, specialized airspace, and unique island infrastructure necessary to ensure U.S. and allied forces maintain readiness for Western Pacific contingencies.

## 1.3 Proposed Action

The Proposed Action is to continue to conduct military readiness activities, comprised of training, testing, and range modernization and sustainment in the MITT Study Area. NMFS's Proposed Action is to evaluate and decide whether to issue Letters of Authorization (LOA) under the MMPA of 1972, as amended (16 U.S.C. 1361 et seq.) in response to the Navy's request for an incidental take authorization (ITA).[1] A detailed description of the Proposed Action is provided in Chapter 2.

## 1.4 Purpose and Need

The purpose of the Proposed Action is to conduct military readiness activities in the MITT Study Area to ensure the Action Proponents, are able to organize, train, and equip service members

[1] NMFS's issuance of an MMPA ITA (i.e., Letter of Authorization [LOA]) is a major federal action (NMFS' Proposed Action) with a discrete purpose and need relative to NMFS's statutory and regulatory obligations. Consequently, NMFS has an independent responsibility to comply with NEPA. If NMFS makes the finding necessary to issue the requested LOA, it will rely on the information and analyses in this document. NMFS intends to adopt this SEIS/OEIS to fulfill its NEPA obligations and issue its own Record of Decision (ROD), if appropriate.

and personnel needed to meet their respective Congressionally-mandated national defense missions (10 U.S.C. sections 7062, 8062, 8063, 9062; 14 U.S.C. sections 101, 102). In alignment with the National Defense Strategy, these activities are essential for maintaining a continuous presence in the Indo-Pacific, enabling U.S. forces to respond to a wide range of contingencies, from full-scale armed conflict to humanitarian assistance.

Complementary to this, NMFS needs to render a decision regarding the request for reauthorization due to NMFS' responsibilities under the MMPA (16 U.S.C. 1371(a)(5)(A)) and its implementing regulations. The purpose of NMFS' action is to evaluate the Action Proponents' request for authorization to take marine mammals pursuant to the MMPA, ensuring that any authorized activities meet statutory mandates regarding mitigation and monitoring. This document analyzes the environmental impacts associated with proposed military readiness activities for which the Action Proponents are seeking authorization to "take" marine mammals. The analysis of mitigation measures includes the requirements for protection and management of marine resources, considers benefits to species or stocks and their habitat, and evaluates the practicability and efficacy of each measure. This analysis will support requirements pertaining to mitigation, monitoring, and reporting specified in the ITA, if issued.

The need for the Proposed Action is driven by the requirement for Action Proponents to maintain military readiness through realistic training and rigorous testing in a marine environment. Training ensures personnel are proficient in the tactics necessary to defend U.S. national interests (refer to Section 1.4.1 in the 2020 SEIS/OEIS for additional information on the Action Proponents' training), while testing allows for the development of advanced systems that maintain a technological edge (refer to Section 1.4.2 in the 2020 SEIS/OEIS for additional information on the Action Proponents' testing). Building upon the foundational analysis in the 2015 EIS/OEIS and the 2020 SEIS/OEIS, the Action Proponents continue to conduct training and testing within the MIRC (a vital dynamic range environment) and throughout the Study Area. The MITT Study Area provides the expansive sea space, specialized airspace, and unique island infrastructure necessary where U.S. and allied forces can conduct joint and combined activities in the Western Pacific.

## 1.5 The Environmental Planning Process

NEPA requires federal agencies to examine the environmental impacts of their proposed actions within the U.S. and its territories. An EIS is a detailed public document that assesses the potential effects that a major federal action might have on the human environment (including the natural and biological environment). Since NEPA does not apply outside of U.S. jurisdiction, President Carter issued EO 12114, *Environmental Effects Abroad of Major Federal Actions,* in 1979, furthering the purpose of NEPA by creating similar procedures for federal agency activities affecting the environment of the global commons outside U.S. jurisdiction. Based upon new information and science, and changes to the Proposed Action that are relevant to environmental concerns, the Action Proponents have chosen to prepare a supplement to the 2020 SEIS/OEIS.

## 1.6 Scope and Content

In this SEIS/OEIS, the Action Proponents reevaluated potential effects from the ongoing and new military readiness activities, at sea and on FDM, in the MITT Study Area in all the applicable resource areas evaluated in the previous MITT analyses, while determining what resources

could potentially be affected by the new or changed activities and new science or data. Resource areas include sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, sea birds, marine vegetation, marine invertebrates, fishes, terrestrial species and habitats, cultural resources, socioeconomic resources, and public health and safety. Resource areas not carried forward for more detailed discussion include *Protection of Children from Environmental Health Risks and Safety Risks*, because the proposed activities occur where there are no children present; and *Environmental Justice*, because of rescission of this requirement via EO 14148.

NMFS is a cooperating agency because the scope of the Proposed Action and alternatives involves activities that have the potential to affect protected resources under the agency's jurisdiction and for which they have special expertise, including marine mammals, threatened and endangered species, and essential fish habitat (EFH). NMFS's special expertise and authority are based on its statutory responsibilities under the MMPA, as amended (16 U.S.C. section 1361 et seq.), the ESA (16 U.S.C. section 1531 et seq.), and the Magnuson-Stevens Fishery Conservation and Management Act. The Navy, as lead agency, has requested an ITA under the MMPA, as amended, to take marine mammals incidental to proposed military readiness activities. NMFS is required to evaluate the applicant's request pursuant to the specific requirements of the MMPA and, if appropriate, issue an ITA under the MMPA. In addition, NMFS has an independent responsibility to comply with NEPA and may adopt the Navy's Final EIS/OEIS after independent review to fulfill its NEPA obligations. NMFS may adopt this SEIS/OEIS and issue a separate ROD associated with its decision to grant or deny the Navy's request for an ITA pursuant to section 101(a)(5)(A) of the MMPA.

## 1.7 Incorporation by Reference

The SEIS/OEIS refers to other environmental documents that provide related information and analyses, which helps keep this document more concise. Cited references may provide additional information in support of this document's analysis. Therefore, documents listed in Table 1.7-1 are incorporated by reference.

**Table 1.7-1: Documents Incorporated by Reference**

| Reference | Description |
|---|---|
| U.S. Department of the Navy (2015b) | Mariana Islands Training and Testing (MITT) Final EIS/OEIS |
| U.S. Department of the Navy (2020) | Mariana Islands Training and Testing (MITT) Final SEIS/OEIS |

# 2 Description of Proposed Action and Alternatives

The Action Proponents propose continuing training activities (hereinafter referred to as "training"); research, development, testing, and evaluation activities (hereinafter referred to as "testing"); and range modernization and sustainment in the MITT Study Area, as represented in Figure 1.1-1. Training, testing, and range modernization and sustainment are collectively referred to as "military readiness activities." The Proposed Action in this SEIS/OEIS is generally consistent with the Proposed Action analyzed in the previous documents; for further details regarding specific military readiness activities, please see Appendix A.

In accordance with the MMPA, the Action Proponents submitted an application requesting NMFS authorization for the incidental take of marine mammals associated with the Proposed Action described in this SEIS/OEIS. NMFS' Proposed Action would be a direct outcome of responding to the Navy's request for an ITA pursuant to the MMPA.

## 2.1 Description of the Mariana Islands Training and Testing Study Area

The Study Area includes the at-sea areas of the MIRC; additional areas on the high seas north and west of the MIRC; the transit corridor between the MIRC and the HRC; pierside locations on Guam in Apra Harbor; nearshore areas of Guam and the CNMI; and the land-based training area on Farallon de Medinilla (Figure 1.1-1). The MIRC itself encompasses 501,873 square nautical miles ($NM^2$) of open ocean, including sea and undersea space from the surface to the ocean floor, as well as land training areas at FDM. Within the MIRC, approximately 40,000 $NM^2$ is designated as Special Use Airspace (SUA), which includes Warning Areas (W) W-517, W-12, W-11, and W-13 (Figure 2.1-1), and 2,463 $NM^2$ of restricted airspace (R; R-7201 and R-7201A) surrounding FDM.

For purposes of this SEIS/OEIS, pierside locations include channels and routes to and from the Navy port in Apra Harbor Naval Complex, and associated wharves and facilities within the Navy port (Figure 2.2-2). A more detailed description of these components and their geographic boundaries is provided in the 2020 SEIS/OEIS, Section 2.1 (Description of the Mariana Islands Training and Testing Study Area). While the MIRC contains portions of the Marianas Trench Marine National Monument, military activities remain exempt from monument prohibitions per the 2009 Presidential Proclamation.

## 2.2 Primary Mission Areas

The Action Proponents categorize at-sea activities into functional warfare areas called primary mission areas. As described in the 2020 SEIS/OEIS, training and testing activities are categorized into the following eight primary mission areas to reflect functional warfare requirements:

- Air warfare
- Amphibious warfare
- Anti-submarine warfare
- Electronic warfare
- Expeditionary warfare
- Mine warfare
- Strike warfare
- Surface warfare

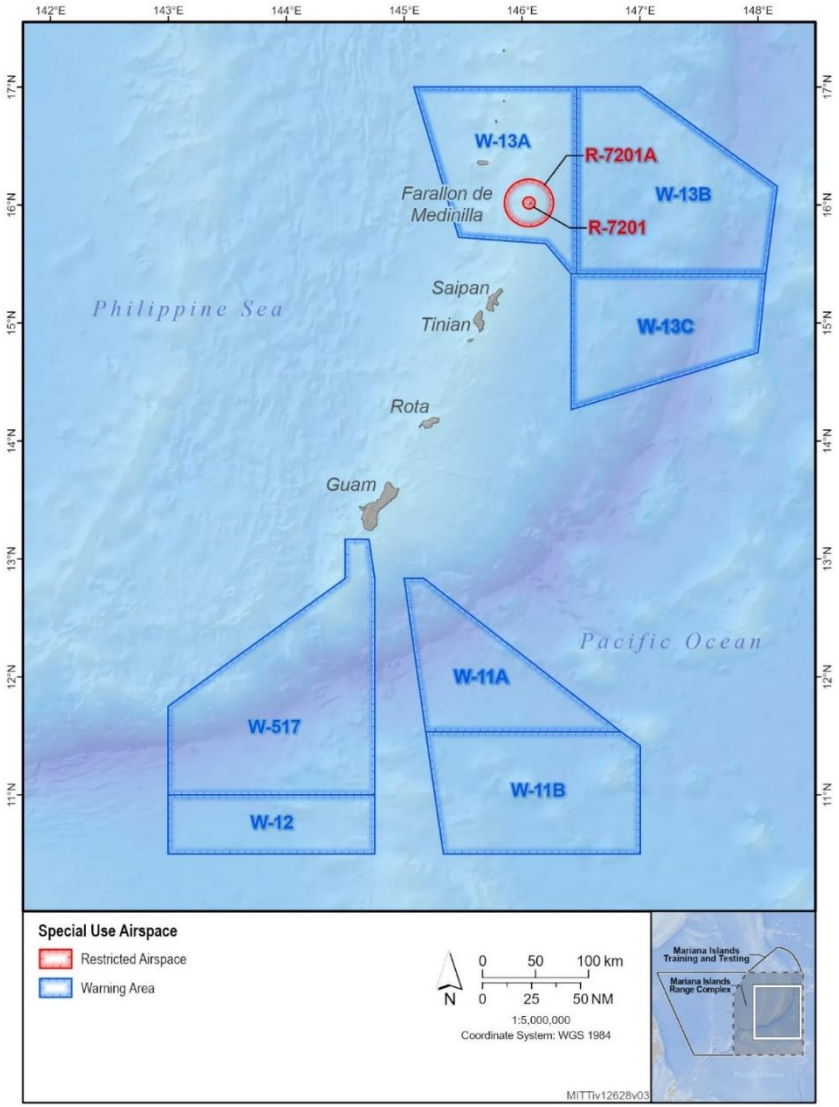


**Figure 2.2-1: Mariana Islands Range Complex Airspace**

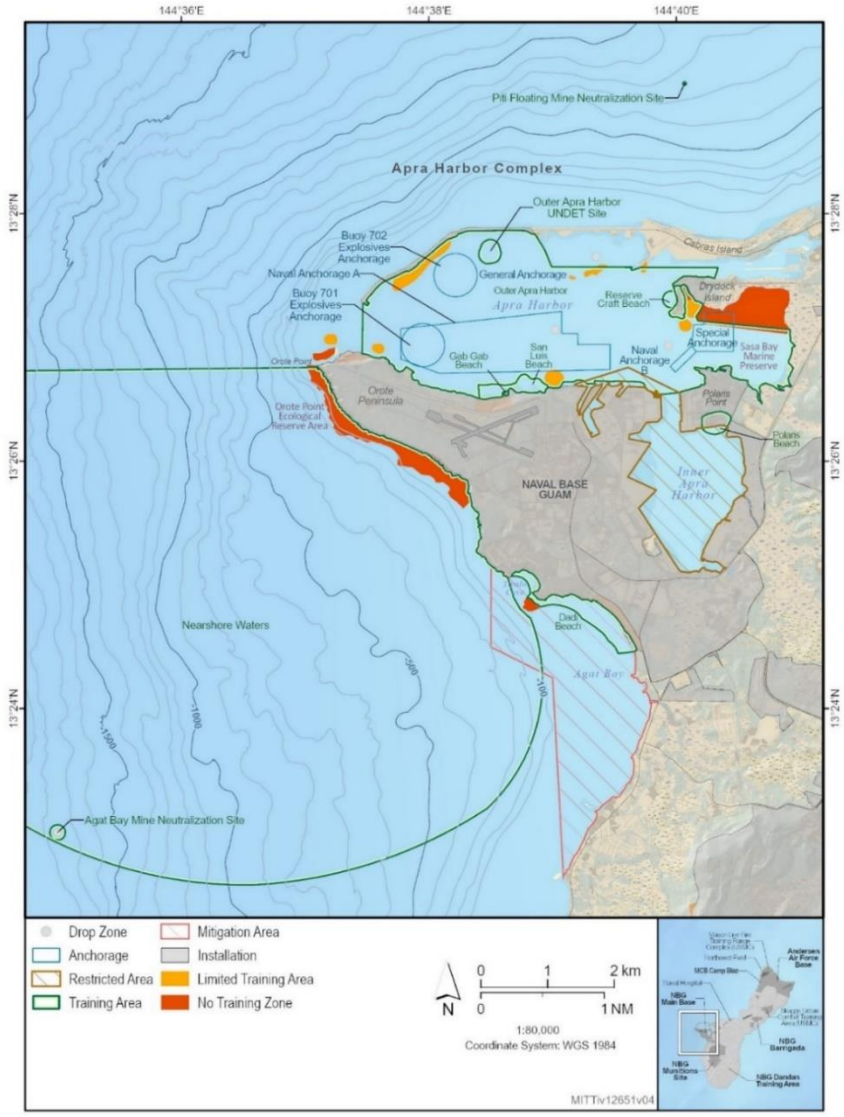


**Figure 2.2-2: Apra Harbor Naval Complex (Main Base) and Main Base/Polaris Point**

## 2.3 Proposed Action

The Action Proponents have been conducting military readiness activities in the Study Area for decades. The tempo and types of military readiness activities have fluctuated because of the introduction of new technologies, the evolving nature of international events, advances in warfighting doctrine and procedures, and changes in force structure (organization of ships, submarines, aircraft, weapons, and personnel). Such developments influence the frequency, duration, intensity, and location of required training and testing activities. This SEIS/OEIS includes the analysis of those at-sea and FDM activities necessary to meet readiness requirements beyond 2027 and into the reasonably foreseeable future, includes any changes to those activities analyzed in the previous MITT analyses, and reflects the most up-to-date compilation of training and testing activities deemed necessary to accomplish military readiness requirements. In addition to training of U.S. Navy, USMC, and USCG forces, this SEIS/OEIS includes an analysis of certain activities by USAF and U.S. Army when those activities within the Study Area are similar to U.S. Navy or USMC activities and are scheduled on U.S. Navy-controlled ranges.

For training and testing to be effective, units must be able to safely use their sensor and weapon systems, to their optimum capabilities, as they are intended to be used in military missions and combat operations. Standard operating procedures (SOPs) applicable to training and testing have been developed through years of experience, and their primary purpose is to provide for both safety (including public health and safety) and mission success. For a more detailed description of the SOPs, see the 2020 SEIS/OEIS, Section 2.3.3 (Standard Operating Procedures). Because they are essential to safety and mission success, SOPs are part of the Proposed Action and are considered in Chapter 3 environmental analyses for applicable resources.

Proposed activities remain fundamentally consistent with the types of military readiness activities that have been conducted in the Mariana Islands for decades. While the majority of these activities remain consistent with previous authorizations, and there are no proposed changes in land-based activities on Saipan, Tinian, and Rota (as previously analyzed in the 2015 EIS/OEIS), the Navy has identified 10 military readiness activities to be analyzed as “new” for this phase. As detailed in Table 2.3-1, these new at-sea activities largely represent the consolidation of existing environmental reviews, the reclassification of ongoing activities into standalone categories, or the inclusion of refined testing parameters to ensure a comprehensive and consistent analysis. More detailed information on proposed new activities is included in Appendix A.

**Table 2.3-1: MITT Phase IV Proposed New Military Readiness Activity Descriptions**

| Activity Name | Activity Description | Representative Location |
|---|---|---|
| **Dive and Salvage Operations*** | Navy divers perform dive operations and salvage training. Divers will conduct a variety of salvage training to include debeaching operations, underwater repairs to ships, underwater survey operations, and other underwater training as required. As part of activities, a practice salvage platform can be sunk and then refloated and removed. No explosives are used. | CNMI Nearshore, Guam Nearshore, MIRC |
| **Underwater Construction Team Training** | Navy and U.S. Coast Guard (USCG) divers conduct underwater repair and construction. This consists of cutting, welding, assembly, and installation of deep-water structures, mooring systems, | CNMI Nearshore, Guam Nearshore; MIRC |

| Activity Name | Activity Description | Representative Location |
|---|---|---|
| | underwater instrumentation, clearing of hazards, and other training as needed. Platforms can include small boats and unmanned bottom crawlers. No explosives are used. | |
| **Port Damage Repair** | Navy Expeditionary forces train to repair critical port facilities. Training includes diving operations; salvage operations; and repairs to piers, quay walls, and other waterfront infrastructure. Platforms can include Small Boat, Support Craft, Fixed Structures, and Unmanned Bottom Crawlers. No dredging, no pile driving, and no explosives are used. | CNMI Nearshore, Guam Nearshore |
| **Maritime Environmental Response** | USCG conducts training on spill and hazmat response for oil or hazardous waste response identified in navigable waters. Training practices agency response to simulated scenarios such as oil sheens identified near ported vessels during fueling activities or that occur after ships run aground. Training includes deployment of oil booms using small boats. No explosives are used. | MITT Study Area |
| **Waterborne Training** | Personnel launch, operate, and recover a variety of small boats to achieve certifications such as coxswain, crewman, and safety observer. No explosives are used. | MITT Study Area, MIRC, CNMI Nearshore, Guam Nearshore |
| **Pierside Sonar** | Pierside testing to ensure systems are fully functional in a controlled pierside environment prior to at-sea test activities and complete any required troubleshooting. Ships and submarines would activate mid- and high-frequency tactical sonars, underwater communications systems, and navigational devices to ensure they are fully functional prior to at-sea test events. Event duration varies, with average durations of three weeks with active sonar used intermittently over two days during the total event duration. This also includes pierside sonar testing during surface combatant sea trials. No explosives are used. | Inner Apra Harbor, Guam (does not occur within CNMI) |
| **Unmanned Aerial Systems Testing** | Unmanned aerial systems are launched from a platform (e.g., fixed platform or submerged submarine) to test the capability to extend the surveillance and communications range of unmanned underwater vehicles, manned and unmanned surface vehicles, and submarines. Platforms can include Submarine, Support Craft, Unmanned Aerial Vehicle - Fixed Wing, Unmanned Aerial Vehicle - Rotary Wing. No explosives are used. | MITT Study Area, MIRC |
| **Unmanned Surface Vehicle (USV) Testing** | Testing involves the production or upgrade of unmanned surface vehicles. This may include testing mine detection capabilities, evaluating the basic functions of individual platforms, or conducting complex events with multiple vehicles. USVs can include remotely operated craft (e.g., semi-submersible, plane hull, semi-plane hull) and test vehicles. During testing, they can operate autonomously, semi-autonomously, or non-autonomously. Non-autonomous or remotely controlled vehicles may be tethered like remotely operated vehicles or remotely controlled. USVs may have multiple test objectives or payloads (such as cameras, sonar, or explosives). USVs may be used in conjunction with unmanned underwater vehicles and unmanned aerial systems. USV launch and retrieval methods are highly variable. USV test vehicle launch | MITT Study Area, MIRC, activities involving explosives > 12 NM from land |

| Activity Name | Activity Description | Representative Location |
|---|---|---|
| | methods include lowering onto the water from a support craft or pier, deploying from another craft, or launching from a boat ramp. The vehicle will propel itself through the water to complete the test objectives, which could include deployment or recovery of a payload, sonar or other sensor use, or completion of a propulsion test. Occurs year round, daytime only.<br>Explosives are used (E9). Activities involving explosives will occur > 12 NM from land. | |
| **In-Port Maintenance Testing** | Each system is tested to ensure it is functioning in a technically acceptable manner and is operationally ready to support in-port and at-sea maintenance capabilities, including Combat Systems testing. Testing includes general system maintenance capabilities (e.g., verifying that submarine tenders can perform resupply and replenishment capabilities). For Combat Systems, the ship's test plans and procedures, Maintenance Repair/Requirement Cards, and computerized planned maintenance system are used in establishing testing standards. No explosives are used. | Guam and CNMI Nearshore |
| **Range Sustainment and Modernization** | Support crews place, move, and remove mine countermeasures (MCM) targets. MCM targets could be inserted on the seafloor or tethered to anchors that are moored on the seafloor. Other temporary training areas can be established by installing instrumentation that could include hydrophones anchored to the seafloor similarly to anchored mine training shapes. Once training is completed, the temporary instrumentation is recovered and utilized elsewhere. No explosives are used. | MITT Study Area |

*Use of the term "operations" throughout this EIS refers to training or testing

### 2.3.1 Foreign Military Participation

In furtherance of national security objectives, foreign militaries may participate in multinational training and testing events in the Study Area. Foreign military activities that are planned by and under the substantial control and responsibility of the Action Proponents are included in the Proposed Action. These participants could be in various training or testing events described in Appendix A, and their effects are analyzed in this EIS. However, when foreign military vessels and aircraft operate independently within the Study Area as sovereign vessels outside the planning, control, and responsibility of the APs, those activities are not considered part of the Proposed Action. There are many reasons why foreign military vessels may traverse U.S. waters or come into U.S. port, not all of which are at the request of any of the Action Proponents. Foreign military vessels and aircraft operate pursuant to their own national authorities and have independent rights under customary international law, embodied in the principle of sovereign immunity, to engage in various activities on the world's oceans and seas.

### 2.3.2 Proposed Changes to Training Activities, Platforms, and Systems

Proposed changes in training activities range from individual tasks to large-scale, integrated exercises. This SEIS/OEIS analyzes proposed changes in training activity levels, including major training exercises and other coordinated exercises supporting the Optimized Fleet Response Plan (U.S. Fleet Forces Command, 2025). The analysis also incorporates new platforms and

weapon systems—such as next-generation aircraft, amphibious vessels, unmanned vehicles, and advanced sensors—alongside unit-level activities required for joint military certification.

Detailed descriptions of major training exercises and integrated/coordinated anti-submarine warfare exercises are provided in the 2020 MITT SEIS/OEIS, Section 2.3.2 (Proposed Training and Testing Activities). Updated descriptions for all ongoing activities are provided in Appendix A. Although changes in training activity levels are proposed in this SEIS/OEIS, the proposed mid-frequency sonar usage—which accounts for the highest number of marine mammal exposures in Alternative 1 (Preferred Alternative)—is lower than what is currently authorized. Additionally, while general vessel movements like refueling or transiting are not listed as discrete training events in the activity tables, they are fully accounted for in Chapter 3 environmental analyses for potential air quality effects and marine mammal strikes.

### 2.3.3 Proposed Changes to Testing Activities, Platforms, and Systems

As described in the 2020 SEIS/OEIS, the Navy's research and acquisition community performs a wide range of testing activities to ensure military systems are effective, safe, and reliable for use by the fleet. This testing includes everything from basic scientific research and technology development to the evaluation and maintenance of advanced systems (such as missiles, radar, and sonar) and platforms (including ships, submarines, and aircraft). The Proposed Action includes updates to testing activity levels to reflect current technology needs and the introduction of new platforms. These adjustments ensure the Navy maintains a technological advantage while rigorously evaluating equipment under realistic conditions. Detailed descriptions for each testing activity are provided in Appendix A.

### 2.3.4 Proposed Range Modernization and Sustainment

The Navy's training and testing ranges provide the air, sea, and undersea space necessary for personnel to conduct live military readiness activities. As technology changes, weapons and systems evolve to provide improved capabilities. Often those new capabilities require modifications to the range to allow for full utilization of the new technology. Installation and Maintenance of Subsurface Targets and Instrumentation have been addressed in previous MITT analyses, and is being carried forward as a separate new military readiness activity in this SEIS/OEIS. The action is described in Table 2.3-1.

## 2.4 Action Alternatives Development

The identification, consideration, and analysis of alternatives are critical components of the NEPA process and contribute to the goal of informed decision-making. Per the Department of Defense's (DoD's) Implementing Procedures, an EIS must rigorously explore and objectively evaluate all reasonable alternatives for implementing the Proposed Action. Additionally, for alternatives eliminated from detailed study, an EIS must briefly discuss the reasons for their exclusion. To be reasonable, an alternative, except for the no action alternative, must be technically and economically feasible and meet the purpose and need for the proposed action.

The following screening criteria were developed to determine that a potential alternative is reasonable and meets the purpose and need if it supports (1)The conduct of realistic military readiness activities; (2) Unit-level to advanced training; (3) Requisite air, surface, and sub-surface

range tracking, instrumentation, and communications capabilities; (4) Variable training and testing schedules by allowing year-round training and testing; (5) The training tempo as required by the Optimized Fleet Response Plan; (6) the introduction of new weapon systems and platforms; (7) Training and testing in proximity to home ports in the Western Pacific region to ensure the United States and ally forces are capable of rapid deployment and response to crises and threats specific to the region; (8) Maximum access to and utilization of existing and future offshore and land-based range infrastructure resources and facilities; (9) Training and testing access to diverse and variable marine environments that replicate real-world conditions where service members would be expected to operate; (10) A continuous operating area large enough to test and train new weapons systems and platforms and the tactics to employ them.

The Action Alternatives, and in particular the mitigation measures that are incorporated in the Action Alternatives, were developed to meet both the Action Proponents' purpose and need to conduct military readiness activities and NMFS' independent purpose and need to evaluate the potential effects of the Action Proponents' activities. The Action Proponents will implement mitigation measures to avoid or reduce potential effects from the Proposed Action on environmental resources. Mitigation measures would be implemented under either Action Alternative and are detailed and analyzed in Chapter 4.

The Action Proponents developed the alternatives considered in this SEIS/OEIS after careful assessment by subject matter experts, including military commands that utilize the ranges, military range management professionals, and environmental managers and scientists.

### 2.4.1 Alternatives Eliminated from Further Consideration

This SEIS/OEIS serves as an update to the previous MITT analyses; therefore, alternatives eliminated from consideration in the 2020 SEIS/OEIS were reevaluated to determine if they should be considered for this SEIS/OEIS. After thorough consideration of each, the Action Proponents determined that the "Status Quo" Alternative, Alternative Training and Testing Locations, Reduced Training and Testing, Alternatives Including Geographic Mitigation Measures within the Study Area, and Simulated Training and Testing alternatives still did not meet the purpose and need for the Proposed Action. For further discussion on these alternatives please refer to the 2020 SEIS/OEIS, Section 2.4.1.

### 2.4.2 Alternatives Considered for Analysis

#### 2.4.2.1 Previous MITT Alternatives

Three alternatives were analyzed in the previous MITT analyses: the No Action Alternative, Alternative 1, and Alternative 2. Refer to the 2015 EIS/OEIS and 2020 SEIS/OEIS for more details regarding alternatives.

#### 2.4.2.2 Action Alternatives

For this SEIS/OEIS, three alternatives are analyzed: the No Action Alternative, Alternative 1 (the Preferred Alternative), and Alternative 2. Because the military's anticipated training and testing levels evolve based on operational needs, the Navy's ongoing sonar reporting program provides classified data used to accurately project future active sonar requirements. In addition to meeting the Action Proponents' purpose and need, the action alternatives and associated

mitigation measures were developed to meet NMFS' independent purpose and need to (1) evaluate the potential effects of the activities; (2) determine whether incidental take would have a negligible effect on affected marine mammal species and stocks; (3) prescribe measures to achieve the least practicable adverse impact on species, stocks, and their habitat; and (4) fulfill monitoring and reporting requirements.

#### 2.4.2.2.1 No Action Alternative

The No Action Alternative for this SEIS/OEIS is the same as described in the 2020 SEIS/OEIS, Section 2.4.2.1 (No Action Alternative). Under this alternative, the Action Proponents would not conduct the proposed at-sea military readiness activities in the Study Area, and NMFS would deny the application for a Letter of Authorization. For FDM, the lease agreement would remain in place and the island would be maintained as a Navy range, though strike warfare training would cease.

As detailed in the 2020 SEIS/OEIS analyses, the No Action Alternative is inherently unreasonable because it fails to meet the purpose and need of the Proposed Action; specifically, the cessation of training would prevent the Action Proponents from meeting statutory readiness requirements and would result in an unacceptable increase in risk to personnel and national security. However, the No Action Alternative is carried forward in this SEIS/OEIS to serve as a baseline for comparing the potential environmental effects of the action alternatives.

#### 2.4.2.2.2 Alternative 1 (Preferred Alternative)

Alternative 1 is the Preferred Alternative. In addition to implementation of proposed new military readiness activities as listed in Table 2.3-1, Alternative 1 reflects a representative year of activity that accounts for natural fluctuations in deployment schedules. Compared to previous years, training with hull-mounted mid-frequency sonar (MF1) would decrease annually. Conversely, some unit level activities, such as Underwater Construction Team Training and Dive and Salvage Operations, are now formalized as discrete activities. Testing activities focus on maintaining technological edges through systems evaluation. While many testing levels remain stable, Alternative 1 includes formalized testing for Unmanned Aerial and Surface Vehicles to reflect modern technological integration.

##### 2.4.2.2.2.1 Training

Under Alternative 1, the Action Proponents propose to conduct military readiness activities into the reasonably foreseeable future, with adjustments from the previous MITT analyses that account for changes in the types and tempo (increases or decreases) of training activities, to meet current and future readiness requirements. These training activities include new activities, as well as activities subject to previous analyses that are currently ongoing and have historically occurred in the Study Area. The requirements for the types of activities, as well as the intensity at which they need to occur, have been validated by senior leadership. Specifically, training activities are based on changing world events, advances in technology, and U.S. tactical and strategic priorities. These activities account for force structure changes and include training with new aircraft, vessels, unmanned/autonomous systems, and weapon systems that will be introduced to the Fleets after July 2027. The numbers and locations of all proposed training activities are provided in Table 2.4-1.

#### 2.4.2.2.2.2 Testing

Alternative 1 reflects a level of testing activities to be conducted into the reasonably foreseeable future, with adjustments from the previous MITT analyses that account for changes in the types and tempo (increases or decreases) of testing activities to meet current and future military readiness requirements. Most testing activities that would be conducted under this alternative are the same as or similar as those conducted currently or in the past. This alternative includes the testing of new systems using new technologies and considers inherent uncertainties in this type of testing. The numbers and locations of all proposed testing activities are listed in Table 2.4-2.

#### 2.4.2.2.2.3 Range Modernization and Sustainment

Alternative 1 includes the installation and maintenance of subsurface targets and instrumentation as described in Table 2.3-1. Alternative 1 includes the nominal number of activities per year (1–2) in the Study Area, with a seven-year maximum range of 7–14 activities total.

### 2.4.2.2.3 Alternative 2

Similar to Alternative 1, Alternative 2 encompasses both new and ongoing activities but assumes a higher annual tempo of systems evaluation to meet the highest levels of military readiness activities

#### 2.4.2.2.3.1 Training

Alternative 2 reflects the maximum number of training activities that could occur within a given year and assumes that the maximum level of activity would occur every year over a seven-year period. Training levels shown in Table 2.4-1 generally represent the upper bounds of activity, such as 7,760 Air Combat Maneuvers annually. This allows for the greatest flexibility for the Action Proponents to maintain readiness when considering potential changes in the national security environment, fluctuations in training and deployment schedules, and anticipated in-theater demands. The numbers and locations of all proposed training activities are provided in Table 2.4-1.

#### 2.4.2.2.3.2 Testing

Under Alternative 2, the Action Proponents would be enabled to meet the highest levels of military readiness by assuming a greater level of testing efforts each year. Alternative 2 includes a higher tempo of systems evaluation compared to Alternative 1 to account for potential near-peer challenges. For example, Undersea Warfare Testing could reach up to 21 events annually, compared to a range of 6–21 in Alternative 1. This alternative includes the contingency for augmenting some weapon systems tests in response to potential increased world conflicts and changing Navy leadership priorities as the result of a direct challenge from a naval opponent that possesses near-peer capabilities. The numbers and locations of all proposed testing activities are listed in Table 2.4-2.

#### 2.4.2.2.3.3 Range Modernization and Sustainment

Installation and maintenance of subsurface targets and instrumentation would be the same as described in Table 2.3-1. Alternative 2 includes the maximum number of activities per year (2) in the Study Area with a seven-year total of 14 activities.

## Table 2.4-1: Action Proponents' Proposed Training Activities

| Activity Name | 2015 EIS/OEIS Annual # of Activities Alt 1[1] | 2020 SEIS/OEIS Annual # of Activities Alt 2[2] | Proposed Action Annual # of Activities Alt 1 | Proposed Action Annual # of Activities Alt 2 | Location |
|---|---|---|---|---|---|
| **Major Training Exercises – Large Integrated Anti-Submarine Warfare Training** | | | | | |
| Joint Multi-Strike Group Exercise | 1 | 1 | 1 | 1 | MITT Study Area > 3 NM from land |
| Joint Expeditionary Exercise* | 1 | 1 | 0 | 0 | MIRC; MITT Study Area |
| **Small Integrated Anti-Submarine Warfare Training** | | | | | |
| Surface Warfare Advanced Tactical Training[3] (SWATT) | 0 | 3 | 1 | 1 | MIRC; MITT Study Area > 3 NM from land |
| Small Integrated Anti-Submarine Warfare Training – Navy Undersea Warfare Training Assessment Course (NUWTAC)/Multi-Sail[3] | 0 | 3 | 7 | 7 | MIRC; MITT Study Area > 3 NM from land |
| **Medium Coordinated Anti-Submarine Warfare Training** | | | | | |
| Medium Coordinated Anti-Submarine Warfare Training[4] | 0 | 3 | 5 | 5 | MIRC; MITT Study Area > 3 NM from land |
| **Small Coordinated Anti-Submarine Warfare Training** | | | | | |
| Independent Deployer Certification Exercise/Tailored Surface Warfare Training[3] | 20 | 3 | 5 | 5 | MIRC; MITT Study Area > 3 NM from land |
| **Air Warfare** | | | | | |
| Air Combat Maneuvers[3] | 9,600 | 8,900 | 7,280–7,760 | 7,760 | MITT Study Area > 12 NM from land; SUA |
| Air Defense Exercise | 100 | 100 | 642–1,122 | 1,122 | MITT Study Area > 12 NM from land; SUA |
| Gunnery Exercise Air-to-Air Medium Caliber | 36 | 36 | 32–48 | 48 | MITT Study Area > 12 NM from land; SUA |
| Gunnery Exercise Surface-to-Air Large Caliber | 5 | 9 | 14 | 14 | MITT Study Area SUA > 12 NM from land |
| Gunnery Exercise Surface-to-Air Medium Caliber | 12 | 19 | 23 | 23 | MITT Study Area SUA > 12 NM from land |
| Missile Exercise Air-to-Air | 18 | 18 | 16–18 | 18 | MITT Study Area SUA > 12 NM from land |
| Missile Exercise Surface-to-Air | 15 | 27 | 6–8 | 8 | MITT Study Area SUA > 12 NM from land |
| **Amphibious Warfare** | | | | | |
| Amphibious Assault | 6 | 6 | 12–24 | 24 | CNMI Nearshore; Guam Nearshore** |
| Amphibious Raid | 6 | 6 | 10–20 | 20 | CNMI Nearshore; Guam Nearshore |
| Amphibious Vehicle Maneuvers/Rehearsals | 12 | 12 | 13–28 | 28 | MITT Study Area; Guam Nearshore; CNMI Nearshore; Apra Harbor |
| Naval Surface Fire Support – Land Based Target | 10 | 15 | 5 | 5 | FDM |
| Non-Combat Amphibious Operation[5] | 10 | 10 | 5–15 | 15 | CNMI Nearshore; Guam Nearshore |
| Unmanned Aerial Vehicle – Intelligence, Surveillance, and Reconnaissance | 100 | 100 | 232–432 | 432 | MIRC; MITT Study Area; SUA |

## Table 2.4-1: Action Proponents' Proposed Training Activities (continued)

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| Marine Air Ground Task Force Exercise (Amphibious) – Battalion* | 4 | 4 | 0 | 0 | Study Area to Nearshore; MIRC; Tinian; Guam; Rota; Saipan; FDM |
| Special Purpose Marine Air Ground Task Force Exercise* | 2 | 2 | 0 | 0 | Study Area to Nearshore; MIRC; Tinian; Guam; Rota; Saipan |
| **Anti-Submarine Warfare** | | | | | |
| Anti-Submarine Warfare Torpedo Exercise – Helicopter | 4 | 6 | 1 | 1 | MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Torpedo Exercise – Maritime Patrol Aircraft | 4 | 6 | 1–2 | 2 | MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Torpedo Exercise – Ship | 3 | 6 | 6–8 | 8 | MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Torpedo Exercise – Submarine | 10 | 4 | 1–2 | 2 | MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Tracking Exercise – Helicopter | 12 | 10 | 16 | 16 | MITT Study Area > 3 NM from land; Transit Corridor |
| Anti-Submarine Warfare Tracking Exercise – Maritime Patrol Aircraft | 34 | 36 | 45–60 | 60 | MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Tracking Exercise – Ship | 132 | 91 | 90 | 90 | MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Tracking Exercise – Submarine | 12 | 4 | 14 | 14 | MITT Study Area > 3 NM from land; Transit Corridor |
| **Electronic Warfare** | | | | | |
| Counter Targeting Chaff Exercise – Ship | 40 | 60 | 10 | 10 | MITT Study Area > 12 NM from land |
| Counter Targeting Chaff Exercise – Aircraft | 3,200 | 2,200 | 1,720–1,730 | 1,730 | MITT Study Area > 12 NM from land |
| Counter Targeting Flare Exercise | 3,200 | 2,200 | 1,720–1,730 | 1,730 | MITT Study Area > 12 NM from land |
| Electronic Warfare Operations | 480 | 522 | 655–1,160 | 1,160 | MITT Study Area |
| **Expeditionary Warfare** | | | | | |
| ***Dive and Salvage Operations*** | 0 | 0 | 250 | 250 | CNMI Nearshore; Guam Nearshore |
| Personnel Insertion/Extraction – Air[6] | 80 | 58 | 95 | 95 | CNMI Nearshore; Guam Nearshore |
| Personnel Insertion/Extraction – Surface and Subsurface[6] | 80 | 136 | 208–213 | 213 | CNMI Nearshore; Guam Nearshore |
| Personnel Insertion/Extraction – Swimmer/Diver[6] | 80 | 106 | 52 | 52 | CNMI Nearshore; Guam Nearshore |
| ***Underwater Construction Team Training*** | 0 | 0 | 50 | 50 | CNMI Nearshore; Guam Nearshore |
| ***Port Damage Repair (No Dredging/No Pile Driving)*** | 0 | 0 | 50 | 50 | CNMI Nearshore; Guam Nearshore |

## Table 2.4-1: Action Proponents' Proposed Training Activities (continued)

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| **Mine Warfare** | | | | | |
| Mine Countermeasures –Mine Detection | 4 | 4 | 8 | 8 | CNMI Nearshore; Guam Nearshore |
| Mine Countermeasures – Towed Mine Neutralization | 4 | 4 | 8 | 8 | CNMI Nearshore; Guam Nearshore |
| Airborne Mine Laying | 4 | 4 | 4 | 4 | MIRC Warning Areas; MITT Study Area |
| Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises | 1 | 1 | 1 | 1 | CNMI Nearshore; Guam Nearshore |
| Limpet Mine Neutralization System | 40 | 60 | 60 | 60 | Apra Harbor; Agat Bay Mine Neutralization Site |
| Mine Neutralization Explosive Ordnance Disposal | 20 | 20 | 20 | 20 | Agat Bay Mine Neutralization Site; Outer Apra Harbor UNDET Site; Piti UNDET Site |
| Surface Ship Object Detection | 0 | 6 | 20–30 | 30 | CNMI nearshore; Guam Nearshore |
| Underwater Demolition Qualification and Certification | 30 | 45 | 45 | 45 | Agat Bay Mine Neutralization Site; Outer Apra Harbor UNDET Site: Piti UNDET Site |
| Underwater Mine Countermeasure – Raise, Tow, Beach, and Exploitation Operations | 4 | 4 | 24 | 24 | Apra Harbor |
| **Strike Warfare** | | | | | |
| Bombing Exercise Air-to-Ground | 2,300 | 2,300 | 1,910–1,990 | 1,990 | FDM |
| Gunnery Exercise Air-to-Ground | 96 | 96 | 175–180 | 180 | FDM |
| Missile Exercise Air-to-Ground | 85 | 115 | 125–145 | 145 | FDM |
| **Surface Warfare** | | | | | |
| Bombing Exercise Air-to-Surface | 37 | 37 | 39 | 39 | MITT Study Area > 50 NM from land |
| Fast Attack Craft and Fast Inshore Attack Craft[7] | 018 | 27 | 22–33 | 33 | MITT Study Area > 3 NM from land |
| Gunnery Exercise Air-to-Surface Medium Caliber | 295 | 120 | 130 | 130 | MITT Study Area SUA > 12 NM from land |
| Gunnery Exercise Air-to-Surface Small Caliber | 242 | 321 | 349–418 | 418 | MITT Study Area SUA > 3 NM from land |
| Gunnery Exercise Surface-to-Surface Boat Medium Caliber | 10 | 20 | 9–24 | 24 | MITT Study Area SUA > 12 NM from land |
| Gunnery Exercise Surface-to-Surface Boat Small Caliber | 40 | 43 | 20–44 | 44 | MITT Study Area SUA > 3 NM from land; Transit Corridor |
| Gunnery Exercise Surface-to-Surface Ship Large Caliber | 140 | 255 | 180–257 | 257 | MITT Study Area SUA > 12 NM from land; Transit Corridor |

**Table 2.4-1: Action Proponents' Proposed Training Activities (continued)**

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| Gunnery Exercise Surface-to-Surface Ship Medium Caliber[8] | 50 | 117 | 104–150 | 150 | MITT Study Area SUA > 12 NM from land |
| Gunnery Exercise Surface-to-Surface Ship Small Caliber[8] | 50 | 117 | 173–230 | 230 | MITT Study Area SUA > 12 NM from land |
| Laser Targeting – Aircraft[9] | 600 | 600 | 310 | 310 | MITT Study Area SUA |
| Laser Targeting – Ship[9] | 600 | 600 | 1–5 | 5 | MITT Study Area SUA |
| Maritime Security Operations | 40 | 40 | 117–139 | 139 | MITT Study Area > 12 NM from land; MIRC |
| Missile Exercise Air-to-Surface | 20 | 10 | 38–50 | 50 | MITT Study Area SUA > 12 NM from land |
| Missile Exercise Air-to-Surface – Rocket | 3 | 111 | 35–47 | 47 | MITT Study Area SUA > 12 NM from land |
| Missile Exercise Surface-to-Surface | 12 | 28 | 8–9 | 9 | MITT Study Area > 50 NM from land |
| Sinking Exercise | 2 | 1 | 1–2 | 2 | MITT Study Area > 50 NM from land |
| Small Boat Attack | 18 | 27 | 6–8 | 8 | MITT Study Area > 3 NM from land |
| Torpedo Exercise (Submarine-to-Surface) | 5 | 0 | 1–5 | 5 | MITT Study Area > 3 NM from land |
| **Other Training Activities** | | | | | |
| Direct Action (Tactical Air Control Party) | 18 | 18 | 18 | 18 | FDM |
| Precision Anchoring | 18 | 18 | 20 | 20 | Apra Harbor; Mariana Islands anchorages |
| Search and Rescue at Sea | 40 | 45 | 50–52 | 52 | MITT Study Area |
| Submarine Navigation | 8 | 8 | 50 | 50 | MITT Study Area; MIRC |
| Submarine Sonar Maintenance | 48 | 86 | 92 | 92 | MITT Study Area > 3 NM from land; Inner Apra Harbor; Transit Corridor |
| Surface Ship Sonar Maintenance | 42 | 44 | 51 | 51 | MITT Study Area > 3 NM from land; Inner Apra Harbor; Transit Corridor |
| Underwater Survey | 16 | 32 | 76 | 76 | MITT Study Area; Marianas Nearshore |
| Unmanned Aerial Vehicle Training and Certification | 1,000 | 951 | 541–556 | 556 | MITT Study Area; Marianas Nearshore; MIRC SUA |
| Unmanned Underwater Vehicle Training | 0 | 64 | 65–70 | 70 | MIRC; Marianas Nearshore, MITT Study Area |
| ***Maritime Environmental Response*** | 0 | 0 | 1–2 | 2 | MITT Study Area |
| ***Waterborne Training*** | 0 | 0 | 50–75 | 75 | MIRC; MITT Study Area; Marianas Nearshore |

## Table 2.4-1: Action Proponents' Proposed Training Activities (continued)

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |

*Activities are not analyzed in this SEIS/OEIS.
**For the purposes of this SEIS/OEIS, the nearshore environment is defined as the area extending from the mean high-water mark seaward to the 3-nautical mile (NM) limit of the territorial sea.
[1]The Department of the Navy selected Alternative 1, the Preferred Alternative, in the Record of Decision signed 28 August 2015. Activities only occur at sea and on FDM.
[2]The Department of the Navy selected Alternative 2, the Preferred Alternative, in the Record of Decision signed 29 July 2020 and only occur at sea and on FDM.
[3]Includes Air Intercept Control activities from 2020 Final SEIS/OEIS.
[4]Surface Warfare Advanced Tactical Training, Small Integrated Anti-Submarine Warfare Training, Medium Coordinated Anti-Submarine Training, and Independent Deployer Certification Exercise/Tailored Surface Warfare Training were not called out in the 2020 SEIS/OEIS, but the components of the exercises were covered under Combined Small Coordinated ASW Exercise (e.g., Multi-Sail/GUAMEX/SWATT).
[5]Includes Humanitarian Assistance Operations.
[6]Personnel Insertion/Extraction – Air, Surface and Subsurface, and Swimmer/Diver were not called out in the 2020 SEIS/OEIS, but the components of the activities were covered under Personnel Insertion/Extraction.
[7]Fast Attack Craft and Fast Inshore Attack Craft was not called out in the 2020 SEIS/OEIS, but the components of the activity were covered under Small Boat Attack.
[8]Gunnery Exercise Surface-to-Surface Ship Medium Caliber and Gunnery Exercise Surface-to-Surface Ship Small Caliber were not called out in the 2020 SEIS/OEIS, but the components of the activities were covered under Gunnery Exercise Surface-to-Surface Ship Small and Medium Caliber.
[9]Laser Targeting – Aircraft and Laser Targeting – Ship was not called out in the 2020 SEIS/OEIS, but the components of the activities were covered under Laser Targeting at Sea.
Notes: ***Bold Italicized*** = New Activity; SEIS/OEIS = Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement, MIRC = Mariana Islands Range Complex, FDM = Farallon de Medinilla, NM = nautical mile(s), SUA = Special Use Airspace, UNDET = Underwater Detonation, W = Warning Area

## Table 2.4-2: Action Proponents' Proposed Testing Activities

| Activity Name | 2015 EIS/OEIS Annual # of Activities Alt 1[1] | 2020 SEIS/OEIS Annual # of Activities Alt 2[2] | Proposed Action Annual # of Activities Alt 1 | Proposed Action Annual # of Activities Alt 2 | Location |
|---|---|---|---|---|---|
| **Naval Air Systems Command** | | | | | |
| **Air Warfare** | | | | | |
| Air Combat Maneuver Test[3] | See Footnote 3 | See Footnote 3 | 7–8 | 8 | MIRC; MITT Study Area > 12 NM from land |
| Intelligence, Surveillance, and Reconnaissance Test | 10 | 20 | 20 | 20 | MIRC: MITT Study Area > 3 NM from land |
| **Anti-Submarine Warfare** | | | | | |
| Anti-Submarine Warfare Torpedo Test (Aircraft) | 40 | 20 | 10 | 10 | MIRC; MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Tracking Test (Fixed-Wing)[4] | 188 | 26 | 3 | 3 | MIRC; MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Tracking Test (Rotary-Wing)[4] | See Footnote 4 | See Footnote 4 | 5 | 5 | MIRC: MITT Study Area > 3 NM from land |
| **Surface Warfare** | | | | | |
| Air-to-Surface Missile Test | 8 | 4 | 6–7 | 7 | MIRC; MITT Study Area > 12 NM from land |
| **Naval Sea Systems Command** | | | | | |
| **Anti-Submarine Warfare** | | | | | |
| ***Pierside Sonar Testing*** | 0 | 0 | 6–12 | 12 | Inner Apra Harbor |
| At-Sea Sonar Testing | 20 | 7 | 6–12 | 12 | MIRC; Study Area > 3 NM from land |
| **Mine Warfare** | | | | | |
| Mine Countermeasure and Neutralization Testing | 32 | 3 | 3 | 3 | Agat Bay Mine Neutralization; Piti Floating Mine Neutralization; Helicopter Laser Hazard Area |
| **Unmanned Systems** | | | | | |
| ***Unmanned Aerial System Testing*** | 0 | 0 | 2–4 | 4 | MITT Study Area |
| ***Unmanned Surface Vehicle System Testing*** | 0 | 0 | 1 | 1 | MITT Study Area |
| **Vessel Evaluation** | | | | | |
| Undersea Warfare Testing | 2 | 1 | 6–21 | 21 | MITT Study Area |
| ***In-Port Maintenance Testing*** | 0 | 0 | 0–12 | 12 | MITT Study Area |
| Submarine Sea Trials – Weapons System Testing | 0 | 1 | 0–1 | 1 | MITT Study Area |
| Vessel Signature Evaluation | 17 | 0 | 8–12 | 12 | MITT Study Area |
| **Office of Naval Research** | | | | | |
| **Acoustic and Oceanographic Science and Technology** | | | | | |
| Acoustic and Oceanographic Research | 1 | 1 | 2–3 | 3 | MITT Study Area |

**Table 2.4-2: Action Proponents' Proposed Testing Activities (continued)**

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |

[1]The Department of the Navy selected Alternative 1, the Preferred Alternative, in the Record of Decision signed August 28, 2015. Activities only occur at sea and on FDM.
[2]The Department of the Navy selected Alternative 2, the Preferred Alternative, in the Record of Decision signed July 29, 2020 and only occur at sea and on FDM.
[3]Air Combat Maneuver Test was not called out in the previous MITT analyses, but the components of the testing were aligned with the training activity "Air Combat Maneuvers."
[4]Anti-Submarine Warfare Tracking Test (Fixed-Wing) was called Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft (Sonobuoys) in the previous MITT analyses. Anti-Submarine Warfare Tracking Test (Rotary-Wing) was not previously identified as an activity, but the components of the activity (e.g., sound sources and platform) were analyzed in the previous MITT analyses as part of other similar activities (e.g., Anti-Submarine Warfare Tracking Exercise – Helicopter) and are not new to the Study Area.
Notes: ***Bold Italicized*** = New Activity; SEIS/OEIS = Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement, MIRC = Mariana Islands Range Complex; MITT = Mariana Islands Training and Testing; NM = Nautical Miles

# 3 Affected Environment and Environmental Consequences

## 3.0 Introduction

Consistent with NEPA, federal agencies must analyze the potential environmental effects of their major actions. This chapter describes the existing environmental conditions in the MITT Study Area, as well as the analysis of resources potentially affected by the Proposed Action described in Chapter 2 and detailed in Appendix A. The Study Area is the same as previously analyzed in the 2020 SEIS/OEIS and is described in Section 2.1 and depicted in Figure 1.1-1.

### 3.0.1 Resources Carried Forward for Analysis

Resources carried forward for this analysis include physical resources (sediments and water quality, air quality); biological resources, including threatened and endangered species (marine habitats, marine mammals, sea turtles, sea birds, marine vegetation, marine invertebrates, fishes, and terrestrial species and habitats); and human resources (cultural resources, socioeconomic resources, and public health and safety). These resources each have unique stressors described in their respective sections of Chapter 3. Due to the offshore location of the Proposed Action, impacts on population demographics and children's health and safety are not anticipated and require no further analysis.

### 3.0.2 Regulatory Framework

The analysis for each resource is conducted within a consistent regulatory framework (see Appendix I); unless otherwise specified, no recent regulatory updates have occurred that would affect the current resource evaluations. In instances where the regulatory framework has changed since the previous environmental documentation, the specific resource section includes a detailed update to reflect those changes (Sections 3.2 and 3.11).

### 3.0.3 No Action Alternative

NEPA requires the analysis of a No Action Alternative to provide the baseline of which to analyze and compare Action Alternatives. As described in Section 2.4.2.2.1, none of the proposed military readiness activities would be conducted under the No Action Alternative. Therefore, baseline conditions of the existing environment for the resources described above would either remain unchanged or would improve slightly after cessation of ongoing military readiness activities. FDM would continue to be maintained as a Navy range, although military readiness activities would no longer continue on the island.

### 3.0.4 Effects Analysis Framework

The following section describes the framework under which effects from Alternative 1 and Alternative 2 of the Proposed Action, as described in Section 2.4.2.2.2 and Section 2.4.2.2.3, respectively, are analyzed. Pursuant to NEPA (as amended) and the DoD's implementing procedures issued on June 30, 2025, the following two-step framework (Figure 3.0-1) is applied to facilitate the analysis for this SEIS/OEIS:

1. ***Reasonably Foreseeable Effects***: First, the Action Proponent determines whether potential effects under each Action Alternative are "reasonably foreseeable." DoD NEPA Implementing Procedures define reasonably foreseeable as "sufficiently likely to occur

such that a person of ordinary prudence would take it into account in reaching a decision."

2. ***Determination of Significance***: If an effect is determined to be reasonably foreseeable, the DoD would consider the potentially affected environment and degree of the effect. In determining if the degree of effect is "significant" or "less than significant," the Action Proponent may consider, as appropriate to the specific action:
    - short-term and long-term effects
    - beneficial and adverse effects
    - effects on public health and safety
    - economic effects
    - effects on the quality of life of the American people

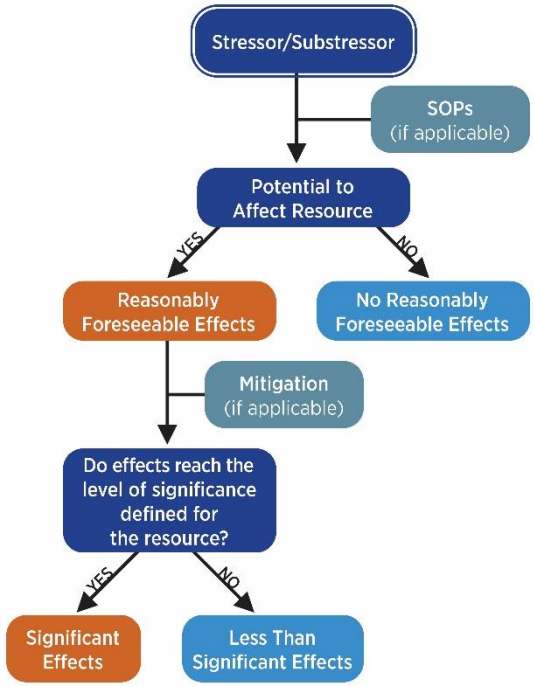


**Figure 3.0-1: Analysis Approach Framework**

Military readiness activities are assessed in this SEIS/OEIS by evaluating the effects of the various stressors associated with the activities. SOPs, which include existing activity-based mitigation measures established in past consultations, are considered as part of the Proposed Action when determining if effects associated with stressors are reasonably foreseeable.

In determining the degree of effect and significance for stressors that are reasonably foreseeable, the potential benefits of mitigation measures developed during SEIS/OEIS consultations are considered. The resulting significance determinations facilitate the comparison of environmental consequences among alternatives.

### 3.0.4.1 Identifying Stressors for Action Alternative Analysis

Military readiness activities that comprise the Proposed Action may produce one or more stimuli that cause stress on a resource. Each proposed activity was examined to determine its potential stressors. The term stressor is broadly used in this document to refer to an agent, condition, or other stimulus that potentially causes strain to an organism or alters physical, socioeconomic, or cultural resources. Not all stressors affect every resource, nor do all proposed activities produce all stressors. Refer to Appendix B to see the relationship of stressors to activities and stressors to resources. The stressors associated with the Proposed Action that are evaluated under this SEIS/OEIS are listed in Table 3.0-1. Stressors are often categorized into specific substressors to allow for a more detailed analysis of the potential effects on each resource. Additionally, some resources may be affected by secondary stressors, which are indirect effects that may result from the Proposed Action. Applicable substressors and secondary stressors are noted and analyzed within the respective resource sections.

**Table 3.0-1: Stressors Carried Forward in this SEIS/OEIS**

| Biological Resources | Physical Resources | Human Resources |
|---|---|---|
| • Acoustic<br>• Explosive<br>• Energy<br>• Physical Disturbance and Strike<br>• Entanglement<br>• Ingestion<br>• Secondary Stressors | • Criteria air pollutants<br>• Hazardous air pollutants<br>• Explosives and explosive by-products<br>• Metals<br>• Chemicals other than explosives<br>• Other materials | • Explosives<br>• Physical disturbance and strike<br>• Accessibility<br>• Airborne acoustics<br>• In-water energy<br>• In-air energy<br>• Physical interactions<br>• Secondary Stressors (for socioeconomic resources and public health and safety) |

The following subsections describe environmental stressors in more detail. Stressors for physical resources (sediments and water quality, air quality) and human resources (cultural resources, socioeconomic resources, and public health and safety) are described further in their respective sections of Chapter 3. Some, but not all, of the descriptions of the stressors identified for consideration in this SEIS/OEIS have been updated from those considered in previous MITT analyses. Only those stressors and substressors with updated descriptions from previous MITT analyses are described in the following sections of this chapter. Refer to Section 3.0.4 of the 2020 SEIS/OEIS and Section 3.0.5.2 in the 2015 EIS/OEIS for additional information on stressor descriptions.

#### 3.0.4.1.1 Acoustic Stressors

Acoustic sources analyzed include sonar, other transducers, and noise from vessels, aircraft, and weapons. Detailed descriptions of these sources are provided in the *Acoustic and Explosive Effects Analysis Technical Report* (U.S. Department of the Navy, 2025a).

To facilitate complex underwater sound analysis, sources are grouped into "bins" based on acoustic properties (frequency, source level, duty cycle, and beam patterns). Unlike previous phases, Phase IV bins are defined strictly by these acoustic properties rather than by the purpose of the source. Duty cycle is the percentage of time that a sonar system is emitting sound compared to the time it is off during an operational period. For example, if a sonar source produces a one-second ping once every 10 seconds, the duty cycle is 10 percent.

- **Sonar and Transducers:** Sources are categorized into six non-impulsive classes, plus broadband and hull-mounted sonar (Table 3.0-2).
- **Aircraft, Vessel, and Weapons Noise:** Characteristics have been updated where applicable. Refer to the 2020 SEIS/OEIS for legacy source levels.

**Table 3.0-2: Sonar and Transducer Sources Quantitatively Analyzed**

| Source Class Category | Description | Unit | Training and Testing | |
|---|---|---|---|---|
| | | | Alternative 1* | Alternative 2 |
| **Broadband Sources** | | | | |
| LF to HF | <= 205 dB | C[1] | 42–52 | 52 |
| MF to HF | | H | 886–907 | 907 |
| **Low-Frequency Acoustic Sources** | | | | |
| LFM | 185 dB to 205 dB | H | 15 | 15 |

| Source Class Category | Description | Unit | Training and Testing | |
|---|---|---|---|---|
| | | | Alternative 1* | Alternative 2 |
| LFH | > 205 dB | C | 243 | 243 |
| **Mid-Frequency Acoustic Sources Other Than Hull-Mounted** | | | | |
| MFM | 185 dB to 205 dB | C | 1,424–1,616 | 1,616 |
| MFH | > 205 dB | H | 536–686 | 686 |
| **Hull-Mounted Surface Ship Sonar** | | | | |
| MF1C | Hull-mounted surface ship sonar (previously MF11) with duty cycle >80% | H | 256–258 | 258 |
| MF1K | Hull-mounted surface ship sonar (previously MF1K) in Kingfisher mode | H | 23–33 | 33 |
| MF1 | Hull-mounted surface ship sonar (previously MF1) | H | 1,386–1,392 | 1,392 |
| **High-Frequency Acoustic Sources** | | | | |
| HFM | 185 dB to 205 dB | H | 208–235 | 235 |
| HFH | > 205 dB | C | 58–93 | 93 |
| | | H | 1,518–1,628 | 1,628 |
| **Very High-Frequency Acoustic Sources** | | | | |
| VHFH | > 205 dB | H | 130–140 | 140 |

*Preferred Alternative

[1] – Count = number of occurrences.

Notes: dB = decibel(s), H = hours; C = count; LF = low frequency; MF = mid frequency; HF = high frequency; VHF = very high frequency; the third letter following LF, MF, HF, and VHF corresponds to: L = low power, M = medium power, H = high power; when following "MF1" C = duty cycle > 80%, K = Kingfisher mode.

As part of the previous MITT analyses and the 2015 and 2020 MMPA LOAs, NMFS authorized the Action Proponents to use non-impulsive sound sources, including sonars and other transducers (hereinafter referred to as sonars). Sonars were grouped into classes that share one or more attributes, such as frequency range or purpose of use. The classes were further sorted into sound source bins.

The Action Proponents identified the type of sonar source that resulted in the highest number of exposures to marine mammals, which was hull-mounted mid-frequency active sonar in bin MF1/MF1-C/MF1-K. Table 3.0-3 provides a comparison between the hours associated with these sonars from the previous MITT analyses, and those proposed for Alternative 1 and Alternative 2 for this SEIS/OEIS.

**Table 3.0-3: Comparison of Proposed Annual Total Hull-Mounted Mid-Frequency Sonar Hour Use Compared to the Number Authorized in the 2015–2020 and 2020–2027 NEPA Planning and MMPA Permits**

| Number of Mid-Frequency (MF1, MF1K, and MF1C) Sonar Hours | | | | |
|---|---|---|---|---|
| Source Class Category | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | Alternative 1* | Alternative 2 |
| MF1C | 324 | 304 | 256-258 | 258 |
| MF1K | 0 | 3 | 23-33 | 33 |
| MF1 | 1,872 | 1,818 | 1,386-1,392 | 1,392 |

*Preferred Alternative

#### 3.0.4.1.2 Explosive Stressors

Explosive stressors include both in-air and in-water detonations. While in-air descriptions remain unchanged from the 2020 SEIS/OEIS, the annual quantities for in-water explosions have been updated to reflect the current Proposed Action.

- **Explosive Binning:** Explosives are divided into bins E0–E12 based on Net Explosive Weight (NEW).
- **Quantitative Updates:** Table 3.0-4 summarizes the annual in-water detonations for each alternative.

As part of the previous MITT analyses and the 2015 and 2020 MMPA LOAs, NMFS authorized the Navy to use impulsive sources (i.e., explosives). As was the case in the previous MITT analyses, for this SEIS/OEIS munitions were divided into more appropriate bins based on current and anticipated weapon inventory. Bins used to sort explosive munitions are further defined and quantified in the *Acoustic and Explosive Effects Analysis Technical Report* (U.S. Department of the Navy, 2025a).

Under Alternative 1 of this SEIS/OEIS, the minimum number of activities results in a 15 percent reduction of explosive sources from the currently authorized amounts. At the maximum, and the same for Alternative 2, there is a 38 percent increase of explosive sources from the currently authorized amounts. Table 3.0-4 provides a comparison between the number of explosives authorized for training and testing in the previous MITT analyses and proposed in this SEIS/OEIS.

**Table 3.0-4: Comparison of Proposed Annual Explosives Use (Bins E1–E12) Compared to the Number Authorized in the 2015–2020 and 2020–2027 NEPA Planning and MMPA Permits**

| Bin | Net Explosive Weight (lb.) | Example Explosive Source | Number of Explosives | | | |
|---|---|---|---|---|---|---|
| | | | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | | | Alternative 1* | Alternative 2 |
| E1 | 0.1–0.25 | Medium-caliber projectiles | 10,140 | 768 | 635–1,080 | 1,080 |
| E2 | > 0.25–0.5 | Grenade | 106 | 400 | 200 | 200 |
| E3 | > 0.5–2.5 | 57 mm projectiles; 2.75" rockets | 932 | 683 | 870–1,896 | 1,896 |
| E4 | > 2.5–5 | Mine Neutralization Charge | 420 | 44 | 41 | 41 |
| E5 | > 5–10 | 5-inch projectiles | 684 | 1,221 | 974–1,314 | 1,314 |
| E6 | > 10–20 | Hellfire missile | 76 | 29 | 86–116 | 116 |
| E7 | > 20–60 | Air-to-Surface Missile | 0 | 0 | 4–16 | 16 |
| E8 | > 60–100 | 250 lb. bomb; Lightweight torpedo | 16 | 134 | 1–2 | 2 |
| E9 | > 100–250 | 500 lb. bomb | 4 | 110 | 135–143 | 143 |
| E10 | > 250–500 | 1,000 lb. bomb | 12 | 78 | 44 | 44 |
| E11 | > 500–650 | Heavyweight torpedo | 6 | 5 | 2–4 | 4 |
| E12 | > 650–1,000 | 2,000 lb. bomb | 184 | 48 | 33–34 | 34 |

Notes: lb. = pound(s), mm = millimeter(s)
* Preferred Alternative

#### 3.0.4.1.2.1 Explosive Utilization at Farallon de Medinilla

As the only U.S.-controlled, unrestricted live-fire range in the Western Pacific west of the international date line, FDM remains critical for maintaining high-level operational readiness in the Indo-Pacific theater. The island's unique and isolated geography provides a specialized environment that cannot be replicated elsewhere for complex training. To ensure the long-term sustainability of the island's unique ecosystem, the military is modernizing its training by integrating advanced precision technologies and digital simulations. This allows forces to achieve mission-essential proficiency with a strategic reduction in the annual use of explosives, favoring highly accurate training over high-volume ordnance delivery. As such, FDM is indispensable for validating the next generation of precision strike capabilities vital to national defense. In this SEIS/OEIS the Action Proponents are evaluating the potential effects associated with explosive utilization on FDM. Alternative 1 (Preferred Alternative) shows a roughly 35 percent reduction in explosive use on FDM from the previous MITT analyses. Alternative 2 also shows a 34 percent reduction of explosives utilized on FDM from the previous MITT analyses. Table 3.0-5 provides a comparison between the number of explosives authorized for training and testing in the 2015 EIS/OEIS, the 2020 SEIS/OEIS, and proposed in this SEIS/OEIS.

**Table 3.0-5: Comparison of Proposed Annual Explosives Utilization on FDM**

| Bin | Net Explosive Weight (lb.) | Explosive Source | Number of Explosives | | | |
|---|---|---|---|---|---|---|
| | | | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | | | Alternative 1* | Alternative 2 |
| E1 | 0.1–0.25 | Medium-caliber projectiles | 17,350 | 19,500 | 14,070 | 14,170 |
| E2 | > 0.25–0.5 | Grenade/Mortar | 1,000 | 1,000 | 1,000 | 1,000 |
| E3 | > 0.5–2.5 | 57mm projectiles; 2.75" rockets | 600 | 2,000 | 1,240 | 1,260 |
| E5 | > 5–10 | 5-inch projectiles | 1,200 | 4,400 | 459 | 459 |
| E6 | > 10–20 | Hellfire missile | 85 | 115 | 141 | 161 |
| E-9–E-12 | > 60–1,000 | 500 lb. bomb–2,000 lb. bomb | 6,242 | 6,242 | 4,530 | 4,610 |

* Preferred Alternative
Note: lb. = pounds

#### 3.0.4.1.3 Other Stressors (Energy, Physical Disturbance/Strike, and Entanglement/Ingestion)

Other stressors have been consolidated into three primary categories: Energy, Physical Disturbance/ Strike, and Entanglement/Ingestion. Detailed descriptions for these stressors remain unchanged from the 2020 SEIS/OEIS and are incorporated herein by reference. Specifically, refer to Section 3.0.4 of the 2020 SEIS/OEIS and Section 3.0.5.2 of the 2015 EIS/OEIS for further information on the nature of these stressors. For the purpose of analysis, historical and updated number of events, as well as physical parameters where applicable, are provided in Tables 3.0-6 through 3.0-19.

**Table 3.0-6: Annual Number of Events in the Study Area that Include In-Water Electromagnetic Devices**

| Annual # of Events | | | |
|---|---|---|---|
| 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | Alternative 1* | Alternative 2 |
| 5 | 4 | 8 | 8 |

*Preferred Alternative

**Table 3.0-7: Events in the Study Area that Include High-Energy Lasers**

| Annual # of Events | | | |
|---|---|---|---|
| 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | Alternative 1 | Alternative 2 |
| 0 | 60 | 14–28 | 28 |

*Preferred Alternative

**Table 3.0-8: Representative Vessel Types, Lengths, and Speeds**

| Type | Example(s) | Length | Typical Operating Speed |
|---|---|---|---|
| **U.S. Navy Vessels** | | | |
| Aircraft Carrier | Aircraft Carrier (CVN) | >1,000 ft. | 10–15 knots |
| Surface Combatant | Cruisers (CG), Destroyers (DDG), Frigates (FFG), Littoral Combat Ships (LCS) | 300–700 ft. | 10–15 knots |
| Amphibious Warfare Ship | Amphibious Assault Ship (LHA, LHD), Amphibious Transport Dock (LPD), Dock Landing Ship (LSD), Medium Landing Ship (LSM), Stern Landing Vessel (SLV) | 200–900 ft. | 10–15 knots |
| Combat Logistics Force Ships | Fast Combat Support Ship (T-AOE), Dry Cargo/Ammunition Ship (T-AKE), Fleet Replenishment Oilers (T-AO) | 600–750 ft. | 8–12 knots |
| Support Craft/Other | Amphibious Assault Vehicle (AAV); Combat Rubber Raiding Craft (CRRC); Landing Craft, Mechanized (LCM); Landing Craft, Utility (LCU); Submarine Tenders (AS); Yard Patrol Craft (YP); Range Support; Torpedo Retrievers | 15–140 ft. | 0–20 knots |
| Support Craft/Other – Specialized High Speed | High Speed Ferry/Catamaran; Patrol Combatants (PC); Rigid Hull Inflatable Boat (RHIB); Expeditionary Fast Transport (EPF); Landing Craft, Air Cushion (LCAC) | 33–320 ft. | 0–50+ knots |
| Submarines | Fleet Ballistic Missile Submarines (SSBN), Attack Submarines (SSN), Guided Missile Submarines (SSGN) | 300–600 ft. | 8–13 knots |

**Table 3.0-9: Representative Types, Sizes, and Speeds of In-Water Devices**

| Type | Example(s) | Length | Typical Operating Speed |
|---|---|---|---|
| Towed Device | Minehunting Sonar Systems; Improved Surface Tow Target; Towed Sonar System; MK-103, MK-104 and MK-105 Minesweeping Systems | < 33 ft. | 10–40 knots |
| Medium USV | Long Range USV, Common USV, MK-33 Seaborne Power Target Drone Boat, QST-35A Seaborne Powered Target, Ship Deployable Seaborne Target, Small Waterplane Area Twin Hull, Unmanned Influence Sweep System | < 190 ft. | Variable, up to 50+ knots |
| Large USV | Research and Development Surface Vessels, Patrol Boats, Ranger, USV, Nomad USV, Mariner, Vanguard USV | 200–300 ft. | Typical 1–15 knots, sprint 25–50 knots |
| Unmanned Underwater Vehicle (UUV) | Acoustic Mine Targeting System, Airborne Mine Neutralization System, Archerfish Common Neutralizer, Crawlers, CURV 21, Deep Drone 8000, Deep Submergence Rescue Vehicle, Gliders, Expendable Mobile Anti-Submarine Warfare Training Targets, Magnum Remotely Operated Vehicle, Manned Portables, MK 30 Anti-Submarine Warfare Targets, Remote Multi-Mission Vehicle, Remote Minehunting System, Large Displacement UUV, Extra-Large UUV | < 100 ft. | 1–15 knots |
| Torpedoes | Light-weight and Heavy-weight Torpedoes | < 33 ft. | 20–30 knots |

Note: ft. = feet, USV = Unmanned Surface Vehicle, UUV = Unmanned Underwater Vehicle

**Table 3.0-10: Annual Number of Events that Include Vessels and In-Water Devices**

| Activity Area | Annual # of Events | | | |
|---|---|---|---|---|
| | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | Alternative 1* | Alternative 2 |
| Vessels | 6,173 | 6,890 | 2,936–3,837 | 3,825–3,837 |
| In-Water Devices | | | 1,581–1,787 | 1,775–1,787 |

*Preferred Alternative

**Table 3.0-11: Annual Number of Events in the Study Area that Include Aircraft Movement**

| Annual # of Events | | | |
|---|---|---|---|
| 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | Alternative 1 | Alternative 2 |
| 22,397 | 20,094 | 13,008—14,987 | 14,987 |

*Preferred Alternative

**Table 3.0-12: Annual Number of Non-Explosive Practice Munitions Expended At Sea in the Study Area**

| Non-Explosive Ordnance | Military Readiness Activities | | | |
|---|---|---|---|---|
| | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | Alternative 1* | Alternative 2 |
| Bombs | 848 | 152 | 154 | 1,078 |
| Flechettes | Note 1 | 89 | 304–608 | 608 |
| Large-Caliber Projectiles | 6,918 | 22,268 | 4,164–6,354 | 6,354 |
| Large-Caliber Projectile Casings | Note 1 | 4,200 | 272–444 | 444 |
| Medium-Caliber Projectile | 87,540 | 280,750 | 135,936–200,938 | 200,938 |
| Medium-Caliber Projectile Casings | Note 1 | Note 2 | 5,425–8,056 | 8,056 |
| Missile | 20 | 0 | 16–18 | 18 |
| Rocket | 0 | 1,697 | 304–608 | 608 |
| Small-Caliber Projectile | 88,140 | 354,318 | 1,885,794–2,400,496 | 2,400,496 |
| Small-Caliber Projectile Casings | Note 1 | 348,306 | 387,959–491,300 | 491,300 |

*Preferred Alternative
Note 1: These items were not calculated in the 2015 EIS/OEIS.
Note 2: These items were not calculated in the 2020 SEIS/OEIS.

**Table 3.0-13: Annual Number of Other Military Expended Materials Used At Sea in the Study Area**

| Other Military Expended Materials | Military Readiness Activities | | | |
|---|---|---|---|---|
| | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | Alternative 1* | Alternative 2 |
| Acoustic Countermeasures | 294 | 466 | 42–52 | 52 |
| Anchor - Other | Note 1 | 28 | 0–441 | 441 |
| Anchor (Mine) | Note 1 | 599 | 291-315 | 315 |
| Chaff – Air Cartridge | Note 1 | 17,600 | 15,280–15,520 | 15,520 |
| Chaff – Air Fibers | Note 1 | Note 2 | 15,280–15,520 | 15,520 |
| Chaff – Ship Fibers | Note 1 | Note 2 | 60 | 60 |
| Chaff- Ship Cartridge | 314 | 360 | 60 | 60 |
| Compression Pad or Plastic Pistons | Note 1 | 17,600 | 15,280–15,520 | 15,520 |

| Other Military Expended Materials | Military Readiness Activities | | | |
|---|---|---|---|---|
| | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | Alternative 1* | Alternative 2 |
| Decelerator/Parachute (Extra-Large) | Note 1 | Note 2 | 22–32 | 32 |
| Decelerator/Parachute (Large) | Note 1 | 10 | 3–5 | 5 |
| Decelerator/Parachute (Medium) | Note 1 | 18 | 16–18 | 18 |
| Decelerator/Parachute (Small) | Note 1 | 5,934 | 6,248–7,138 | 7,138 |
| Endcap – Chaff and Flares | Note 1 | 35,218 | 30,576–31,058 | 31,058 |
| Expended Bathythermograph | 520 | 364 | 542–545 | 545 |
| Fiber Optic Cannister | 28 | 44 | 45 | 45 |
| Flare | Note 1 | 17,600 | 15,280–15,520 | 15,520 |
| Flare O-ring | Note 1 | 17,618 | 15,296–15,538 | 15,538 |
| Heavyweight Torpedo Accessories | 54 | 73 | 25–57 | 57 |
| JATO Bottle | 20 | 20 | 22-32 | 32 |
| Lander | Note 1 | Note 2 | 12-18 | 18 |
| Lightweight Torpedo Accessories | 72 | 66 | 33–36 | 36 |
| Sabot – Kinetic Energy Projectile | Note 1 | 180 | 28,925–30,950 | 30,950 |
| Sabot – Plastic | Note 1 | 180 | 30,925–40,550 | 40,550 |
| Ship Hulk | Note 1 | 1 | 1–3 | 3 |
| Sonobuoys (Non-Explosive) | 11,912 | 5,876 | 6,334–7,239 | 7,239 |
| Surface Device – Floating (Small) | Note 1 | Note 2 | 44–46 | 46 |
| Torpedoes | Note 1 | 7 | 4–6 | 6 |

*Preferred Alternative

Note 1: These items were not calculated in the 2015 EIS/OEIS.

Note 2: These items were not calculated in the 2020 SEIS/OEIS.

## Table 3.0-14: Annual Number of Explosive Munitions Expended At Sea in the Study Area

| Explosive Ordnance | Military Readiness Activities | | | |
|---|---|---|---|---|
| | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | Alternative 1* | Alternative 2 |
| AMNS Neutralizer | 28 | 44 | 41 | 41 |
| Grenades | Note 1 | 400 | 200 | 200 |
| Torpedoes | 10 | 7 | 2–4 | 4 |
| Bombs | 212 | 198 | 180–182 | 182 |
| Rockets | 114 | 323 | 546–666 | 666 |
| Missiles | 145 | 249 | 175–241 | 241 |
| Large-Caliber Projectiles | 12,220 | 1,658 | 1,259–2,505 | 2,505 |
| Medium-Caliber Projectiles | 10,190 | 22,480 | 19,417–26,128 | 26,128 |

*Preferred Alternative

Note 1: These items were not calculated in the 2015 EIS/OEIS.

## Table 3.0-15: Annual Number of Targets Expended At Sea in the Study Area

| Target | Military Readiness Activities | | | |
|---|---|---|---|---|
| | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | Alternative 1* | Alternative 2 |
| Air Targets – Drone | Note 1 | 168 | 6–11 | 11 |
| Air Targets – Other | Note 1 | 1 | 7–9 | 9 |
| Land Targets | Note 1 | Note 2 | 274 | 274 |
| Mine Targets | Note 1 | 599 | 35–40 | 40 |

| Target | Military Readiness Activities | | | |
|---|---|---|---|---|
| | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | Alternative 1* | Alternative 2 |
| Ship Hulk | 2 | 1 | 0–1 | 1 |
| Subsurface Target - Maneuvering | Note 1 | 265 | 127–140 | 140 |
| Surface Target - Floating | Note 1 | 1,581 | 472–588 | 588 |

*Preferred Alternative
Note 1: These items were not calculated in the 2015 EIS/OEIS.
Note 2: These items were not calculated in the 2020 SEIS/OEIS.

## Table 3.0-16: Impact Area of Proposed Military Expended Materials

| Explosive Ordnance | Area of Potential Impact (acre) | | | |
|---|---|---|---|---|
| | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | Alternative 1* | Alternative 2 |
| Bombs (Explosive) | 0.5495 | 0.5132 | 0.1336 | 0.1350 |
| Bombs (Non-Explosive) | 2.1980 | 0.940 | 0.0825 | 0.0825 |
| Grenades (Explosive) | Note 1 | 0.0019 | 0.0001 | 0.0001 |
| Kinetic Energy Rounds | Note 1 | 0.0042 | 0.9801 | 1.0487 |
| Large-Caliber Projectiles (Explosive) | 1.1330 | 0.1537 | 0.0634 | 0.1261 |
| Large-Caliber Projectiles (Non-Explosive) | 0.6414 | 2.0645 | 0.1411 | 0.2153 |
| Large-Caliber Land-Based Casings | Note 1 | 0.0974 | 0.0092 | 0.0150 |
| Medium-Caliber Projectiles (Explosive) | 0.0524 | 0.1155 | 0.0284 | 0.0382 |
| Medium-Caliber Projectiles (Non-Explosive) | 0.4500 | 1.4431 | 0.1988 | 0.2938 |
| Small-Caliber Projectiles | 0.2460 | 0.9891 | 1.3048 | 1.6609 |
| Small-Caliber Casing | Note 1 | 0.2407 | 0.2684 | 0.3399 |
| Missiles (Explosive) | 0.2487 | 0.4271 | 0.3023 | 0.4163 |
| Missiles (Non-Explosive) | 0.0285 | 0.0000 | 0.0104 | 0.0117 |
| Rockets (Explosive) | 0.0042 | 0.0118 | 0.0215 | 0.0263 |
| Rockets (non-explosive) | 0.0000 | 0.0622 | 0.0122 | 0.0243 |
| Sabot | Note 1 | 0.0042 | 0.9801 | 1.0487 |
| Air Target – Flare | Note 1 | 0.1082 | 0.0009 | 0.0010 |
| Air Target – Towed | Note 1 | 0.0.1082 | 0.0950 | 0.1171 |
| Air Target - Drone | Note 1 | 0.0044 | 0.0208 | 0.0349 |
| Mine Shape (Non-Explosive) | Note 1 | 0.2233 | 0.0358 | 0.0393 |
| Subsurface Targets (Mobile) | Note 1 | 0.0149 | 0.1034 | 0.1133 |
| Surface Targets – Floating (Large) | Note 1 | 0.4175 | 2.1445 | 3.2221 |
| Surface Targets – Floating (Medium) | Note 1 | Note 2 | 0.0129 | 0.0141 |
| Surface Targets – Floating (Small) | Note 1 | Note 2 | 0.0143 | 0.0170 |
| Acoustic Countermeasures | 0.0084 | 0.0133 | 0.0091 | 0.0113 |
| Chaff – Air Cartridge | 0.0013 | 0.0009 | 0.0406 | 0.0412 |
| Chaff – Ship Cartridge | 0.0404 | 0.0331 | 0.0055 | 0.0055 |
| Flares | 2.9005 | 1.9710 | 0.0974 | 0.0990 |
| Mine Neutralization System Neutralizers (Explosive) | 0.0021 | 0.0033 | 0.0031 | 0.0031 |
| Lightweight Torpedoes (Non-Explosive) | 0.0009 | 0.0005 | 0.0007 | 0.0008 |
| Lightweight Torpedo Accessories | 0.0033 | 0.0031 | 0.0015 | 0.0017 |
| Heavyweight Torpedo (Explosive) | 0.0109 | 0.0091 | 0.0031 | 0.0061 |

| Explosive Ordnance | Area of Potential Impact (acre) | | | |
|---|---|---|---|---|
| | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
| | | | Alternative 1* | Alternative 2 |
| Heavyweight Torpedo (Non-Explosive) | Note 1 | Note 2 | 0.0018 | 0.0040 |
| Heavyweight Torpedo Accessories | 0.0040 | 0.0054 | 0.0012 | 0.0026 |
| Anchors (Other) | Note 1 | 0.0080 | 0.0347 | 0.5062 |
| Compression Pad/Pistons | Note 1 | 0.0035 | 0.0097 | 0.0099 |
| Endcaps | Note 1 | 0.0035 | 0.0195 | 0.0198 |
| Flare O-rings | Note 1 | 0.0035 | 0.0098 | 0.0099 |
| Sonobuoys (Non-Explosive) | 0.6676 | 0.3293 | 0.3542 | 0.4048 |
| Expended Bathythermograph | 0.0066 | 0.0046 | 0.0069 | 0.0069 |
| Fiber Optic Can | 0.0000 | 0.0000 | 0.0001 | 0.0001 |
| JATO Bottle | 0.0033 | 0.0033 | 0.0011 | 0.0016 |
| Decelerator/Parachute (Extra Large) | Note 1 | Note 2 | 5.0196 | 7.3275 |
| Decelerator/Parachute (Large) | 1.8030 | 0.9105 | 0.2028 | 0.3831 |
| Decelerator/Parachute (Medium) | 0.4206 | 0.2103 | 0.1869 | 0.2103 |
| Decelerator/Parachute (Small) | 2.1959 | 2.4634 | 8.1097 | 9.2649 |
| Ship Hulk | 29.0299 | 14.5150 | 14.5092 | 29.0299 |
| **TOTAL** | **49.31** | **32.80** | **34.72** | **55.47** |

*Preferred Alternative

Note 1: These items were not calculated in the 2015 EIS/OEIS.

Note 2: These items were not calculated in the 2020 SEIS/OEIS.

### Table 3.0-17: Annual Number of Events in the Study Area that Include Seafloor Devices

| 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
|---|---|---|---|
| | | Alternative 1* | Alternative 2 |
| 200 | 182 | 596–654 | 642–654 |

*Preferred Alternative

### Table 3.0-18: Annual Number of Events in the Study Area that Include the Potential for Personnel Disturbance

| 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
|---|---|---|---|
| | | Alternative 1* | Alternative 2 |
| 272 | 272 | 377–404 | 404 |

*Preferred Alternative

### Table 3.0-19: Annual Number of Wires and Cables Expended in the Study Area

| Wires and Cables | 2015 EIS/OEIS | 2020 SEIS/OEIS | Proposed Action | |
|---|---|---|---|---|
| | | | Alternative 1* | Alternative 2 |
| Expended Bathythermograph Wire | Note 1 | 364 | 542–545 | 545 |
| Fiber Optic Cable | 144 | 44 | 45 | 45 |
| Guidance Wire | 60 | 73 | 25–57 | 57 |
| Sonobuoy Wires | Note 1 | 5,876 | 6,319–7,224 | 7,224 |

*Preferred Alternative

Note 1: These items were not calculated in the 2015 EIS/OEIS.

### 3.0.5 Navy's Quantitative Analysis to Determine Effects on Sea Turtles and Marine Mammals

To establish the environmental baseline and assess potential consequences, the Navy utilized the best available science and supported internal and independent research or monitoring to fill critical data gaps. The quantitative analysis of effects on marine mammals and sea turtles was conducted using the Navy Acoustic Effects Model (NAEMO) (U.S. Department of the Navy, 2024b). This modeling process integrates species-specific density data from the Navy Marine Species Density Database with updated acoustic and explosive criteria to estimate potential impacts from training and testing activities (U.S. Department of the Navy, 2024d, 2026b).

Several notable technical refinements were implemented for the Phase IV analysis to improve NAEMO accuracy. For a comprehensive explanation of these NAEMO refinements, as well as modeling parameters, density data sources, and the analytical framework used in this study, refer to the technical report titled *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase IV Training and Testing* (U.S. Department of the Navy, 2024b). These updates further ensure a comprehensive estimation of auditory injury, temporary threshold shifts, and behavioral responses. Refer to the Acoustic and Explosive Impacts Supporting Information Technical Report (U.S. Department of the Navy, 2026b) for information regarding the categories of potential effects that could result from exposure to acoustic and explosive activities.

### 3.0.6 Effects Not Reasonably Foreseeable Effects by Resource Area

Consistent with previous MITT analyses and based on the framework presented in Section 3.0.4, the Navy concluded that, under the Proposed Action, effects from some stressors by resource area would not be reasonably foreseeable. Table 3.0-20 summarizes these findings and considers the analysis presented in the appropriate resource sections in the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

## Table 3.0-20: Stressors with No Reasonably Foreseeable Effects by Resource Area

| Stressor with No Reasonably Foreseeable Effects | Rationale |
|---|---|
| **Sediments and Water Quality** | |
| Explosives and explosive byproducts | (1) most explosives would be consumed during detonations; (2) the frequency of low-order detonations (and direct release of explosives) is low; (3) the amounts of explosives used are small relative to the distribution area; (4) residual constituents would be degraded, diluted, and dispersed to undetectable levels by physical, chemical, and biological processes; and (5) concentrations at any single location would be a small fraction compared to decades of accumulation at World War II-era disposal sites and ranges, making them negligible. |
| Metals | (1) metals released through corrosion would be diluted by currents or sequestered in adjacent sediment; (2) elevated concentrations of metals in sediments would be limited to the immediate area around the expended material; (3) the distribution areas for munitions and other metal components are large and typically outside state coastal waters, reducing the potential to contribute to existing impairments in nearshore areas; and (4) anchors used during range sustainment would be buried or removed, and not expected to release measurable amounts of metals. |
| Chemicals Other than Explosives | (1) the distribution area for expended materials is large; (2) most propellant combustion byproducts are benign, and those of concern would be diluted to below detectable levels quickly; (3) most propellants are consumed during normal operations, and the failure rate of munitions using propellants is low; (4) most torpedoes are recovered (limiting fuel exposure), and the byproducts are predominantly naturally occurring; and (5) most constituents of concern are biodegradable by marine organisms or physical and chemical processes. |
| Other Metals | (1) materials released via breakdown would be diluted by currents or sequestered in adjacent sediment; (2) elevated concentrations in sediments would be limited to the immediate areas around the materials; and (3) materials are distributed across a large area outside the territorial waters of Guam and CNMI. |
| **Marine Mammals** | |
| Energy (In-Water Electromagnetic Devices) | (1) In-water devices designed to produce an electromagnetic field are towed behind a vessel or unmanned mine countermeasure systems in a controlled, closely monitored event; (2) the events are brief (lasting a few hours); (3) events would occur in areas designated for mine countermeasures and mine neutralization activities (e.g., where mine shapes are moored), limiting potential encounters with marine mammals to those areas; (4) the electromagnetic field would have no greater effect than an electromagnetic field from a passing ship, a common occurrence in the marine environment; and (5) there is no evidence to suggest the magnetic field from a passing vessel would adversely affect marine mammals. |
| Energy (High Energy Lasers) | (1) marine mammals could be exposed to energy from a high-energy laser only if the laser beam misses the target; however, high-energy lasers automatically cease transmitting laser light if target lock is lost, eliminating any potential for a marine mammal to be affected by the laser; (2) precision targeting high-energy lasers are fired over relatively short ranges, allowing for observation of the target; (3) marine mammals spend up to 90 percent of their time underwater limiting opportunities for exposure; (4) marine mammals do not remain stationary and may avoid activities at the target area prior to and during activity; and (5) the small diameter of the laser beam limits the size of the area exposed to the energy. |

**Table 3.0-20: Stressors with No Reasonably Foreseeable Effects by Resource Area (continued)**

| Stressor with No Reasonably Foreseeable Effects | Rationale |
|---|---|
| Physical Disturbance and Strike (Seafloor Devices) | (1) the likelihood of any marine mammal species encountering a seafloor device is considered low even for species that interact with benthic habitat, including humpback whales, sperm whales, and beaked whales, because these devices are either stationary or move very slowly along the bottom; (2) devices deployed offshore in deep waters (over hundreds to thousands of meters) would be inaccessible to nearly all marine mammals and extremely unlikely to be encountered by deep-diving species, which rarely interact with the seafloor; (3) in the unlikely event that a marine mammal is in the vicinity of a seafloor device, the stationary or very slowly moving devices would not be expected to physically disturb or alter natural behaviors of marine mammals; (4) the likelihood of a marine mammal encountering or being struck when targets, instruments, or anchors are deployed or retrieved during range modernization and sustainment activities, is low since anchors (e.g., large concrete blocks) that remain on the seafloor would not move due to their size and weight; and (5) most marine mammal species in the Study Area do not regularly interact with the benthic environment and are unlikely to encounter anchors or other instrumentation remaining on the seafloor. |
| Entanglement (Cables and Wires) | (1) the chance that an individual marine mammal would encounter expended wires or cables is low, because wires and cables sink directly to the seafloor upon release and would not remain suspended in the water column; (2) even if encountered, the physical properties of guidance wires and some cables (low breaking strength, sinking rates, and resistance to coiling or looping) make entanglement unlikely; (3) relatively few marine mammal species forage on the seafloor, particularly in deep offshore waters where wires and cables would be expended; and (4) expended wires and cables would be sparsely distributed on the seafloor throughout the Study Area and become fully or partially buried if residing in soft sediments. |
| Entanglement (Decelerators/Parachutes) | (1) most decelerators/parachutes are small, and their distribution in the Study Area would be sparse; (2) a decelerator/parachute would have to land directly on an animal, or an animal would have to swim into a floating decelerator/parachute to become entangled within the cords or fabric while the decelerator/parachute is floating at the surface or sinking through the water column; and (3) most small and medium decelerators/parachutes would be expended in deep ocean areas and sink to the bottom relatively quickly, reducing the likelihood of encounter by marine mammals that occur predominantly in nearshore waters. The main potential for entanglement is with large and extra-large decelerators/parachutes. While these larger parachutes would eventually sink and flatten on the seafloor, these decelerators/parachutes could remain suspended in the water column before sinking or billow at the seafloor for a longer period of time before flattening. The longer parachute lines pose an entanglement risk as well. Nevertheless, larger decelerators/parachutes would ultimately sink and become inaccessible to marine mammals, and the likelihood of encounter at the surface and in the water column is low. Also, decelerators/parachutes on unconsolidated soft sediments (e.g., sand or silt) are likely to become partially or completely buried over time, further reducing the likelihood that a marine mammal would encounter a decelerator/parachute. |
| Ingestion | (1) most munitions are composed mainly of solid metal materials and would quickly and directly sink through the water column and settle on the seafloor, becoming inaccessible to most if not all marine mammals, depending on water depth; (2) fragments from detonated munitions vary in size and quantity depending on the type and size of the munition; while the specific sizes are unknown, some fragments would likely be too large to ingest and others would be so small as to be |

**Table 3.0-20: Stressors with No Reasonably Foreseeable Effects by Resource Area (continued)**

| Stressor with No Reasonably Foreseeable Effects | Rationale |
|---|---|
| | undetectable; (3) solid metal fragments from explosive munitions would sink quickly to the seafloor, making them unavailable to most marine mammals; (4) munitions and fragments residing on the seafloor in unconsolidated soft sediments (e.g., sand or silt) would ultimately become partially or complete buried over time; and (5) most explosive munitions and many non-explosive munitions are expended at least 12 NM and some more than 50 NM from shore where waters throughout the Study Area are deeper than the foraging depths of benthic foragers, and under these circumstances there would be no potential for ingestion; (6) most other military expended material (MEM) (e.g., chaff, plastic flare caps) that remain floating on the surface or in the water column are too small to pose a risk of intestinal blockage to any marine mammal that happened to encounter and then ingest it. The adverse effects of ingesting MEM would be limited to cases where an individual marine mammal might consume an indigestible item too large to be passed through the gut (e.g., a small decelerator/parachute). This is unlikely to occur for the following reasons: (1) with the possible exception of decelerators/parachutes that may appear similar to the prey of some species such as sperm whales and beaked whales, marine mammals would not be preferentially attracted to floating MEM as potential prey; (2) most small and medium decelerators/parachutes would be expended in deep ocean areas and sink to the bottom relatively quickly, reducing the likelihood of encounter by marine mammals; and (3) MEM would most likely only be incidentally ingested by individuals foraging on the bottom where these items were released, and most MEM are expended in deep offshore waters more than 3 NM and often more than 12 NM from shore, where the seafloor is inaccessible to most marine mammals, in particular benthic foraging species. |
| Secondary | Potential indirect adverse effects on marine mammals would be through effects on their habitat or prey and could result from the following stressors: (1) explosives, (2) explosives byproducts and unexploded munitions, (3) metals, and (4) chemicals.<br>Adverse effects on abiotic habitat, specifically sediments and water, are analyzed in Section 3.1. Indirect effects from explosive materials, byproducts, and unexploded munitions on marine mammals from chemical constituents in sediments are possible only if a marine mammal were to ingest a substantial amount of sediment. Section 3.4.2.1.4 explains why ingestion of MEM, which would include chemicals, in sediments is unlikely. Similarly, as discussed in Section 3.1, water quality within the water column or near the seafloor where MEM settles is not expected to be reduced due to the limited release of chemicals into the marine environment during training and testing activities and as MEM corrode and the low concentrations of potentially toxic substances, which are expected to rapidly dilute at sea.<br>Marine mammals as a group feed on a wide variety of prey ranging from small crustaceans, the primary prey for baleen whales, to other marine mammals (e.g., some killer whales prey on seals and even large whales). U.S. Department of the Navy (2025b) describes foraging habitats and behaviors for marine mammals in the Study Area. For an adverse effect on prey to result in an indirect adverse effect on a marine mammal species, the population or a regional subpopulation of the prey (e.g., a fishery) would need to be significantly adversely affected. The analysis presented in Section 3.8 on marine invertebrates and Section 3.9 on fishes concluded that there would be less than significant to no direct adverse effects on those species. Therefore, there would be no reasonably foreseeable effects from secondary stressors on marine mammals. |

**Table 3.0-20: Stressors with No Reasonably Foreseeable Effects by Resource Area (continued)**

| Stressor with No Reasonably Foreseeable Effects | Rationale |
|---|---|
| **Sea Turtles** | |
| Energy | (1) In-water devices designed to produce an electromagnetic field are towed behind a vessel or unmanned mine countermeasure systems in a controlled, closely-monitored event; (2) the events are brief (lasting a few hours); (3) events would occur in areas designated for mine countermeasures and mine neutralization activities (e.g., where mine shapes are moored), limiting potential encounters with sea turtles to those areas; (4) the electromagnetic field would have no greater effect than an electromagnetic field from a passing ship, a common occurrence in the marine environment; (5) there is no evidence to suggest the magnetic field from a passing vessel would adversely affect sea turtles; (6) sea turtles could be exposed to energy from a high-energy laser only if the laser beam misses the target; however, high-energy lasers automatically cease transmitting laser light if target lock is lost, thus eliminating any potential for a marine mammal to be affected by the laser; (7) precision targeting high-energy lasers are fired over relatively short ranges, allowing for observation of the target; (8) sea turtles spend up to 90 percent of their time underwater, limiting opportunities for exposure; (9) sea turtles do not remain stationary and may avoid activities at the target area prior to and during activity; and (10) the small diameter of the laser beam limits the size of the area exposed to the energy. |
| Physical Disturbance and Strike (Seafloor Devices) | (1) the likelihood of any sea turtle species encountering a seafloor device is considered low, even for species that interact with benthic habitat, because most of these devices will be deployed in depths that exceed benthic foraging activities; (2) devices deployed offshore in deep waters (over hundreds to thousands of meters) would be inaccessible to nearly all sea turtles and extremely unlikely to be encountered by deep-diving species, which do not interact with the seafloor; (3) in the unlikely event that a sea turtle is in the vicinity of a seafloor device, the stationary or very slowly moving devices would not be expected to physically disturb or alter natural behaviors of sea turtles; (4) the likelihood of a sea turtle being struck with or encountering a target, instrument, or anchor during deployment or retrieval is low because devices are lowered or dropped from slow-moving vessels; (5) mooring anchors (e.g., large concrete blocks) are typically left in place on the seafloor when devices are retrieved and would not move due to their size and weight; and (6) mitigation measures would be implemented where applicable. |
| Entanglement (Cables and Wires) | (1) the chance that an individual sea turtle would encounter expended wires or cables is low, because wires and cables sink directly to the seafloor upon release and would not remain suspended in the water column; (2) even if encountered, the physical properties of guidance wires and some cables (low breaking strength, sinking rates, and resistance to coiling or looping) make entanglement unlikely; (3) relatively few sea turtle species forage on the seafloor, particularly in deep offshore waters where wires and cables would be expended; (4) expended wires and cables would be sparsely distributed on the seafloor throughout the Study Area and become fully or partially buried if residing in soft sediments; (5) mitigation would be implemented where applicable. |
| Entanglement (Decelerators/Parachutes) | (1) most decelerators/parachutes are small, and their distribution in the Study Area would be sparse; (2) a decelerator/parachute would have to land directly on a sea turtle, or a sea turtle would have to swim into a floating decelerator/parachute to become entangled within the cords or fabric while the decelerator/parachute is floating at the surface or sinking through the water column; (3) most small and medium decelerators/parachutes would be expended in |

**Table 3.0-20: Stressors with No Reasonably Foreseeable Effects by Resource Area (continued)**

| Stressor with No Reasonably Foreseeable Effects | Rationale |
|---|---|
| | deep ocean areas and sink to the bottom relatively quickly, reducing the likelihood of encounter by sea turtles that occur predominantly in nearshore coastal waters; (4) the likelihood of sea turtles encountering larger parachutes and their associated lines is low, and the parachutes would ultimately sink and become inaccessible to sea turtles; (5) decelerators/parachutes on unconsolidated soft sediments (e.g., sand or silt) are likely to become partially or completely buried over time, further reducing the likelihood that a sea turtle would encounter a decelerator/parachute; (6) mitigation would be implemented where applicable. |
| Ingestion | (1) most munitions are composed mainly of solid metal materials and would quickly and directly sink through the water column and settle on the seafloor, becoming inaccessible to most if not all sea turtles, depending on water depth; (2) fragments from detonated munitions vary in size and quantity depending on the type and size of the munition; while the specific sizes are unknown, some fragments would likely be too large to ingest and others would be so small as to be undetectable; (3) most explosive munitions and many non-explosive munitions are expended at least 12 NM and some more than 50 NM from shore, where waters throughout the Study Area are deeper than the foraging depths of benthic foraging for sea turtles, and under these circumstances there would be no potential for ingestion; (4) most other MEM (e.g., chaff, plastic flare caps) that remain floating on the surface or in the water column are too small to pose a risk of intestinal blockage to any sea turtle that happened to encounter it and then ingested the item; (5) with the possible exception of decelerators/parachutes that may appear similar to the prey of some species such as leatherback sea turtles (feeding on soft-bodied jellyfish), sea turtles would not be preferentially attracted to larger floating MEM as potential prey; (6) most small and medium decelerators/parachutes that would be too large to pass if ingested would be expended in deep ocean areas and sink to the bottom relatively quickly, reducing the likelihood of encounter by sea turtles; and (7) mitigation measures would be implemented where applicable. |
| Secondary | Potential indirect adverse effects on marine sea turtles would be through effects on their habitat (used for sheltering, feeding, or breeding) or prey. Stressors from military readiness activities that could pose indirect effects on sea turtles via habitat or prey include (1) explosives, (2) explosives byproducts and unexploded munitions, (3) metals, (4) chemicals, and (5) transmission of disease and parasites.<br>Effects on abiotic habitat, specifically sediments and water, are analyzed in Section 3.1. Indirect effects from explosive materials, byproducts, and unexploded munitions on sea turtles from chemical constituents in sediments are possible only if a sea turtle were to ingest the substantial amount of sediment. *Supplemental Biological Information Technical Report for the Mariana Islands Training & Testing Study Area* describes foraging habitats and behaviors for marine sea turtles in the Study Area (U.S. Department of the Navy, 2025b). For an adverse effect on prey to result in an indirect adverse effect on a sea turtle species, the population or a regional subpopulation of the prey would need to be significantly adversely affected. The analysis presented in Section 3.8 on invertebrates and Section 3.9 on fishes concluded that there would be less than significant to no direct adverse effects on those species. Therefore, there would be no reasonably foreseeable effects from secondary stressors on sea turtles. |

**Table 3.0-20: Stressors with No Reasonably Foreseeable Effects by Resource Area (continued)**

| Stressor with No Reasonably Foreseeable Effects | Rationale |
|---|---|
| **Seabirds** | |
| Acoustic (Sonar and Other Transducers) | (1) Sonar and other transducers would not be regularly used in nearshore areas that could be utilized by foraging shorebirds, except during pierside maintenance activities or navigation in areas around ports; (2) a diving bird would have to be in close proximity to an emitting source to have an adverse effect; (3) if a bird was exposed to sound generated by sonar and other transducers, it would likely be sufficiently low (because of the distance from the sound source) so as to not alter normal feeding activities; and (4) the duration of exposure would likely be sufficiently brief as to have no discernable effect on normal activities. |
| Acoustic (Vessel Noise) | (1) few exposures would occur based on the infrequency of operations and the low density of vessels within the Study Area at any given time; (2) short-term behavioral or physiological responses elicited from vessel noise would not be likely to disrupt major behavior patterns, such as migration, reproduction migration, reproduction, feeding, and sheltering, or result in serious injury to any seabirds; (3) concentrated food sources (catch and bycatch) that attract seabirds to commercial fishing vessels are not present around Navy vessels; (4) vessels are not expected to result in major acoustic disturbance of seabirds in the Study Area; (5) seabird masking in response to continuous noise from Navy vessels is expected to be temporary due to the transient nature of Navy vessels; and (6) noises from Navy vessels are similar to or less than those generated by the general maritime environment. |
| Energy | (1) seabirds could be exposed to energy from a high-energy laser only if the laser beam misses the target; however, high-energy lasers automatically cease transmitting laser light if target lock is lost, eliminating any potential for a seabird to be affected by the laser; (2) precision targeting high-energy lasers are fired over relatively short ranges, allowing for observation of the target; (3) seabirds do not remain stationary and may avoid activities at the target area prior to and during activity; (4) the small diameter of the laser beam limits the size of the area exposed to the energy; and (5) mitigation measures would be implemented where applicable |
| Physical Disturbance and Strike | (1) The likelihood of an MEM strike on a seabird is extremely low; (2) seabirds and military readiness activities are widely dispersed throughout the Study Area, (3) munitions are precisely targeted, (4) once in the water column, MEM descend rapidly through the water column decreasing the probability of strike, and (5) mitigation measures would be implemented where applicable. |
| Entanglement | (1) the encounter rate for wires and cables is low; (2) the types of seabirds that are susceptible to these items is limited; (3) there is restricted overlap with susceptible seabirds; (4) the physical characteristics of the wires and cables and lack of associated bait reduce entanglement risk to seabirds compared to monofilament used for fishing gear; (5) seabirds would be unlikely to encounter and become entangled in any decelerators/parachutes or sonobuoy accessories due to the size of the range complexes, and the resulting widely scattered decelerators/ parachutes;(6) activities are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment; (7) population-level effects are not anticipated; and (8) mitigation measures described in Chapter 4 would be implemented. |

**Table 3.0-20: Stressors with No Reasonably Foreseeable Effects by Resource Area (continued)**

| Stressor with No Reasonably Foreseeable Effects | Rationale |
|---|---|
| Ingestion | (1) the likelihood of ingestion is low, based on the dispersed nature of the materials and the limited exposure of those items at the surface or water column within the dive depth range of diving seabirds; and (2) In addition, mitigation measures described in Chapter 4 would be implemented that limit the locations where MEM are released; (3) the number of seabirds potentially affected by ingestion of MEM would be assumed to be low, and population-level effects would not be expected. |
| Secondary | Secondary or indirect effects on seabirds via habitat (e.g., sediment, and water quality) and prey availability could come from (1) explosives and explosion byproducts; (2) metals; (3) chemicals; and (4) other materials such as targets, chaff, and plastics.<br>Mitigation would be implemented to avoid potential effects from explosives and physical disturbance and strike stressors in mitigation areas throughout the Study Area (Chapter 4). This mitigation, although not specifically designed for seabirds, would consequently help avoid potential effects on prey (fishes) that shelter in and feed on shallow-water coral reefs, coral beds, artificial reefs, and shipwrecks.<br>The effect of the Proposed Action on marine habitats is described in Section 3.3. Any physical effects on habitats would be temporary and localized because military readiness activities would occur infrequently, be distributed across a vast area, and not routinely repeated in the same location. Military readiness activities would not be expected to indirectly affect seabirds through degradation of habitats used by seabirds and prey species.<br>Effects on sediments and water quality (Section 3.1) were determined to be not reasonably foreseeable and therefore would not indirectly affect seabirds.<br>As noted in Section 3.8 and Section 3.9, implementation of the Proposed Action would not adversely affect populations of invertebrate or fish prey resources (e.g., crustaceans, bivalves, worms, sand lance, herring) of seabirds and therefore would not indirectly affect seabirds. Any effects on bird prey resources would be temporary and localized. Therefore, there would be no reasonably foreseeable effects from secondary stressors on seabirds. |
| **Marine Vegetation** | |
| Secondary | The effects of explosives and MEM in terms of habitat disturbance are described in Section 3.3. The assessment of potential sediment and water quality degradation on aquatic life is covered in Section 3.1. The analysis of sediment and water quality degradation in Section 3.1 is sufficient to suggest that marine vegetation does not have elevated sensitivities to the types of pollutants generated from military readiness activities. Potential effects from secondary stressors on marine vegetation are consistent with the analysis presented in previous MITT documents and remains valid. Supporting information on secondary stressors and their potential effects on marine vegetation are provided in U.S. Department of the Navy (2026b). |
| **Marine Invertebrates** | |
| Acoustic | (1) marine invertebrates are likely only sensitive to water particle motion caused by nearby low-frequency sources and likely do not sense distant or mid- and high-frequency sounds; (2) only individuals within a short distance (potentially a few feet) of the most intense sound levels would experience effects on sensory structures; (3) behavioral responses would be short term and brief; and (4) acoustic stressors would not affect the survival, growth, recruitment, or reproduction of marine invertebrate |

**Table 3.0-20: Stressors with No Reasonably Foreseeable Effects by Resource Area (continued)**

| Stressor with No Reasonably Foreseeable Effects | Rationale |
|---|---|
| | populations or subpopulations; (5) acoustic stressors originating from outside the water is not applicable to marine invertebrates due to the very low transmission of sound pressure across the air/water interface. |
| Entanglement | (1) most pelagic invertebrates would be too small to be ensnared by MEM (wires and cables, decelerators/parachutes) sinking through the water column; (2) lines would be relatively straight during descent, and there are large openings between the cords; (3) the area exposed to the stressor is extremely small (localized) relative to most marine invertebrates' ranges, (4) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, and (5) activities involving cables, guidance wires, and decelerators/parachutes are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels. |
| Ingestion | (1) MEM are typically too large to be consumed by most marine invertebrates; and (2) most MEM, such as chaff, poses little environmental risk to marine invertebrates at concentrations that could reasonably occur from military readiness activities; (3) only a small fraction of MEM would be of ingestible size or become ingestible after degradation and would be unlikely to affect populations. |
| Secondary | Secondary or indirect effects on marine invertebrates via habitat (e.g., sediment, and water quality) and prey availability could come from (1) explosives and explosion byproducts; (2) metals; (3) chemicals; and (4) other materials such as targets, chaff, and plastics. Effects on sediments and water quality (Section 3.1) were determined to not be reasonably foreseeable and therefore would not indirectly affect marine invertebrates. |
| **Fishes** | |
| Entanglement | (1) for many pelagic species, the risk of entanglement is unlikely given their body shape and ability to avoid materials that could entangle them in the water column; (2) it would be very unlikely that fishes would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories due to the size of the range complexes and the resulting widely scattered decelerators/parachutes; (3) cables and wires do not easily form loops and are relatively brittle; (4) the encounter rate for cables and wires or decelerators/parachutes would be extremely low, as few would be expended; (5) most sonobuoys are expended in offshore areas away from more densely populated coastal habitats; and (6) decelerators/ parachutes are relatively large and visible, reducing the chance that fish would accidentally become entangled; (7) military readiness activities that produce entanglement stressors are also not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, nor population-level effects are anticipated; (8) mitigation measures described in Chapter 4 would be implemented. |
| Secondary | Secondary or indirect effects on fishes via habitat (e.g., sediment, and water quality) and prey availability could come from (1) explosives and explosion byproducts; (2) metals; (3) chemicals; and (4) other materials such as targets, chaff, and plastics. Potential effects from secondary stressors are consistent with the analysis presented in previous MITT documents. Supporting information on secondary stressors and their potential effects on fishes are provided in U.S. Department of the Navy (2026b).<br>The Action Proponent recently completed a literature review of reef fish bioaccumulation, sediment, and water quality impacts of military readiness activities (U.S. Department of the Navy, 2023). The objective of this review was to determine |

**Table 3.0-20: Stressors with No Reasonably Foreseeable Effects by Resource Area (continued)**

| Stressor with No Reasonably Foreseeable Effects | Rationale |
|---|---|
| | whether the available literature supports conclusions of negligible impacts from munitions constituents on human health and the environment in the 2020 SEIS/OEIS. The literature review concluded that there are no potentially unacceptable risks from military readiness activities in the MITT Study Area on sediments, water quality, ecological and human health. |
| **Cultural Resources** | |
| Explosive | (1) There are no identified cultural resources within the UNDET areas within the MITT Study Area; (2) the Action Proponents routinely avoid areas with known submerged obstructions and cultural resources during training and testing activities by utilizing sonar and seafloor maps; and (3) military readiness activities would be conducted in accordance with the mitigations and best management practices (Section 2.3.3 of the 2020 SEIS/OEIS) that minimize and avoid effects on cultural resources. |
| **Socioeconomics** | |
| Secondary | Effects on sediments and water quality, fishes, invertebrates, and marine mammals were considered to be potential secondary stressors to socioeconomic resources. Commercial and recreational fishing, and tourism could be affected if military readiness activities altered fish or invertebrate populations to such an extent that species abundance was no longer sufficient to support these activities. The analysis in Section 3.4, Section 3.8, and Section 3.9 of this SEIS/OEIS concluded that would be no population-level effects on marine species from military readiness activities, including from the use of explosives and sonar and other transducers. Data show no discernable correlation between fluctuations in fishery landings and military readiness activities that have been ongoing in the Study Area for decades. Additionally, the analysis presented in Section 3.1 shows effects to sediments and water quality is not reasonably foreseeable as toxicity studies indicate that munitions are unlikely to have an adverse effect on marine species at the population and community level. |
| **Public Health and Safety** | |
| In-Water Energy | (1) activities that could affect public health and safety are often held far from popular swim and dive areas, reducing the potential for exposure; (2) public notification via USCG Broadcast Notice to Mariners to alert the public of scheduled events, allowing non-participants to avoid the areas; and (2) military readiness activities would be conducted in accordance with SOPs and range guidelines to ensure that the potential for military readiness activities to affect public health and safety would be unlikely. |
| In-Air Energy | (1) activities that could affect public health and safety would typically be conducted at controlled locations at sea or within restricted docked testing facilities, limiting public access and potential exposure; and (2) military readiness activities would be conducted in accordance with SOPs and range guidelines to ensure that the potential for military readiness activities to affect public health and safety would be unlikely. |
| Physical Internation | (1) all activities with the potential for physical interaction utilize established communication channels to inform the public of upcoming events, ensuring non-participants are aware of where and when events will occur so they can avoid these areas; and (2) military readiness activities would be conducted in accordance with SOPs and range guidelines to ensure that the potential for military readiness activities to affect public health and safety would be unlikely. |

**Table 3.0-20: Stressors with No Reasonably Foreseeable Effects by Resource Area (continued)**

| Stressor with No Reasonably Foreseeable Effects | Rationale |
|---|---|
| Secondary | Public health and safety has the potential to be affected if sediment or water quality were degraded. Section 3.1 (Sediments and Water Quality) considered the effects on marine sediments and water quality of explosions and explosive byproducts, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). The analysis determined that no Guam, CNMI, or federal water quality standards or guidelines would be violated under any of the alternatives. Although a change in military readiness activities and military expended materials would occur, military readiness activities would not significantly degrade sediment or water quality or contaminate the food supply as discussed in Sections 3.1 (Sediments and Water Quality) and 3.9 (Fishes). In addition, because standards and guidelines are structured to protect human health, and no violations would occur, no secondary effects on public health and safety would result from military readiness activities. Sections 3.9 (Fishes) and 3.11 (Socioeconomic Resources) discuss the effects that the Proposed Action would have on fish and fisheries in the Study Area. |

# 3.1 SEDIMENTS AND WATER QUALITY

## 3.1.1 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on sediments and water quality found in Section 3.1 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020).

### 3.1.1.1 Sediments

Since the 2020 SEIS/OEIS, additional information on sediments has been reviewed for the purposes of this analysis. Updated reports include the U.S. Environmental Protection Agency (USEPA) *Guam Deep Ocean Disposal Site Monitoring and Assessment Report* (U.S. Environmental Protection Agency, 2024a). The 2024 report from the USEPA, following a 2022 monitoring survey of the Guam Deep Ocean Disposal Site (G-DODS) (located approximately 11.1 nautical miles [NM] offshore of Apra Harbor at 2,680 m depth), confirmed that disposal activities had minor, localized effects but no significant adverse effects outside the site boundaries. The report noted a slight change in sediment composition at G-DODS, with silt becoming dominant over the previously dominant sand; this is likely attributable to changes in grain-size classifications between surveys. Total organic carbon and most metal concentrations (cadmium, zinc, mercury, arsenic, chromium, and lead) remained similar to the 2015 findings, while silver concentrations decreased threefold, and selenium concentrations increased sevenfold. The selenium increase was likely due to broader regional environmental changes rather than G-DODS activity, as similar increases were found in surrounding sediments. Pesticide and organotin levels remained non-detectable, but trace amounts of total dichlorodiphenyltrichloroethane (DDTs), polychlorinated aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and dioxin and furans were detected, all remaining well below the Effects Range – Low, which indicates adverse effects are rarely observed.

Updated marine litter data from the 2023 International Coastal Cleanup Annual Report identified marine litter collected along the shores and ocean/waterways near Guam totaling 11,865 pounds (lb.) (5,382 kilograms [kg]). In the CNMI, collected marine litter totaled 6,139 lb. (2,785 kg) (Ocean Conservancy, 2023). For more information regarding marine debris and sediments, refer to the 2015 EIS/OEIS. New information on marine debris and sediments provided in this section does not indicate an appreciable change to the existing environmental conditions as described in the previous MITT analyses.

### 3.1.1.2 Water Quality

The 2020 Guam Integrated Report, a comprehensive assessment of the island's surface waters, identified water quality and impairment status. The report identified 11 impaired marine bays, one impaired coastal/recreational water body, and 45 coastal/recreational assessment units as impaired, as defined under Section 303(d) of the Clean Water Act, with a developed total maximum daily load. For bays, the causes of impairment were determined to be PCBs, pesticides, dioxins, nutrients, pathogen indicators, and dissolved oxygen. In coastal shorelines, the causes of impairment were identified to be pathogens (*Enterococcus* bacteria) and PCBs (Guam Environmental Protection Agency, 2020).

#### 3.1.1.2.1 Water Quality Standards

**Guam Water Quality Standards and Classifications**. There is no new information on Guam water quality standards and classifications since the publication of the 2020 SEIS/OEIS.

**CNMI Water Quality Standards and Classifications**. The 2020 SEIS/OEIS included the most recent water quality standards for the CNMI under Chapter 65-130 Part 200 through 400 of the Northern Marianas Administrative Code. There has been no update to the CNMI Water Classifications presented in Part 200 of the Northern Marianas Administrative Code. As of May 2024, Chapter 65-130 Part 400 of the Northern Marianas Administrative Code updated CNMI water quality standards.

**USEPA Water Quality Standards.** Since the 2015 EIS/OEIS, the federal standards and guidelines for metals in marine waters have been updated for cadmium. The threshold values for cadmium in marine waters is 33 micrograms per liter for acute toxicity and 7.9 micrograms per liter for chronic toxicity (U.S. Environmental Protection Agency, 2024d).

Overall, there is no other new information on water quality that would change the basis of the conclusions in the previous MITT analyses.

### 3.1.2 Environmental Consequences

This SEIS/OEIS analyzes potential effects of the Proposed Action on sediments and water quality and considers the same stressors as previous MITT analyses, which include (1) explosives and explosive byproducts, (2) metals, (3) chemicals other than explosives, and (4) other materials.

For each stressor, implementation of SOPs are considered part of the Proposed Action when determining if an effect is reasonably foreseeable (as described in Section 3.0.4). While SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and mitigation measures (Chapter 4) were not specifically designed to address sediments and water quality, the implementation of some of these measures (which were designed for other resource areas) would help avoid or reduce potential effects on sediments and water quality.

Based on the framework presented in Section 3.0.4, the Navy concluded that, under the Proposed Action, effects from explosives and explosive byproducts, metals, chemicals other than metals, and other materials stressors on sediments and water quality would not be reasonably foreseeable. Table 3.0-20 summarizes these findings.

## 3.2 AIR RESOURCES

### 3.2.1 Regulatory Framework

Laws, regulations, and guidance that were described in the 2020 SEIS/OEIS remain applicable to this SEIS/OEIS. The current National Ambient Air Quality Standard (NAAQS) and Guam Ambient Air Quality Standards (AAQS) are presented in Table 3.2-1. Primary standards provide public health protection, including protecting the health of “sensitive” populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

**Table 3.2-1: National and Guam Ambient Air Quality Standards**

| Pollutant | Averaging Time | Primary Standard | | Secondary Standard |
|---|---|---|---|---|
| | | National | Guam | |
| CO | 8-hour (1) | 9 ppm (10 µg/m$^3$) | Same as Federal | None |
| | 1-hour (1) | 35 ppm (40 µg/m$^3$) | Same as Federal | None |
| Pb | Rolling 3-month average (2) | 0.15 µg/m$^3$ | None | Same as Primary |
| | Calendar Quarter | None | 1.5 µg/m$^3$ | Same as Primary |
| $NO_2$ | Annual (3) | 53 ppb (4) | Same as Federal | Same as Primary |
| | 1-hour (5) | 100 ppb | None | None |
| $PM_{10}$ | 24-hour (6) | 150 µg/m$^3$ | Same as Federal | Same as Primary |
| | Annual | None | 50 µg/m$^3$ | Same as Primary |
| $PM_{2.5}$ | Annual (7) | 9 µg/m$^3$ | None | 15 µg/m$^3$ (NAAQS) |
| | 24-hour (6) | 35 µg/m$^3$ | None | Same as Primary |
| $O_3$ | 8-hour (8) | 0.070 ppm | None | Same as Primary |
| | 1-hour | None | 0.12 ppm | Same as Primary |
| $SO_2$ | 1-hour (9) | 75 ppb (10) | None | None |
| | 3-hour(1) | None | None | 1300 ug/m$^3$ (0.5 ppm) – Guam AAQS |
| | 24-hour | None | 365 µg/m$^3$ (0.14 ppm) | None |
| | Annual mean | None | 80 µg/m$^3$ (0.03 ppm) | 10 ppb (NAAQS) |

Sources: (Guam Environmental Protection Agency, 2023; U.S. Environmental Protection Agency, 2024c).
Notes: Parenthetical values are approximate equivalent concentrations. ppm = parts per million; ppb = parts per billion; µg/m$^3$ = micrograms per cubic meter
(1) Not to be exceeded more than once per year. (2) Not to be exceeded. (3) Annual mean. (4) The official level of the annual $NO_2$ standard is 0.053 ppm, equal to 53 ppb.(5) Annual 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years. (6) Not to be exceeded more than once per year on average over 3 years. (7) Annual mean, averaged over 3 years. (8) Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years. (9) 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years. (10) Final rule signed June 2, 2010. The 1971 annual (0.03 ppm) and 24-hour (0.14 ppm) $SO_2$ standards were revoked in that same rulemaking. These standards, however, remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

### 3.2.1.1 General Conformity Rule

Section 176(c)(1) of the Clean Air Act (CAA), commonly known as the General Conformity Rule, was described in the 2020 SEIS/OEIS (Section 3.2.1.2) and remains unchanged for this SEIS/OEIS.

### 3.2.1.2 Hazardous Air Pollutants

In addition to the six criteria pollutants, the USEPA currently designates 188 substances as Hazardous Air Pollutants (HAPs) under the federal CAA. HAPs were described in Section 3.2.1.1 of the 2015 EIS/OEIS.

#### 3.2.1.3 Executive Order 12114 – Environmental Effects Abroad of Major Federal Actions

EO 12114, issued on January 4, 1979, applies to coastal waters and foreign lands beyond 12 NM of the U.S. coastline. EO 12114 was described in Section 1.6.2 of the 2020 SEIS/OEIS.

#### 3.2.1.4 Guam Air Pollution Control Standards and Regulations

Guam's Air Pollution Control Act, Air Pollution Control Standards and Regulations were described in Section 3.2.1.4.3 of the 2015 EIS/OEIS. Title 22 of the Guam Administrative Code (Chapter 1, Article 3, section 1302) sets AAQS for Guam to protect the public health, safety, and welfare of the population. As shown in Table 3.2-1, most of the standards are the same as the NAAQS.

#### 3.2.1.5 Commonwealth of the Northern Mariana Islands

The Proposed Action includes activities that occur on FDM, which is within the CNMI. In addition, aircraft takeoff and landing preparation activities occur on Tinian and Rota, which are also within the CNMI. CNMI's air quality regulations are codified in Title 65: Division of Environmental Quality, Chapter 65-10 of the Northern Mariana Islands Administrative Code. The requirements focus on protecting public health, welfare, and the environment by controlling emissions of air pollutants, achieving and maintaining compliance with the NAAQS, and ensuring that new or modified air-emission sources do not significantly degrade air quality.

### 3.2.2 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on air quality found in Section 3.2 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020).

Military readiness activities occur mostly offshore of the Territory of Guam and the CNMI, in distances greater than 3 NM, where NAAQS do not apply. Some elements of the Proposed Action would occur within or over territory waters. Given fluctuations in wind direction, air quality in adjacent onshore areas may be affected by releases of air pollutants from offshore Study Area sources.

#### 3.2.2.1 Receptors

Identification of receptors, including sensitive receptors, is part of describing the existing air quality environment. Sensitive receptors are individuals in residential areas, schools, parks, hospitals, or other sites who are more susceptible to adverse effects of exposure to air pollutants. On the oceanic portions of the Study Area, crews of commercial vessels and recreational users of the Pacific Ocean could encounter the air pollutants generated by the Proposed Action. Few such individuals are expected to be present, and the duration of exposure to these pollutants is limited because the areas are cleared of nonparticipants before event commencement.

The air quality analysis also evaluates effects on potential receptors within the affected military installations, including military housing residents, daycares and schools, restaurants, and workers within the facility that are not part of the Proposed Action.

#### 3.2.2.2 Climate of the Study Area

Climate in the MITT Study Area was discussed in detail in the 2015 EIS/OEIS. Meteorological conditions affect the dispersion and transport of air pollutants and the resulting air quality. On Guam, during the dry season, the prevailing winds (trade winds) from the east and northeast intensify and tend to transport pollutants released from the west shoreline toward the ocean. During the warmest months from March through August, the trade winds still blow steadily from the east or northeast. Winds from the south and west are associated with low wind speeds that could result in transport of coherent plumes. CNMI has a tropical marine climate with consistently warm temperatures (averaging 70–85°F or 21–29°C) year-round, high humidity, and distinct wet (July–November) and dry (December–June) seasons. Prevailing winds typically blow from the northeast from November to March and shift to easterly winds from May to October. Wind roses for Guam, Saipan, and Tinian are included in Appendix D.

#### 3.2.2.3 Existing Conditions

##### 3.2.2.3.1 Air Quality Status

The USEPA designated the Northern Mariana Islands to be in attainment or unclassified for all criteria pollutants (40 Code of Federal Regulations [CFR] 81.354). Because the CNMI is in attainment of the NAAQS, a state implementation plan is not required, and the General Conformity Rule does not apply. As shown in Table 3.2-1, Guam is in attainment with all NAAQS, except for areas centered on Piti and Tanguisson power plants that are in nonattainment for the 1971 sulfur dioxide ($SO_2$) NAAQS (U.S. Environmental Protection Agency, 2024b); and the Piti-Cabras area is in nonattainment for the 2010 $SO_2$ NAAQS, effective April 9, 2018 (U.S. Environmental Protection Agency, 2024b).

Guam has an approved nonattainment State Implementation Plan for the 1971 $SO_2$ NAAQS. On September 18, 2025, USEPA took final action on a clean data determination that the Piti-Cabras area has attained the 2010 1-hour $SO_2$ NAAQS. The clean data determination suspends the obligation to submit certain attainment planning requirements for the Piti-Cabras area for as long as the area continues to attain the 2010 $SO_2$ NAAQS or until the area is formally redesignated (U.S. Environmental Protection Agency, 2025).” Until the areas are redesignated to attainment, the annual net $SO_2$ emissions generated within the nonattainment area are compared to the General Conformity *de minimis* level of 100 tons per year (tpy) for $SO_2$ to determine if a general conformity determination is required. Although no recent ambient air quality data are available for Guam, the island is expected to have the same attainment/nonattainment status for Guam’s AAQS as for the NAAQS for the same pollutant. Similarly, no recent ambient air quality data are available for the CNMI.

Currently, there are no air monitoring stations operating on Guam, and ambient air quality data has not been collected for the island since 1991. However, a conservative indication of expected air quality conditions on Guam is to consider observations on a more populated island with similar military, industrial, and commercial activities and trade winds, Oahu, Hawaii, which operates six monitoring stations to monitor concentrations of criteria pollutants. The 2023 monitoring data show no violation of particulate matter with an aerodynamic size less than or equal to 10 microns ($PM_{10}$), particulate matter with an aerodynamic size less than or equal to

2.5 microns ($PM_{2.5}$), ozone ($O_3$), carbon monoxide (CO), or $SO_2$ NAAQS on Oahu (State of Hawaii Department of Health, 2023). With the exception of $SO_2$, it is expected that air quality on Guam would also have concentrations of criteria pollutants that are well below the applicable AAQS. Guam EPA is in the process of developing an annual emissions inventory for Guam; currently, no air emissions inventory information is available for the island. Air quality on CNMI is also expected to have concentrations of criteria pollutants that are well below the applicable AAQS.

USEPA's 2020 Air Toxics Screening Assessment (AirToxScreen) provides emissions, ambient concentrations, and exposure estimates for 181 HAPs plus diesel particulate matter (diesel PM). For HAP/air toxics with health data based on long-term exposure, the assessment estimates cancer risks, the potential for noncancer health effects, or both, including non-cancer health effects for diesel PM. The AirToxScreen assessment is not currently available for Guam. However, for reasons discussed previously, the assessment for Oahu, Hawaii, can be used as an indication of potential HAPs of concern on Guam. The 2020 AirToxScreen data for Hawaii show that the top contributors to cancer risk are formaldehyde, carbon tetrachloride, benzene, acetaldehyde, naphthalene, 1,3-butadiene, polycyclic aromatic hydrocarbon/ polycyclic organic matter, hexavalent chromium, ethylbenzene, and nickel compounds.

#### 3.2.2.3.2 Air Emissions from Current Activities

Table 3.2-2 presents the updated estimated total emissions from current activities within the Study Area and includes all emissions generated, regardless of proximity to the coastline. The estimated emissions reflect updated emission factors and methodologies since the 2020 SEIS/OEIS was prepared. The estimated emissions also include transit emissions from shore location to range location for ship and aircraft, startup/idle/shutdown emissions to prepare for shore connect and disconnect, and emissions due to aircraft startup/idle and idle/shutdown activities.

**Table 3.2-2: Annual Criteria Air Pollutant Emissions from Military Readiness Activities Occurring Within the MITT Study Area, Baseline[1]**

| Scenario | Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | 2,793.14 | 355.89 | 1,314.01 | 25.20 | 326.89 | 326.89 |
| Vessel | 543.52 | 1,586.31 | 55.71 | 33.65 | 19.15 | 19.14 |
| Munitions | 195.56 | 0.08 | -- | -- | 0.81 | 0.58 |
| Total Emissions from Existing Military Readiness Activities | 3,532.22 | 1,942.28 | 1,369.72 | 58.85 | 346.84 | 346.61 |

[1] Table includes criteria pollutant precursors for ozone (e.g., VOC). Individual values may not add exactly to total values due to rounding.

Notes: CO = carbon monoxide, $NO_X$ = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, $PM_{10}$ = particulate matter ≤ 10 microns in diameter, $SO_X$ = sulfur oxides (precursor to $PM_{2.5}$), TPY = tons per year, VOC = volatile organic compounds

### 3.2.3 Environmental Consequences

This SEIS/OEIS analyzes potential impacts of the Proposed Action on air quality and considers the same stressors as previous MITT analyses, which includes (1) Criteria Air pollutants, and (2) HAPs.

For each stressor, the implementation of SOPs, if applicable, is considered as part of the Proposed Action when determining if an effect is reasonably foreseeable (as described in Section 3.0.4).

Based on the framework presented in Section 3.0.4, the Navy concluded that, under the Proposed Action, effects on air quality from criteria air pollutants and HAPs stressors would be reasonably foreseeable. Effects would be considered significant if expected air quality conditions would result in an exceedance of a AAQS; and exposure to HAPs would cause significant and unacceptable health effects on populations, including sensitive receptors. The air quality analysis also evaluates the change in emissions due to changes in the types and tempo (increases or decreases) of the existing military readiness activities. The following sections detail these effects and take into account the analyses presented in Section 3.2 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

#### 3.2.3.1 Effects from Air Emissions under Alternative 1

Table 3.2-3 presents the total estimated change in emissions under Alternative 1 within the Study Area and includes all emissions generated, regardless of proximity to the coastline. The upper range value was used to estimate the change in emissions for activities where the number of proposed annual operations are presented as a range. The estimated change in emissions includes transit emissions from shore location to range location for ship and aircraft, startup/idle/shutdown emissions to prepare for shore connect and disconnect, and emissions due to aircraft startup/idle and idle/shutdown activities.

**Table 3.2-3: Total Annual Net Change in Criteria Air Pollutant Emissions from Military Readiness Activities Occurring Within the Entire MITT Study Area, Alternative 1[1]**

| Scenario | Change in Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -71.10 | 181.61 | -54.46 | 5.30 | 20.88 | 20.88 |
| Vessel | 72.36 | 324.73 | 16.95 | 6.01 | 10.95 | 10.92 |
| Munitions | -52.07 | -0.02 | -- | -- | -0.17 | -0.12 |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.000496 | 0.000192 | 0.0004 | 0.0004 |
| Total Net Change in Emissions from Proposed Military Readiness Activities | -50.79 | 506.35 | -37.51 | 11.31 | 31.66 | 31.68 |

[1] Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

Notes: CO = carbon monoxide, $NO_X$ = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, $PM_{10}$ = particulate matter≤ 10 microns in diameter, $SO_X$ = sulfur oxides (precursor to $PM_{2.5}$), TPY = tons per year, VOC = volatile organic compounds

##### 3.2.3.1.1 Criteria Pollutant Emissions subject to AAQS and General Conformity under Alternative 1

Emissions within 3 NM impact air quality the most for areas subject to the AAQS and where human exposure to HAPs would be the highest. Refer to the Section 3.2.3.1.2 for discussion of effects from these pollutants. Emissions that occur within 3 NM of nonattainment or maintenance areas are subject to the CAA General Conformity evaluation. Table 3.2-4 presents the estimated annual emissions change for proposed activities within 3 NM of Guam under Alternative 1 as compared to the current level of nearshore activities. The increase in emission is primarily due to the increase in nearshore Amphibious Warfare activities such as Amphibious Assault and Non-Combat Amphibious Operations. The emissions presented in this table do not all occur within the Guam nonattainment areas. Some of the emissions occur nearshore areas

that are in attainment with the NAAQS for all criterial pollutants. As such, Table 3.2-4 presents a conservative comparison of the net annual $SO_x$ emissions increase to the General Conformity *de minimis* level for the 2010 $SO_2$ nonattainment area, which is 100 tpy (see footnote 2 of the table).

As shown in Table 3.2-4, even with the conservative assumption that all the emissions within 3 NM occur within nonattainment areas, the estimated annual $SO_2$ emission increase is well below the applicable General Conformity *de minimis* level. A General Conformity Determination is not required, and this is documented in the Record of Non-Applicability, included in Attachment A of Appendix D.

**Table 3.2-4: Estimated Net Change in Annual Criteria Air Pollutant Emissions from Military Readiness Activities Within 3 NM of Guam, Alternative 1[1]**

| Source | Change in Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_x$[2] | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -19.80 | 45.97 | -1.78 | 1.31 | 8.01 | 8.01 |
| Vessel | 24.42 | 171.64 | 9.17 | 2.86 | 7.18 | 7.16 |
| Munitions | -- | -- | -- | -- | -- | -- |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.0005 | 0.0002 | 0.0004 | 0.0004 |
| Total Change in Emissions, TPY | 4.64 | 217.64 | 7.39 | 4.17 | 15.20 | 15.18 |
| de minimis threshold | N/A | N/A | N/A | 100 | N/A | N/A |
| Exceeds threshold? | -- | -- | -- | No | -- | -- |

[1] Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. [2] Sulfur oxides ($SO_x$) are a broader category that includes sulfur dioxide ($SO_2$) and other sulfur-oxygen compounds. For the purpose of this analysis, the *de minimis threshold for* $SO_2$ is conservatively compared to $SO_x$ emissions. Notes: CO = carbon monoxide, $NO_X$ = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, $PM_{10}$ = particulate matter≤ 10 microns in diameter, $SO_X$ = sulfur oxides (precursor to $PM_{2.5}$), TPY = tons per year, VOC = volatile organic compounds.

#### 3.2.3.1.2 Effects from Criteria Pollutants and HAPs Under the National Environmental Policy Act Alternative 1

Table 3.2-5 presents the estimated change in criteria pollutant emissions within 12 NM for proposed activities under Alternative 1 as compared to the current level of activities. The decrease in CO, volatile organic compound emissions is primarily due to the decrease in Air Combat Maneuvers - CNMI activities, which in turn reduce aircraft takeoff and landing preparation activities on Tinian and Guam. The increase in vessel emissions is primarily due to increase in Amphibious Warfare activities.

**Table 3.2-5: Estimated Net Change in Annual Criteria Air Pollutant Emissions from Military Readiness Activities (Within 12 NM), Alternative 1[1]**

| Source | Change in Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -455.80 | 172.66 | -317.19 | 3.94 | -22.15 | -22.15 |
| Vessel | 5.73 | 226.41 | 13.99 | 2.64 | 12.42 | 12.40 |
| Munitions | -- | -- | -- | -- | -- | -- |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.0005 | 0.0002 | 0.0004 | 0.0004 |
| Total Change in Emissions, TPY | -450.06 | 399.09 | -303.19 | 6.57 | -9.73 | -9.75 |

| Source | Change in Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |

[1] Table includes criteria pollutant precursors (e.g., volatile organic compounds). Individual values may not add exactly to total values due to rounding. Notes: CO = carbon monoxide, $NO_X$ = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, $PM_{10}$ = particulate matter≤ 10 microns in diameter, $SO_X$ = sulfur oxides, TPY = tons per year, VOC = volatile organic compounds

Table 3.2-6 presents the estimated annual change in HAP emissions within 12 NM for proposed activities under Alternative 1 as compared to the current level of activities. The HAPs listed in the table are those typically associated with aircraft and vessel activities. The decrease in HAP emissions is primarily due to the decrease in Air Combat Maneuvers - CNMI activities. HAP emissions from Range Modernization and Sustainment activities are negligible; no HAP emissions are associated with munition activities within 12 NM.

**Table 3.2-6: Estimated Net Change in Annual Hazardous Air Pollutants of Concern Emissions from Military Readiness Activities (Within 12 NM), Alternative 1**

| Pollutant | Aircraft | Vessel | Total, tons/year | Total, lb/year |
|---|---|---|---|---|
| 1,3 Butadiene | -5.35 | -- | -5.35 | -10,702 |
| 2,2,4-Trimethylpentane | -- | 0.10 | 0.10 | 199 |
| Acetaldehyde | -13.55 | 0.14 | -13.41 | -26,827 |
| Acrolein | -7.77 | 0.03 | -7.74 | -15,484 |
| Benzene | -5.33 | 0.07 | -5.27 | -10,531 |
| Ethylbenzene | -0.55 | -- | -0.55 | -1,104 |
| Formaldehyde | -39.05 | 0.60 | -38.45 | -76,896 |
| Hexane | -- | 0.04 | 0.04 | 78 |
| Methanol | -5.73 | -- | -5.73 | -11,450 |
| Naphthalene | -1.72 | 0.44 | -1.28 | -2,556 |
| Phenol | -2.30 | -- | -2.30 | -4,606 |
| Propanal | -2.31 | 0.02 | -2.28 | -4,569 |
| Styrene | -0.98 | -- | -0.98 | -1,960 |
| Toluene | -2.04 | 0.03 | -2.01 | -4,016 |
| Xylenes (Mixed Isomers) | -1.42 | 0.02 | -1.40 | -2,802 |
| Inorganic HAPs (including Metals) | -- | 0.001 | 0.0006 | 1.26 |

The Study Area includes pierside locations on Guam in Apra Harbor and nearshore areas of Guam and the Commonwealth of the Northern Mariana Islands (CNMI);where public exposure to the increase in emissions could occur. Figure 3.2-1 presents the sensitive receptors near Apra Harbor, which include public parks, William C. McCool Elementary and Middle School, Navy Gateway Inns and Suites, and Naval Base Guam (NBG) Medical Branch Clinic on Guam. Appendix D includes figures for the sensitive receptors near the proposed activity areas on Saipan and Tinian, including beaches, public parks, and resorts.

Table 3.2-4 and Table 3.2-5 show the change in criteria pollutant emissions within 3 NM and 12 NM, respectively. Upon initial release into the atmosphere, pollutant emissions are expected to initially rise in the immediate vicinity of the activity; however, wakes developed from wind flowing past the asset body or asset in motion cause downwash of the exhaust plume.

Downwash is expected to overcome any plume rise that could have resulted from buoyancy and momentum, and increase atmospheric concentrations at ground level and sea level. Depending on the location of these activities and time of year, winds would disperse emissions from the military readiness activities away from the coastal land masses. During periods when winds would transport emissions into coastal areas, the substantial transport distance and resulting dispersion of these emissions would produce minor increases of air pollutant concentrations near onshore locations.

Figure 3.2-1 shows that HAP emissions within 12 NM would decrease for most HAP. Any increase in HAP emissions due to vessel activities is relatively small. The prevailing winds from the east and northeast would transport HAP emissions released toward the ocean. However, during certain meteorological conditions, HAP emissions could be transported toward nearby receptors. Due to the relatively low HAP emissions occurring infrequently and given the distance to downwind receptors, emissions are not expected to cause any discernable increase to human health risks from HAP exposure in areas where public presence is expected.

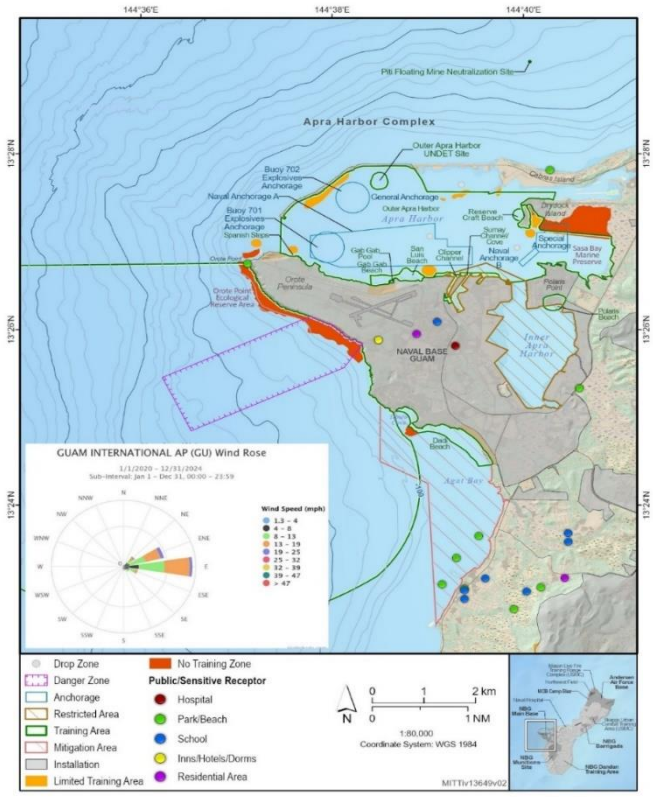


**Figure 3.2-1: Sensitive Receptors Near Pierside Locations in Apra Harbor, Guam**

#### 3.2.3.1.3 Effects from Hazardous Air Pollutants Under Executive Order 12114 Alternative 1

Table 3.2-7 presents the estimated total change in annual HAP emissions beyond 12 NM under Alternative 1. Most of the HAP emissions are due to aircraft activity. The increase in formaldehyde and acetaldehyde emissions are primarily due to aircraft landing and takeoff preparation activities associated with the increase in carrier-based Air Combat Maneuvers and Air Defense Exercises. The slight decrease in inorganic HAP emissions is due to the decrease in vessel operations associated with Joint Expeditionary Exercises. Given the distance to downwind receptors, emissions are not expected to cause any discernable increase to human health risks from HAP exposure toxic effects in areas where public presence is expected.

**Table 3.2-7: Estimated Net Change in Annual Hazardous Air Pollutants of Concern Emissions from Military Readiness Activities (Greater than 12 NM), Alternative 1**

| Pollutant | Aircraft | Vessel | Total, tons/year | Total, lb/year |
|---|---|---|---|---|
| 1,3 Butadiene | 4.43 | | 4.43 | 8,864 |
| 2,2,4-Trimethylpentane | | 0.021 | 0.02 | 42 |
| Acetaldehyde | 11.22 | 0.029 | 11.25 | 22,505 |
| Acrolein | 6.43 | 0.005 | 6.44 | 12,879 |
| Benzene | 4.42 | 0.014 | 4.43 | 8,861 |

| Pollutant | Aircraft | Vessel | Total, tons/year | Total, lb/year |
|---|---|---|---|---|
| Ethylbenzene | 0.46 | | 0.46 | 914 |
| Formaldehyde | 32.34 | 0.126 | 32.47 | 64,935 |
| Hexane | | 0.008 | 0.01 | 16 |
| Methanol | 4.74 | | 4.74 | 9,484 |
| Naphthalene | 1.42 | 0.093 | 1.51 | 3,028 |
| Phenol | 1.91 | | 1.91 | 3,815 |
| Propanal | 1.91 | 0.004 | 1.91 | 3,829 |
| Styrene | 0.81 | | 0.81 | 1,624 |
| Toluene | 1.69 | 0.006 | 1.69 | 3,385 |
| Xylenes (Mixed Isomers) | 1.18 | 0.004 | 1.18 | 2,362 |
| Inorganic HAPs (including Metals) | | -0.00008 | 0.00 | -0.15 |

#### 3.2.3.1.4 Summary of Effects from Criteria Pollutants and HAPs Under Alternative 1

The increase in criteria air pollutants emitted in the Study Area is not expected to result in air quality conditions that lead to exceedance of an AAQS. Exposure to increase in HAP emissions resulting from the Proposed Action would not cause significant and unacceptable health effects to populations, including sensitive receptors. Net emission increases within the $SO_2$ nonattainment area in the Study Area are below the applicable General Conformity Rule *de minimis* thresholds. Therefore, implementation of Alternative 1 would result in less than significant effects on air quality.

### 3.2.3.2 Effects from Air Emissions under Alternative 2

Table 3.2-8 presents the total estimated change in emissions under Alternative 2 within the Study Area and includes all emissions generated, regardless of proximity to the coastline. The change in emissions is nearly identical to Alternative 1 since Alternative 2 proposed activities are the same as the upper range of activities proposed under Alternative 1. The estimated change in emissions includes transit emissions from shore location to range location for ship and aircraft, startup/idle/shutdown emissions to prepare for shore connect and disconnect, and emissions due to aircraft startup/idle and idle/shutdown activities.

**Table 3.2-8: Total Annual Net change in Criteria Air Pollutant Emissions from Military Readiness Activities Occurring Within the Entire MITT Study Area, Alternative 2[1]**

| Scenario | Change in Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -71.10 | 181.61 | -54.46 | 5.30 | 20.88 | 20.88 |
| Vessel | 72.36 | 324.73 | 16.95 | 6.01 | 10.95 | 10.92 |
| Munitions | -48.76 | -0.01 | -- | -- | 0.05 | 0.04 |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.000496 | 0.000192 | 0.0004 | 0.0004 |
| Total Net Change in Emissions from Proposed Military Readiness Activities | -47.48 | 506.36 | -37.51 | 11.31 | 31.88 | 31.84 |

[1] Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding.

Notes: CO = carbon monoxide, $NO_X$ = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, $PM_{10}$ = particulate matter≤ 10 microns in diameter, $SO_X$ = sulfur oxides (precursor to $PM_{2.5}$), TPY = tons per year, VOC = volatile organic compounds

#### 3.2.3.2.1 Criteria Pollutant Emissions subject to AAQS and General Conformity, Alternative 2

Table 3.2-9 presents the estimated annual emissions change, within 0–3 NM, for proposed activities under Alternative 2 as compared to the current level of nearshore activities. Emission changes under Alternative 2 are similar to those under Alternative 1. The discussion presented in Section 3.2.3.1.1 applies to Alternative 2.

**Table 3.2-9: Estimated Net Change in Annual Criteria Air Pollutant Emissions from Military Readiness Activities Within 3 NM of Guam , Alternative 2[1]**

| Source | Change in Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$[2] | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -19.80 | 45.97 | -1.78 | 1.31 | 8.01 | 8.01 |
| Vessel | 24.42 | 171.64 | 9.17 | 2.86 | 7.18 | 7.16 |
| Munitions | -- | -- | -- | -- | -- | -- |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.0005 | 0.0002 | 0.0004 | 0.0004 |
| Total Change in Emissions, TPY | 4.64 | 217.64 | 7.39 | 4.17 | 15.20 | 15.18 |
| de minimis threshold | N/A | N/A | N/A | 100 | N/A | N/A |
| Exceeds threshold? | -- | -- | -- | No | -- | -- |

[1] Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. [2] Sulfur oxides ($SO_x$) are a broader category that includes sulfur dioxide ($SO_2$) and other sulfur-oxygen compounds. For the purpose of this analysis, the *de minimis threshold for* $SO_2$ is conservatively compared to $SO_x$ emissions. Notes: CO = carbon monoxide, $NO_X$ = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter

#### 3.2.3.2.2 Effects from Criteria Pollutants and HAPs Under the National Environmental Policy Act Alternative 2

Table 3.2-10 presents the estimated change in criteria pollutant emissions within 12 NM for proposed activities under Alternative 2 as compared to the current level of activities.

**Table 3.2-10: Estimated Net Change in Annual Criteria Air Pollutant Emissions from Military Readiness Activities (Within 12 NM), Alternative 2[1]**

| Source | Change in Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$[2] | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -455.80 | 172.66 | -317.19 | 3.94 | -22.15 | -22.15 |
| Vessel | 5.73 | 226.41 | 13.99 | 2.64 | 12.42 | 12.40 |
| Munitions | -- | -- | -- | -- | -- | -- |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.0005 | 0.0002 | 0.0004 | 0.0004 |
| Total Change in Emissions, TPY | -450.06 | 399.09 | -303.19 | 6.57 | -9.73 | -9.75 |

[1] Table includes criteria pollutant precursors (e.g., volatile organic compounds). Individual values may not add exactly to total values due to rounding.
Notes: CO = carbon monoxide, $NO_X$ = nitrogen oxides, $PM_{2.5}$ = particulate matter ≤ 2.5 microns in diameter, $PM_{10}$ = particulate matter≤ 10 microns in diameter, $SO_X$ = sulfur oxides, TPY = tons per year, VOC = volatile organic compounds

Table 3.2-11 presents the estimated annual change in emissions of HAPs within 12 NM for proposed activities under Alternative 2 as compared to the current level of activities. Criteria pollutants and HAP emission changes under Alternative 2 are similar to those under Alternative

1. The discussion presented in Section 3.2.3.1.2 applies to Alternative 2.

**Table 3.2-11: Estimated Net Change in Annual Hazardous Air Pollutants of Concern Emissions from Military Readiness Activities (Within 12 NM), Alternative 2[1]**

| Pollutant | Aircraft | Vessel | Total, tons/year | Total, lb/year |
|---|---|---|---|---|
| 1,3 Butadiene | -5.35 | -- | -5.35 | -10,702 |
| 2,2,4-Trimethylpentane | -- | 0.10 | 0.10 | 199 |
| Acetaldehyde | -13.55 | 0.14 | -13.41 | -26,827 |
| Acrolein | -7.77 | 0.03 | -7.74 | -15,484 |
| Benzene | -5.33 | 0.07 | -5.27 | -10,531 |
| Ethylbenzene | -0.55 | -- | -0.55 | -1,104 |
| Formaldehyde | -39.05 | 0.60 | -38.45 | -76,896 |
| Hexane | -- | 0.04 | 0.04 | 78 |
| Methanol | -5.73 | -- | -5.73 | -11,450 |
| Naphthalene | -1.72 | 0.44 | -1.28 | -2,556 |
| Phenol | -2.30 | -- | -2.30 | -4,606 |
| Propanal | -2.31 | 0.02 | -2.28 | -4,569 |
| Styrene | -0.98 | -- | -0.98 | -1,960 |
| Toluene | -2.04 | 0.03 | -2.01 | -4,016 |
| Xylenes (Mixed Isomers) | -1.42 | 0.02 | -1.40 | -2,802 |
| Inorganic HAPs (including Metals) | -- | 0.001 | 0.0006 | 1.26 |

### 3.2.3.2.3 Effects from Hazardous Air Pollutants Under Executive Order 12114 Alternative 2

Table 3.2-12 presents the estimated total change in annual HAP emissions beyond 12 NM under Alternative 2. HAP emission changes under Alternative 2 are similar to those under Alternative 1. The discussion presented in Section 3.2.3.1.3 applies to Alternative 2.

**Table 3.2-12: Estimated Net Change in Annual Hazardous Air Pollutants of Concern Emissions from Military Readiness Activities (Greater than 12 NM), Alternative 2**

| Pollutant | Aircraft | Vessel | Total, tons/year | Total, lb/year |
|---|---|---|---|---|
| 1,3 Butadiene | 4.43 | -- | 4.43 | 8,864 |
| 2,2,4-Trimethylpentane | -- | 0.021 | 0.02 | 42 |
| Acetaldehyde | 11.22 | 0.029 | 11.25 | 22,505 |
| Acrolein | 6.43 | 0.005 | 6.44 | 12,879 |
| Benzene | 4.42 | 0.014 | 4.43 | 8,861 |
| Ethylbenzene | 0.46 | -- | 0.46 | 914 |
| Formaldehyde | 32.34 | 0.126 | 32.47 | 64,935 |
| Hexane | -- | 0.008 | 0.01 | 16 |
| Methanol | 4.74 | -- | 4.74 | 9,484 |
| Naphthalene | 1.42 | 0.093 | 1.51 | 3,028 |
| Phenol | 1.91 | -- | 1.91 | 3,815 |
| Propanal | 1.91 | 0.004 | 1.91 | 3,829 |
| Styrene | 0.81 | -- | 0.81 | 1,624 |
| Toluene | 1.69 | 0.006 | 1.69 | 3,385 |
| Xylenes (Mixed Isomers) | 1.18 | 0.004 | 1.18 | 2,362 |
| Inorganic HAPs (including Metals) | -- | -0.00008 | 0.00 | -0.15 |

#### 3.2.3.2.4 Summary of Effects from Criteria Pollutants and HAPs Under Alternative 2

Effects from Criteria Pollutants and HAPs Under Alternative 2 are similar to those under Alternative 1. The discussion presented in Section 3.2.3.1.4 applies to Alternative 2.

### 3.2.4 Greenhouse Gas Emissions

Activities conducted as part of the Proposed Action would involve mobile sources using fossil fuel combustion as a source of power. Additionally, the expenditure of munitions could generate greenhouse gas (GHG) emissions. GHGs are naturally occurring and human-made atmospheric constituents that absorb and re-emit infrared radiation. Common GHGs include carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons, perfluorocarbons, nitrogen trifluoride, sulfur hexafluoride, and water vapor. GHG emissions are commonly reported in carbon dioxide equivalent ($CO_2e$). To convert emissions of a GHG to CO2e, the emissions are multiplied by the gas' Global Warming Potential, which is a measure of how much heat a GHG traps in the atmosphere over a specific period (usually 100 years) relative to $CO_2$.

The increase in GHG emissions for each alternative was calculated for all altitudes using emissions factors provided by the U.S. Navy for aircraft and vessels and published by the USEPA for munitions. GHG emissions, in $CO_2e$ units, are summarized in Table 3.2-13, along with estimated baseline GHG emissions. These data show that Alternatives 1 and 2 would result in increases in GHG emissions within the Study Area compared to the current level of activities.

**Table 3.2-13: Estimated Baseline and Increase in Annual Greenhouse Gas Emissions from Military Readiness Activities in the Study Area**

| Alternative | Annual Increase in $CO_2e$ Emissions ($CO_2e$ [in Metric Tons/Year]) |
|---|---|
| Baseline | 1,242,640 |
| Alternative 1 | 90,941 |
| Alternative 2 | 90,943 |

Note: $CO_2e$ = carbon dioxide equivalent

Per the 2023 Fiscal Responsibility Act amendments to NEPA and current DoD guidance, environmental analysis is limited to "reasonably foreseeable" impacts with a close causal connection to the federal action. Given the lack of specific ambient air quality standards for GHGs and the absence of a direct causal link between project-level emissions and specific local climate outcomes, the impact of these emissions on the human environment would not be reasonably foreseeable; therefore, no further analysis is required.

## 3.3 MARINE HABITATS

### 3.3.1 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on marine habitats found in Section 3.3 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020). Potential effects on terrestrial habitat at FDM are addressed in Section 3.10. Other necessary habitats for living resources, including those that form biotic habitats such as aquatic plant beds and coral reefs, are discussed in other sections (e.g., Section 3.7 and Section 3.8). For the purposes of this analysis, the term "marine habitats" is synonymous with "benthic habitats" and is used interchangeably.

Overall, the new information presented below for marine habitats would not change the basis of conclusions from previous MITT analyses. Three basic abiotic substrates[2] described the affected environment: soft, hard, and mixed substrates. The term "mixed" has been updated to be inclusive of the term "rocky shores," previously used in Phase II and III. This update is also consistent with the Coastal Marine Ecological Classification Standard developed to provide a consistent classification framework for federally funded projects (Federal Geographic Data Committee, 2012). Mixed substrates are dominated by unconsolidated material larger than sand but smaller than cobbles (e.g., gravel, shell fragments), and may or may not be stable enough for habitat-forming invertebrates or attached seaweeds, depending on depth and other factors (e.g., current speeds). Overall, the classification of soft and hard bottoms is consistent with the descriptions in Sections 3.3.2.5 (Soft Bottoms) and 3.3.2.6 (Hard Bottoms) of the 2015 EIS/OEIS (U.S. Department of the Navy, 2015b).

### 3.3.1.1 Marine Habitats Mapping

There is no comprehensive benthic habitat mapping for the MITT Study Area. Mapping is conducted primarily in U.S. territorial waters (<12 NM from shore) where the dominant habitat is hard bottom. The Study Area does not include sea extending inland from 12 NM towards the Federated States of Micronesia and Palau, and therefore is not included in marine habitat mapping figures. No benthic habitat data is available for offshore areas of the MITT Study Area. As such, habitat distribution is disproportionately represented within the Study Area, since the majority of the mapped area is nearshore, which is dominated by hard bottom. Offshore habitat is typically dominated by soft substrates, as discussed in Section 3.3.2.5.2 (Distribution) of the 2015 EIS/OEIS; however, it is not represented by the available benthic habitat mapping data (U.S. Department of the Navy, 2015b). For the purposes of this SEIS/OEIS, unmapped offshore habitat is assumed to be soft substrates.

Nearshore benthic habitat data has been mapped across 14 islands, five of which are within the Study Area: Guam, Rota, Saipan, FDM, and Tinian (Table 3.3-1; Figures 3.3-1 and 3.3-2). Detailed benthic habitat data was available in Saipan Lagoon (Figure 3.3-1) and Apra Harbor, Guam (Figure 3.3-2). Updated benthic habitat sources from the previous MITT analyses are described below.

Andersen (2004) provided the basis of benthic habitat mapping in the 2015 EIS/OEIS for Guam and FDM. Since the development of the 2020 SEIS/OEIS, very little updated benthic habitat data have been released. However, two new data sources were identified during a literature/data review in preparation of this SEIS/OEIS, one in Saipan Lagoon and one in Guam's Apra and Haputo Harbors, and they are discussed further in this section.

The 2020 SEIS/OEIS cited Kendall et. al. (2017) benthic habitat data of Saipan Lagoon for updated benthic habitat data. Since the development of the 2020 SEIS/OEIS, this dataset has been updated in 2024 by the NOAA National Center for Environmental Information (NCEI). The updated benthic habitat of Saipan lagoon has been taken into consideration during the development of this SEIS/OEIS and is shown in Figure 3.3-1.

In 2024, NOAA NCEI mapped the benthic habitat within NBG's Apra and Haputo Harbors (Costa

[2]Although many classification schemes are available that span a range of spatial dimension and granularity (Allee et al., 2000; Cowardin et al., 1979; Federal Geographic Data Committee, 2012; Howell et al., 2010; Kendall et al., 2001; United Nations Educational Scientific and Cultural Organization, 2009; Valentine et al., 2005), for purposes of this EIS/OEIS, soft, hard, and mixed substrates are used to describe the affected environment.

et al., 2024). The updated benthic habitat of NBG Apra and Haputo Harbors was taken into consideration in this SEIS/OEIS and is shown in Figure 3.3-2.

**Table 3.3-1: Area Coverage of Mapped Abiotic Substrate Types in the MITT Study Area**

| Island | Mapped Habitat Type | | | Total Mapped Area ($km^2$) |
|---|---|---|---|---|
| | Hard ($km^2$) | Soft ($km^2$) | Mixed($km^2$) | |
| Guam | 68.0 | 30.3 | 7.6 | 105.8 |
| Farallon de Medinilla | 4.7 | 1.4 | 0.0 | 6.5 |
| Rota | 12.5 | 8.7 | 4.1 | 25.3 |
| Saipan | 76.3 | 23.0 | 4.6 | 103.8 |
| Tinian | 12.5 | 5.5 | 8.3 | 26.2 |
| *Area Grand Total* | 174 | 68.9 | 24.6 | 207.9 |

Notes: $km^2$ = square kilometers
Totals were calculated prior to rounding and may result in minor differences compared to what is presented in the table.

### 3.3.1.2 Farallon de Medinilla

The Navy is committed to performing shallow water hardbottom (including coral reef, artificial reefs, and shipwrecks) habitat surveys in accordance with the NMFS 2017 and 2020 Biological Opinions (National Marine Fisheries Service, 2017, 2020b), which includes terms and conditions for conducting in-water surveys at FDM. Coral reef surveys have historically been conducted around FDM. Since 2017, the Navy began FDM coral reef surveys, which are revisited every five years to monitor the status and health of these reefs (Marx et al., 2023). In 2022, FDM coral reef surveys identified two fresh (identified by lack of colonization of marine biological growth) ordnance items, with the majority of ordnance identified being old (defined as supporting marine life/colonized). The 2024 Technical Report for the FDM 2022 Coral Reef Survey concluded that the conditions of marine habitats had not changed from what was assessed in 2017; except for the two new ordnance items, the report indicated coral growth on most ordnance observed. The surveys concluded that training activities at FDM do not affect marine habitats (Marx et al., 2023). Refer to Section 3.8 for further discussion regarding corals.

## 3.3.2 Environmental Consequences

This SEIS/OEIS analyzes potential impacts of the Proposed Action on marine habitats and is focused on the same stressors as previous MITT analyses, which includes (1) explosive (in-water explosions), and (2) physical disturbance and strike (vessels and in-water devices, MEM, and seafloor devices).

For each stressor, implementation of SOPs is considered part of the Proposed Action when determining if an effect is reasonably foreseeable (as described in Section 3.0.4). While SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and mitigation measures (Chapter 4) were not specifically designed to address marine habitats, the implementation of some of these measures (which were designed for other resource areas) would help avoid or reduce potential effects on marine habitats.

Based on the framework presented in Section 3.0.4, the Navy concluded that, under the Proposed Action, effects on marine habitats from explosives and physical disturbance and strike stressors would be reasonably foreseeable; effects would be considered significant if marine habitats are degraded over the long term or permanently, such that they would no longer possess sustainable habitat requirements. The following sections analyze the effects of the Proposed Action on marine habitats and take into account the analysis presented in Section 3.3 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

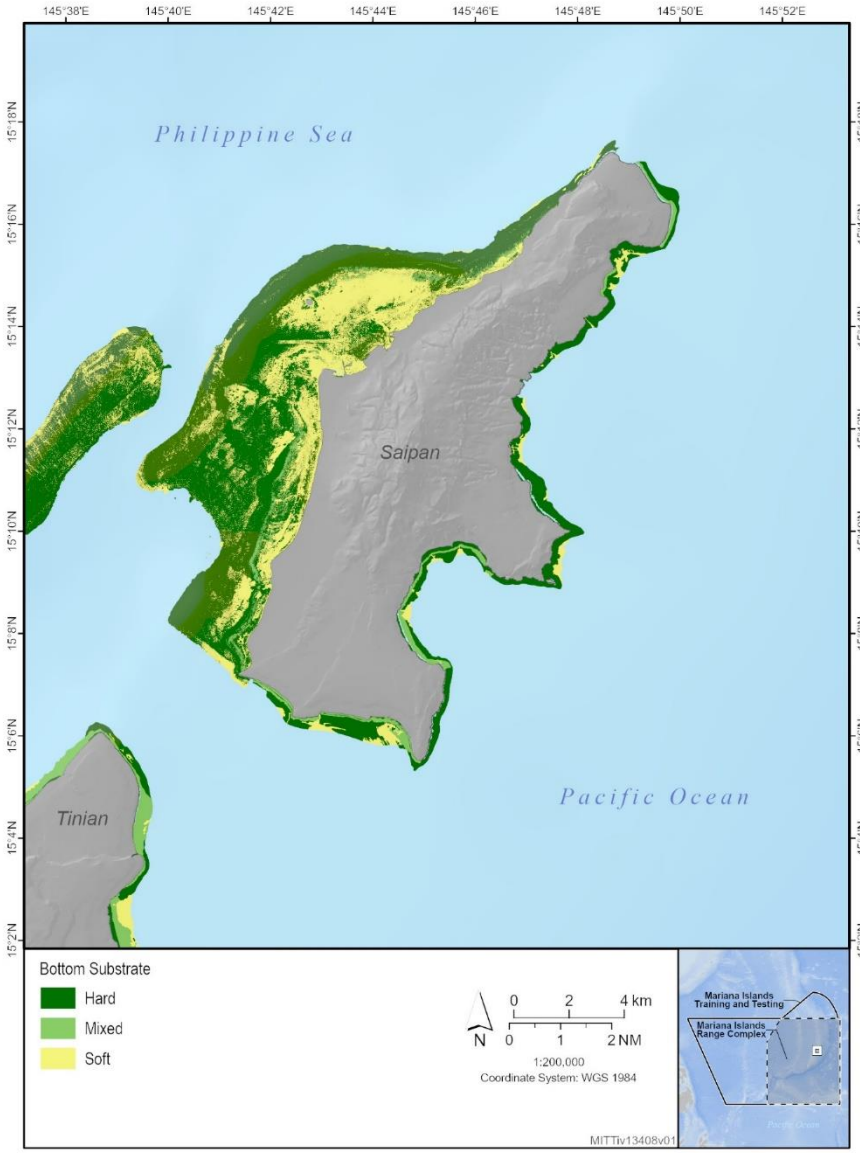


**Figure 3.3-1: Mapped Marine Habitat in Saipan**

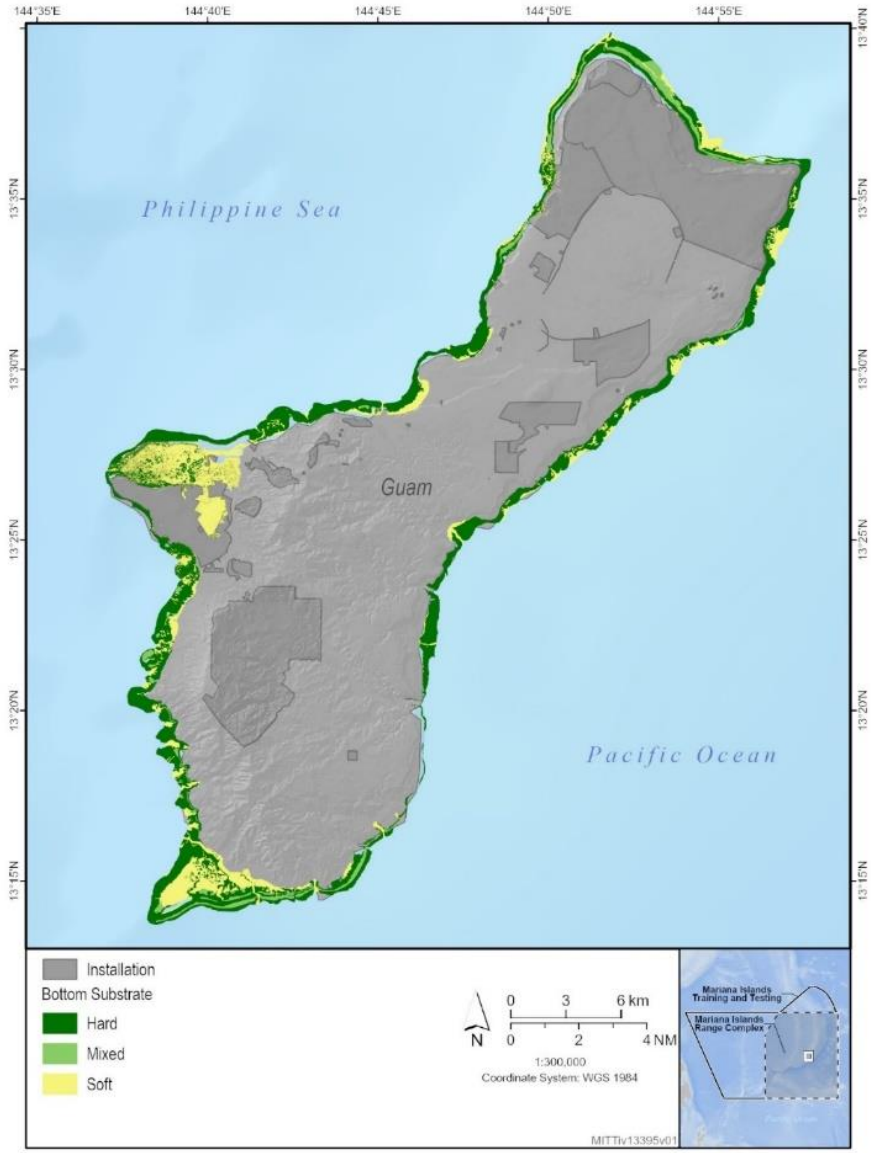


**Figure 3.3-2: Mapped Marine Habitat on Guam**

### 3.3.2.1 Effects on Marine Habitats Under Alternative 1

#### 3.3.2.1.1 Effects from Explosive Stressors

Underwater detonations that occur on or near the bottom during mine warfare activities are the only explosive stressors that would have the potential to affect marine habitats. All other explosive stressors (e.g., gunnery exercises, missile exercises, and air-to-surface rockets) used during military readiness activities occur on the water surface or in the water column and would not affect marine habitats. As stated in the previous MITT analyses, mine warfare military readiness activities utilizing bottom placed detonations would only occur in the existing mine warfare underwater detonation area at Agat Bay site, Piti, and Outer Apra Harbor. These sites are comprised of soft substrate and mixed or hard-bottom habitat. Those hard-bottom areas, which may contain coral or wrecks, would be avoided during military readiness activities to the maximum extent practicable (refer to Chapter 4). Detailed information on explosive stressors can be found in Section 3.0.4.1.2 of this SEIS/OEIS.

**Training and Testing.** Under Alternative 1, explosives used during mine warfare activities would change from the number analyzed in the 2020 SEIS/OEIS (see Bin E4 in Table 3.0-4); however, these activities would continue to occur in the same areas and would have no appreciable change in the analysis or conclusions for explosive stressors as presented in the previous MITT analyses.

**Range Modernization and Sustainment**. Explosives would not be used during range modernization and sustainment; therefore, there would be no explosives effects.

**Conclusion**. Consistent with previous MITT analyses, military readiness activities involving explosive stressors under Alternative 1 of the Proposed Action would have a reasonably foreseeable effect on marine habitats; however, the degree of effect would be less than significant because: (1) seafloor detonations would be infrequent, (2) the percentage of the Study Area affected would be small, and (3) impacts on soft bottom habitat would be temporary (recovery in days to weeks) to short term (recovery in weeks up to three years) in duration.

#### 3.3.2.1.2 Effects from Physical Disturbance and Strike Stressors

This section analyzes the potential effects on marine habitats from the various types of physical disturbance and strike stressors during military readiness activities within the Study Area. Three types of physical disturbance and strike stressors are evaluated for their effects on marine habitats, including (1) vessels and in-water devices, (2) MEM, and (3) seafloor devices. For further supporting information on physical disturbance and strike stressors on marine habitats, refer to Appendix F.

**Training and Testing**. Under Alternative 1, the number of proposed training and testing events that would result in physical disturbance and strike stressors (see Tables 3.0-10, 3.0-12 through 3.0-15, 3.0-17) would change compared to the numbers analyzed in the 2020 SEIS/OEIS. Because the stressors associated with these new activities would be the same as those evaluated in previous MITT analyses, the potential effects of activities utilizing vessels and towed in-water devices, military expended materials, and seafloor devices on marine habitats

as presented in the 2015 EIS/OEIS (Section 3.3.3.2) and the 2020 SEIS/OEIS (Section 3.3.2.2) remain valid and are summarized below.

Under Alternative 1, the number of MEM used for training and testing events that have the potential to affect marine habitats would generally increase (see Tables 3.0-12 through 3.0-15). MEM during military readiness activities could disturb or strike marine habitat as it falls to the seafloor.

The number of seafloor devices used during training and testing under Alternative 1 would increase (Table 3.0-17). The use of seafloor devices could disturb marine habitats depending on the type of substrate they are deployed over. Seafloor devices may fracture hard bottom or suspend sediments over soft or mixed substrates.

The use of vessels and in-water devices would decrease under Alternative 1 (Table 3.0-10). This includes increases in amphibious warfare training activities occurring in the Guam and CNMI nearshore (Table 2.4-1). As stated in the previous MITT analyses, the effects of vessels and in-water devices on marine habitats would remain inconsequential because vessel and in-water activities that could come in contact with marine substrates would be located in previously disturbed areas (i.e., nearshore shallow waters).

**Range Modernization and Sustainment**. Physical disturbance and strike from installation and maintenance of subsurface targets and instrumentation would be primarily in soft bottom habitat, and would occur in a relatively small area, and any effects on marine habitats would be expected to be short term.

**Conclusion**. Consistent with previous MITT analyses, military readiness activities involving physical disturbance and strike stressors under Alternative 1 of the Proposed Action would have a reasonably foreseeable effect on marine habitats; however, the degree of effect would be less than significant because: (1) the impact area of MEM is very small relative to the amount of marine habitat, (2) increases in military readiness activities would not significantly change the quality or type of habitat presented throughout the Study Area, (3) hard bottom habitats are avoided for all activities, (4) vessels avoid contact with the bottom (excluding amphibious vehicles and landings on soft-bottom substrate only), and (5) soft bottom habitats that would be likely affected recover quickly.

### 3.3.2.2 Effects on Marine Habitats Under Alternative 2

Under Alternative 1, the number of activities with associated explosive and physical disturbance and strike stressors would be equal to or increase compared to Alternative 1. However, while SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and mitigation measures (Chapter 4) were not specifically designed to address marine habitats, the implementation of some of these measures (which were designed for other resource areas) would help avoid or reduce potential effects on marine habitats. As such, although activities involving explosive and physical disturbance and strike would increase under Alternative 2, potential effects on marine habitats are not expected to be meaningfully different from those analyzed under Alternative 1.

Therefore, military readiness activities involving explosive and physical disturbance and strike stressors under Alternative 2 would result in less than significant effects on marine habitats.

## 3.4 MARINE MAMMALS

### 3.4.1 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on marine mammals found in Section 3.4 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020).

Information describing each marine mammal species and stock or Distinct Population Segment (DPS) is presented in the *Biological Resources Background Information Technical Report for the Mariana Islands Training and Testing Study Area* (U.S. Department of the Navy, 2025b). The content of the technical report is focused on information necessary to support the analysis of adverse effects on marine mammals from the Proposed Action and provides information on status and management, habitat and distribution, population trends, and population threats to marine mammals.

While all potential effects from the Proposed Action are considered in this section, the primary quantitative analysis focuses on potential effects from acoustic stressors and explosive stressors.

#### 3.4.1.1 Marine Mammals in the Study Area

There are 27 marine mammal species with known occurrence in the Study Area. All species are protected under the MMPA and are managed by NMFS within the U.S. Exclusive Economic Zone off Guam and the CNMI. The stock structure for marine mammals in the Western North Pacific is not well defined, so the analysis in this SEIS/OEIS is at the species level, with the exception of blue whale and humpback whale.

Table 3.4-1 provides an abundance estimate (if known) for each marine mammals species in the Study Area and associated coefficient of variation value (if available), which is a measure of uncertainty in the abundance estimate. NMFS stock assessment reports do not provide abundance estimates for species in this region, so abundances are taken from other published sources, which are identified in footnotes at the bottom of the table. Details on species' distributions in the Study Area, including seasonal occurrence, are described in the technical report, *U.S. Navy Marine Species Density Database Phase IV for the Mariana Islands Training and Testing Study Area* (U.S. Department of the Navy, 2024d).

**Table 3.4-1: Marine Mammal Occurrence Within the Study Area**

| Common Name | Scientific Name | Status | | Occurrence in the Study Area | Abundance (CV) in U.S. EEZ Waters of Guam and CNMI [8] |
|---|---|---|---|---|---|
| | | MMPA | ESA | | |
| **Mysticetes: VLF (larger whales) and LF Hearing Groups** | | | | | |
| Blue whale (Central North Pacific stock) | *Balaenoptera musculus* | Depleted | Endangered | Seasonal, likely absent in summer | Unknown |
| Bryde's whale | *Balaenoptera edeni* | - | - | Regular | 233 (0.45) [1] |
| Fin whale | *Balaenoptera physalus* | Depleted | Endangered | Seasonal, likely absent in summer | Unknown |

| Common Name | Scientific Name | Status | | Occurrence in the Study Area | Abundance (CV) in U.S. EEZ Waters of Guam and CNMI [8] |
|---|---|---|---|---|---|
| | | MMPA | ESA | | |
| Humpback whale (Western North Pacific stock/DPS) | *Megaptera novaeangliae* | Depleted | Endangered | Seasonal, likely absent in summer | 61 (0.21) for shallow waters off Saipan and neighboring islands[2] |
| Minke whale | *Balaenoptera acutorostrata* | - | - | Seasonal, likely absent in summer | 91 (0.34) [3] |
| Omura's whale | *Balaenoptera omurai* | - | - | Rare | Unknown |
| Sei whale | *Balaenoptera borealis* | Depleted | Endangered | Seasonal, likely absent in summer | 166 (0.49) [1] |
| **Odontocetes: HF (dolphins, beaked whales, sperm whales) and VHF (porpoises and *Kogia* species) Hearing Groups** | | | | | |
| Blainville's beaked whale | *Mesoplodon densirostris* | - | - | Regular | 15,667 (0.19) [4] |
| Common bottlenose dolphin | *Tursiops truncatus* | - | - | Regular | 1,800 (1.11) [5] |
| Deraniyagala's beaked whale | *Mesoplodon hotaula* | - | - | Rare | Unknown |
| Dwarf sperm whale | *Kogia sima* | - | - | Regular | Unknown |
| False killer whale | *Pseudorca crassidens* | - | - | Regular | 1,059 (0.84) [5] |
| Fraser's dolphin | *Lagenodelphis hosei* | - | - | Regular | Unknown |
| Ginkgo-toothed beaked whale | *Mesoplodon ginkgodens* | - | - | Regular | Unknown |
| Goose-beaked whale (or Cuvier's beaked whale [6]) | *Ziphius cavirostris* | - | - | Regular | 6,001 (0.20) [4] |
| Killer whale | *Orcinus orca* | - | - | Regular | Unknown |
| Longman's beaked whale | *Indopacetus pacificus* | - | - | Regular | 730 (1.09) [5] |
| Melon-headed whale | *Peponocephala electra* | - | - | Regular | 2,455 (0.70) [1] |
| Pantropical spotted dolphin | *Stenella attenuata* | - | - | Regular | 33,866 (0.39) [7] |
| Pygmy killer whale | *Feresa attenuata* | - | - | Regular | 4,351 (1.11) [5] |
| Pygmy sperm whale | *Kogia breviceps* | - | - | Regular | Unknown |
| Risso's dolphin | *Grampus griseus* | - | - | Regular | Unknown |
| Rough-toothed dolphin | *Steno bredanensis* | - | - | Regular | 9,256 (1.22) [5] |
| Short-finned pilot whale | *Globicephala macrorhynchus* | - | - | Regular | 1,192 (0.98) [5] |
| Sperm whale | *Physeter macrocephalus* | Depleted | Endangered | Regular | 1,574 (0.79) [5] |
| Spinner dolphin | *Stenella longirostris* | - | - | Regular | 9,011 (0.46) [7] |
| Striped dolphin | *Stenella coeruleoalba* | - | - | Regular | 7,103 (0.37) [7] |

| Common Name | Scientific Name | Status | | Occurrence in the Study Area | Abundance (CV) in U.S. EEZ Waters of Guam and CNMI [8] |
|---|---|---|---|---|---|
| | | MMPA | ESA | | |

[1] Fulling et al. (2011); [2] Hill et al. (2020)' [3] Norris et al. (2017); [4] Badger et al. (2024) [5] Bradford et al. (*In Prep*.)
[6] The species *Ziphius cavirostris* is known by two common names: Goose-beaked whale and Cuvier's beaked-whale. Henceforth in this section, the species is referred to as the goose-beaked whale.
[7] Becker et al. (*In Prep*.)
[8]Species' densities (animals/km$^2$) and seasonal distributions are described in detail in the technical report, *U.S. Navy Marine Species Density Database Phase IV for the Mariana Islands Training and Testing Study Area* (U.S. Department of the Navy, 2024d).
Notes: DPS = Distinct Population Segment, EEZ = Exclusive Economic Zone, ESA = Endangered Species Act, MMPA = Marine Mammal Protection Act, CV = coefficient of variation, LF = Low Frequency, VLF = Very LF, HF = High Frequency, VHF = Very HF.

#### 3.4.1.2 Consultations Under the ESA and MMPA

Due to the potential co-occurrence of ESA-listed marine mammals and military readiness activities, the Navy is preparing a Biological Assessment and consulting with NMFS under the ESA. In addition, the Navy has requested a LOA from NMFS in accordance with the MMPA for training and testing activities that use sonars and explosives. Military readiness activities that introduce other stressors into the marine environment are not expected to result in Level A or Level B harassment of any marine mammals.

Within the Study Area, no critical habitat has been designated for ESA-listed marine mammal species.

### 3.4.2 Environmental Consequences

This SEIS/OEIS analyzes potential impacts of the Proposed Action on marine mammals and is focused on the same stressors as previous MITT analyses, which include (1) acoustic (sonar and other transducers; vessel noise; aircraft noise; and weapons noise), (2) explosive (explosions in-water), (3) energy (in-water electromagnetic devices; high-energy lasers), (4) physical disturbance and strike (vessels and in-water devices; MEM; seafloor devices), (5) entanglement (decelerators/parachutes; wires and cables), (6) ingestion (MEM), and (7) secondary stressors.

For each stressor, the implementation of SOPs, which may indirectly reduce or avoid potential effects on marine mammals (Section 2.3.3 of the 2020 SEIS/OEIS); and activity-based and geographic mitigation measures specifically applicable to activities with explosives, acoustic, and physical disturbance and strike stressors (Chapter 4) established in previous consultations are considered part of the Proposed Action when determining if an effect is reasonably foreseeable (as described in Section 3.0.4). The development of geographic mitigation is discussed in detail in Appendix I of the 2020 SEIS/OEIS and will be carried forward unchanged as part of the Proposed Action in this SEIS/OEIS.

Based on the framework presented in Section 3.0.4, the Navy concluded that, under the Proposed Action, effects from energy stressors, seafloor devices (a physical disturbance and strike stressor), entanglement, ingestion, and secondary stressors would not be reasonably foreseeable. Table 3.0-20 summarizes these findings.

Effects on marine mammals from acoustic, explosive, and certain physical disturbance and strike stressors would be reasonably foreseeable; effects would be considered significant if there are short-term or long-term changes well outside the limits of natural variability in terms of the species' ability to meet nutritional, physiological, or reproductive requirements within the Study Area. A significant impact finding would be appropriate if a marine mammal species would be adversely affected over the long term or permanently such that the population in the Study Area would no longer be sustainable. The following sections analyze the effects of the Proposed Action on marine mammals and take into account the analysis presented in Section 3.4 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

### 3.4.2.1 Effects on Marine Mammals Under Alternative 1

In this analysis, marine mammal species are grouped based on similar biology (e.g., hearing sensitivity) or behaviors (e.g., feeding or expected reaction to stressors) when appropriate for the analysis. For some stressors, species are grouped based on their taxonomic relationship and discussed as mysticetes (baleen whales) or odontocetes (toothed whales, dolphins, and porpoises). When adverse effects are expected to be similar for all species or when it is determined there would be no adverse effect on any species, the discussion is general and not species-specific. If military readiness activities would only occur in or be concentrated in certain areas, the discussion is geographically focused.

In coordination with NMFS, effects from acoustic and explosive stressors are quantified at the species or stock level to facilitate take authorizations under the MMPA.

#### 3.4.2.1.1 Effects from Acoustic Stressors

This section summarizes the potential adverse effects of acoustic stressors used during military readiness activities within the Study Area. The acoustic sub-stressors included for analysis are (1) sonars, (2) vessel noise, (3) aircraft noise, and (4) weapons noise. Detailed information on acoustic terminology used in this analysis and acoustic effects categories as well as a summary of best available science on effects on marine mammals specific to each sub-stressor, are provided in the *Acoustic and Explosive Concepts Technical Report* (U.S. Department of the Navy, 2026b).

Due to new information, such as revised criteria and thresholds that have been updated since the 2020 SEIS/OEIS, effects on marine mammals from Navy sonar was reanalyzed in this SEIS/OEIS. Detailed results on the effects of sonars on marine mammals in the Study Area is presented in the *Acoustic and Explosive Effects Analysis Technical Report* (U.S. Department of the Navy, 2025a).

In addition to changes in the Proposed Action, changes in the predicted effects from sonars compared to the 2020 results are due to the following:

- Improvements to criteria used to determine if exposures to acoustic stressors may cause auditory effects and behavioral responses. Changes to the auditory effects criteria include changes to some hearing group divisions and names. A summary of these changes is provided in the *Acoustic and Explosive Effects Analysis Technical Report* (U.S. Department of the Navy, 2025a). For additional details on criteria and thresholds see

the technical report *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase IV)* (U.S. Department of the Navy, 2024a).

- Revisions to the Navy Acoustic Effects Model, including a new sonar avoidance model (U.S. Department of the Navy, 2024a).
- Updates to data on marine mammal distribution, including species density (number of animals per square kilometer [$km^2$]) group size, and depth distribution. For details see the technical reports *U.S. Navy Marine Species Density Database Phase IV for the Mariana Islands Training and Testing Study Area* (U.S. Department of the Navy, 2024d) and *Dive Distribution and Group Size Parameters for Marine Species Occurring in the U.S. Navy's Mariana Islands Training and Testing Study Area* (Oliveira et al., 2025).
- The number of model-predicted auditory injuries is not reduced due to activity-based mitigation, unlike in prior analyses.

The Action Proponents will implement activity-based mitigation and geographic mitigation under Alternative 1 or Alternative 2 to reduce potential adverse effects from acoustic stressors on marine mammals, including within important marine mammal habitats (see Chapter 4). Detailed information on geographic mitigation areas is presented in Appendix I of the 2020 SEIS/OEIS.

#### 3.4.2.1.1.1 Sonar and Other Transducers

The effects of sonars on marine mammals may result in hearing loss, masking, physiological stress, or behavioral reactions. Behavioral reactions can depend on the characteristics of the sonar signal; behavioral state of the animal; sensitivity and individuals' prior experience with the sound; and other contextual factors, including distance from the sound source, movement of the source, physical presence of vessels or other devices, time of year, and geographic location. Different groups of marine mammals may respond in different ways to sonars.

**Mysticetes**: Mysticetes (low frequency [LF] and very low frequency [VLF] hearing groups) are susceptible to masking, behavioral responses, and adverse auditory effects from LF and mid-frequency (MF) sonars. Mysticetes are less likely to be affected by signals from high-frequency and very high-frequency sonars, which are outside of their range of best hearing. Mysticetes are more adaptive while migrating; however, sonar signals could have a greater effect on mysticete behavior at seasonal foraging and breeding grounds. Little is known about possible physiological stress responses by mysticetes.

**Odontocetes**: Odontocetes (high frequency [HF] and very high frequency [VHF] hearing groups) are susceptible to masking, behavioral responses, noise-induced vocal modification, and adverse auditory effects due to sonars. MF and HF sonars are more likely to result in masking and adverse auditory effects than other sonars. Beaked whales are more sensitive to disturbance than other odontocetes.

**Sonars**: As discussed in Section 3.0.4.1.1, a detailed comparison of sonar quantities analyzed in the 2020 SEIS/OEIS with sonar quantities under this Proposed Action is not feasible due to changes in the acoustic source binning. One exception is the sonar systems within the MF1 bins (i.e., MF1; MF1K; and MF1C, formerly MF11). MF1 and MF1C sonars are mid-frequency sonar systems mounted on surface ships and used during certain anti-submarine warfare activities (see Chapter 2 and Appendix A). As shown in U.S. Department of the Navy (2025a), activities

using MF1 and MF1C sonars are associated with some of the highest percentages of predicted effects on marine mammals. Table 3.0-3 shows that the annual use of MF1 and MF1C sonars combined would decrease by at least 472 hours annually compared to hours proposed in the 2020 SEIS/OEIS. Fewer sonar hours reduce the potential for exposure to sound and the likelihood of effects on marine mammals, including auditory injury (AINJ), Temporary Threshold Shift (TTS), masking, and behavioral responses.

Most anti-submarine warfare sonars produce individual sounds, or pings, which are short, lasting up to a few seconds each. Systems typically operate with low-duty cycles for most tactical sources, but some systems may operate nearly continuously or with higher duty cycles. These higher duty cycle sources would pose a greater risk of masking than intermittent sources. Most anti-submarine warfare activities are geographically dispersed, have a limited duration, and intermittently use sonars with a narrow frequency band. These factors reduce the potential for significant or extended masking in marine mammals.

**Effects of Sonars on Marine Mammals**: Low- (less than 1 kHz), mid- (1 to 10 kHz), and some high (greater than 10 to 100 kHz) frequency sonars are within the hearing ranges of all marine mammals. Additionally, all high- and very high-frequency (100 to 200 kHz) sonars are in the hearing range of all odontocetes. Sonars with higher source levels, longer durations, higher duty cycles, and frequencies near the best range of hearing for a species or hearing group are more likely to affect hearing. Due to their high source levels and low transmission loss (compared to higher frequency sources), anti-submarine warfare sonar sources, including hull-mounted sonar (MF1) and high duty cycle hull-mounted sonar (MF1C), have large zones of effects. See U.S. Department of the Navy (2025a) for ranges to auditory effects for MF1, MF1C, and other selected sonars.

The number of predicted auditory effects have changed since the previous MITT analyses, with the number of effects decreasing for some species and increasing for others. While some changes may be attributable to changes in the Proposed Action, many are due to changes in methodologies used to model effects as listed in Section 3.4.2.1.1. Notably, the updated criteria for the HF cetacean hearing group, which includes delphinids and most other odontocetes, indicate increased susceptibility to auditory effects at low and mid-frequencies compared to the prior auditory criteria. Consequently, predicted auditory effects from most anti-submarine warfare sonars are substantially higher for HF cetaceans than in prior analyses of the same activities. The change in susceptibility to auditory effects from sonars is less pronounced for other hearing groups. For most hearing groups, the revision to the avoidance model, which assumes that some marine mammals may avoid sound levels that can cause AINJ, has also resulted in increased estimates of auditory injuries for certain activities, particularly activities using certain high duty cycle sonars. The revised avoidance method bases the initiation of an avoidance response on the behavioral response criteria. The ability to avoid a sonar exposure that may cause auditory effects in the model depends on a species' susceptibility to auditory effects, a species' sensitivity to behavioral disturbance, and characteristics of the sonar source, including duty cycle, source level, and frequency. Thus, predicted auditory effects have increased for species that have a higher susceptibility to auditory effects and are less likely to avoid sound sources due to being less sensitive to acoustic disturbance.

The number of predicted behavioral effects has changed for all species since the prior analysis. These changes are primarily due to revisions to the behavioral response functions. The updated behavioral response functions predict lower sensitivity for the odontocete and mysticete behavioral groups compared to the previous behavioral response functions. The new function for the sensitive species behavioral group predicts greater sensitivity at lower received levels for beaked whales. In addition, the cut-off conditions for predicting behavioral responses have been revised. These factors interact in complex ways that make comparing the predicted behavioral responses in this analysis to the prior analyses challenging.

**Other Factors Influencing Model Predicted Effects**: In addition to the changes in the analysis of acoustic sound sources, densities for species in the Study Area were updated based on new survey data, improved understanding of species' distribution and abundance, and refined species distribution models developed to estimate densities (U.S. Department of the Navy, 2024d). While several factors typically combine to influence model-predicted acoustic effects, an increase or decrease in a species' density generally results in a proportional change in predicted effects.

While model-predicted effects are not quantitatively reduced to account for activity-based mitigation (as in previous MITT analyses), opportunities to mitigate model-predicted effects were identified by determining if the closest points of approach associated with predicted auditory injuries were also within the mitigation zone. This analysis is presented in U.S. Department of the Navy (2025a).

While the geographic mitigation areas are established for specific species, the limitations on sonar use defined in the mitigation measures would also benefit other marine species, including other marine mammals, occurring in the geographic mitigation areas. Detailed information on geographic mitigation areas is presented in Appendix I of the 2020 SEIS/OEIS.

**Training and Testing.** Under Alternative 1, the overall use of sonars would decrease from the previous MITT analyses for both training and testing activities for most sources. MF hull-mounted sonar systems have historically resulted in the highest number of predicted effects on marine mammals. For regular duty cycle (MF1) hull-mounted sonar, the maximum year of training and testing activities includes 23 percent fewer hours in the Study Area compared to the 2020 SEIS/OEIS analysis (Table 3.0-3). For high duty cycle (MF1C) hull-mounted sonar, the maximum year of training and testing activities includes 15 percent fewer hours compared to the 2020 SEIS/OEIS analysis, and for regular duty cycle (MF1K) hull-mounted sonar, the maximum year of training and testing activities would increase from 3 to 33 hours in the Study Area compared to the 2020 SEIS/OEIS analysis. While the MF1K sonar hours would increase, the MF1K is operated at a lower power setting than the MF1 and MF1C sonars and would have a lower probability of affecting marine mammals.

The number of effects on each species due to exposure to sonar and explosives combined during training and testing under Alternative 1 are shown in Table 3.4-2 for seven years of activities. The number of effects due to sonars alone annually and over seven years is provided in the *Acoustic and Explosive Effects Analysis Technical Report* (U.S. Department of the Navy, 2025c). Depending on the species, effects on individuals may be permanent (AINJ) or temporary (TTS, masking, stress, or behavioral response). Effects resulting in AINJ would persist with the

individual, which would experience decreased hearing sensitivity in the affected frequency range.

Decreased hearing sensitivity may lead to a reduced ability to sense biologically important cues from the environment, such as vocalizations from other marine mammals, sounds made by prey, and anthropogenic sounds like noise from an approaching vessel. Behavioral patterns of some individuals, which may include communication, foraging, or breeding, are likely to be temporarily disrupted. Individuals or groups may avoid areas around sonar activities and be temporarily displaced from a preferred habitat. Displacement may be brief for short duration activities or extended for multi-day events and would depend on the behavioral sensitivity of the species. Sensitive species, particularly beaked whales, may avoid at farther distances and for longer durations.

Most proposed activities do not occur for extended multi-day periods and would occur over small areas relative to population ranges. Comparing the predicted number of effects to the number of animals modeled in the Study Area shows that individuals of most species would be affected less than once per year on average. Individuals of several beaked whale species are predicted to be affected about once per year. These comparisons are described in detail in the *Acoustic and Explosive Effects Analysis Technical Report* (U.S. Department of the Navy, 2025c). Individuals of some behaviorally sensitive species or in populations concentrated near warning areas in the MIRC have higher repeated effects.

**Range Modernization and Sustainment.** Sonar would not be used during range modernization and sustainment activities.

**Conclusion.** Consistent with previous MITT analyses, training and testing activities involving sonars under Alternative 1 would have a reasonably foreseeable effect on marine mammals; however, the degree of effect would be less than significant, because (1) most individuals would be affected an average of less than once per year; (2) 99 percent of total predicted effects are either temporary shifts in hearing sensitivity or brief behavioral responses; and (3) effects are not expected to interfere with feeding, reproduction, or other biologically important functions such that the continued viability of a population would be threatened.

#### 3.4.2.1.1.2 Vessel Noise

Vessels produce broadband, non-impulsive, continuous noise during operation and transit. Vessel noise may result in masking, physiological stress, or behavioral reactions. Behavioral reactions to vessels can be caused by multiple factors. Vessel sound exposure is rarely decoupled from the physical presence of a surface vessel, making it difficult to determine the source of the reaction. In some more industrialized or populated areas, vessel noise is a chronic and frequent stressor.

Different groups of marine mammals may respond in different ways to vessels disturbance. LF and VLF vocalizations by mysticetes are likely to be masked or otherwise affected (noise-induced vocal modification) by vessel noise, resulting in decreased communication space. Responses to vessel noise vary and include no response to approaching vessels and both horizontal (swimming away) and vertical (diving) avoidance.

## Table 3.4-2: Effects Due to 7 Years of Sonar and Explosives Training and Testing Under Alternative 1 and Alternative 2

| Species | Stock or Population | Alternative 1 | | | | | Alternative 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BEH | TTS | AINJ | INJ | MORT | BEH | TTS | AINJ | INJ | MORT |
| ***ESA-Listed*** | | | | | | | | | | | |
| Blue whale | Central North Pacific | 15 | 254 | 3 | - | - | 16 | 255 | 3 | - | - |
| Fin whale | (NSD) | 18 | 211 | 1 | - | - | 19 | 212 | 1 | - | - |
| Humpback whale | Western North Pacific stock and DPS | 319 | 10,215 | 136 | - | - | 343 | 10,266 | 137 | - | - |
| Sei whale | (NSD) | 10 | 231 | 2 | - | - | 10 | 233 | 2 | - | - |
| Sperm whale | (NSD) | 850 | 691 | 0 | - | - | 860 | 693 | 0 | - | - |
| ***Non ESA-Listed*** | | | | | | | | | | | |
| Bryde's whale | (NSD) | 17 | 432 | 5 | - | - | 19 | 434 | 5 | - | - |
| Minke whale | (NSD) | 6 | 148 | 2 | - | - | 6 | 149 | 2 | - | - |
| Omura's whale | (NSD) | 15 | 321 | 2 | - | - | 16 | 323 | 2 | - | - |
| Bottlenose dolphin | (NSD) | 795 | 1,659 | 1 | 0 | 0 | 809 | 1,664 | 1 | 0 | 0 |
| Dwarf sperm whale | (NSD) | 9,212 | 120,366 | 2,156 | 0 | 0 | 9,751 | 121,207 | 2,214 | 0 | 0 |
| False killer whale | (NSD) | 482 | 1,094 | 0 | 0 | - | 490 | 1,098 | 0 | 0 | - |
| Fraser's dolphin | (NSD) | 29,067 | 50,112 | 22 | 1 | 0 | 29,644 | 50,301 | 22 | 1 | 0 |
| Killer whale | (NSD) | 92 | 274 | 0 | - | - | 94 | 275 | 0 | - | - |
| Melon-headed whale | (NSD) | 1,177 | 2,113 | 1 | 0 | - | 1,191 | 2,122 | 1 | 0 | - |
| Pantropical spotted dolphin | (NSD) | 9,337 | 22,156 | 11 | 0 | 0 | 9,605 | 22,268 | 12 | 0 | 0 |
| Pygmy killer whale | (NSD) | 1,849 | 4,283 | 1 | 0 | 0 | 1,881 | 4,296 | 1 | 0 | 0 |
| Pygmy sperm whale | (NSD) | 10,390 | 134,939 | 2,486 | 0 | 0 | 10,998 | 135,908 | 2,554 | 0 | 0 |
| Risso's dolphin | (NSD) | 3,799 | 8,555 | 3 | 1 | - | 3,879 | 8,585 | 3 | 1 | - |
| Rough-toothed dolphin | (NSD) | 3,466 | 10,297 | 6 | 0 | 0 | 3,534 | 10,332 | 7 | 0 | 0 |
| Short-finned pilot whale | (NSD) | 549 | 1,018 | 0 | 0 | 0 | 558 | 1,023 | 0 | 0 | 0 |
| Spinner dolphin | (NSD) | 14,664 | 12,711 | 9 | 0 | - | 15,723 | 12,889 | 9 | 0 | - |
| Striped dolphin | (NSD) | 2,977 | 7,865 | 3 | 0 | - | 3,028 | 7,892 | 3 | 0 | - |
| Blainville's beaked whale | (NSD) | 21,373 | 162 | 0 | 0 | - | 21,657 | 162 | 0 | 0 | - |
| Deraniyagala beaked whale | (NSD) | 34,165 | 26 | 3 | - | - | 34,764 | 30 | 3 | - | - |
| Ginkgo-toothed beaked whale | (NSD) | 40,346 | 374 | 0 | 0 | - | 41,119 | 375 | 0 | 0 | - |
| Goose-beaked whale | (NSD) | 17,905 | 130 | 0 | 0 | - | 18,181 | 131 | 0 | 0 | - |
| Longman's beaked whale | (NSD) | 6,885 | 72 | 0 | 0 | - | 7,016 | 72 | 0 | 0 | - |

*BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality*
*A dash (-) indicates a (true zero) and zero (0) indicates a rounded value less than 0.5.*
*Stocks are not shown if no effects are estimated.*
*NSD = No stock designation.*

Odontocetes' communication calls are more likely to be masked by vessel noise than higher-frequency echolocation, but masking of echolocation is possible. Responses to vessel noise includes both attraction (e.g., bowriding) and avoidance behaviors, particularly by more sensitive species (e.g., *Kogia* whales and beaked whales) or individuals. Many noise-induced vocal modifications and short-term response to boat traffic have been documented. Additional information on the assessment of this acoustic stressor is in U.S. Department of the Navy (2025a).

**Training and Testing.** Marine mammals may be exposed to vessel-generated noise throughout the Study Area, but the greatest potential for exposure would occur in high vessel traffic areas, including within and adjacent to Apra Harbor (see Chapter 2 and Appendix A). Table 3.0-10 shows the number of events using vessels would decrease by approximately 50 percent compared with the number of events in the 2020 SEIS/OEIS.

Vessel noise during training and testing activities under Alternative 1 may include brief behavioral reactions and short periods of masking while a marine mammal is in the proximity of a stationary or passing vessel. Navy and USCG vessels do not purposefully approach marine mammals and noise from passing vessels is not expected to elicit significant behavioral responses from any marine mammal species.

**Range Modernization and Sustainment.** Vessel noise would be produced during range modernization and sustainment activities when target and instrument placement and recovery activities are conducted. Vessel speeds for modernization and sustainment activities are typically much slower than during training and testing activities, ranging from 0 to 3 knots, which would limit ship-radiated noise from propeller cavitation and water flow across the hull. These slowly moving vessels would be easily avoided by marine mammals, reducing the level of effect. Marine mammals that occur offshore would not be affected by vessel noise from modernization and sustainment activities that typically occur in shallower nearshore waters. Vessel noise may result in masking, physiological stress, or behavioral reactions, but effects are expected to be short-term and infrequent

**Conclusion.** Consistent with previous MITT analyses, military readiness activities involving vessel noise under Alternative 1 would have a reasonably foreseeable effect on marine mammals; however, the degree of effect would be less than significant because: (1) activities that include the use of vessels would generate temporary and transient noise that may result in minor disturbance or masking to nearby marine mammals; and (2) such disturbances are not expected to interfere with feeding, reproduction, or other biologically important functions needed to sustain an individual or a population, and would not rise to the level of harassment under MMPA.

#### 3.4.2.1.1.3 Aircraft Noise

Aircraft produce broadband, non-impulsive, continuous noise from overflights, hovering rotary wing aircraft, and unmanned aircraft. An infrequent type of aircraft noise is the sonic boom, produced when the aircraft exceeds the speed of sound. While also producing higher frequency sounds, sound from rotary-wing aircraft is often dominated by low-frequency (< 20 Hz to 30 Hz) sound and vibration (Naz et al., 2020). Additional information on the different types of aircraft noise and how they may affect marine mammals is presented in the *Acoustic and Explosive Effects Analysis Technical Report* (U.S. Department of the Navy, 2025c)

Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors, but significant acoustic energy is primarily transmitted into the water directly below the craft in a narrow cone. Underwater sounds from aircraft are strongest just below the surface and directly under the aircraft. Most aircraft noise would be concentrated around airbases but could also occur in the waters immediately surrounding aircraft carriers at sea as aircraft take off and land, or directly below hovering rotary-wing aircraft that are near the water's surface.

Marine mammals may respond to both the physical presence and to the noise generated by aircraft, making it difficult to attribute causation to one or the other stimulus. All low-flying aircraft can produce shadows, which may cause animals at the surface to react. Rotary-wing aircraft may also produce strong downdrafts, which can affect an animal's behavior at or near the surface. Aircraft noise may result in temporary masking, physiological stress, or behavioral reactions.

Different groups of marine mammals may respond in different ways to aircraft noise. Typically, mysticetes either ignore or occasionally dive in response to aircraft overflights. Some whales may avoid helicopters or fixed-wing aircraft, but unmanned aerial vehicles have not produced responses in any mysticete species to date.

Odontocete responses to aircraft noise are varied, but overall little change in behavior has been observed. Some odontocetes will fluke, flipper slap or avoid the noise source, particularly species sensitive to noise or other stimuli like beaked whales or *Kogia* whales. Effects on deep-diving species not frequently at the surface (e.g., beaked whales), would occur less often due to fewer opportunities for exposure. Odontocetes may react to helicopters, but they do not appear responsive to smaller unmanned aerial vehicles, except at low altitudes.

**Training and Testing.** Training and testing activities with aircraft would be conducted as described in the activity descriptions in Appendix A. The number of events using aircraft is shown in Table 3.0-11 in Section 3.0. As shown in the table, the number of training and testing events using aircraft would decrease by about 25 percent compared with the number of events analyzed in the 2020 SEIS/OEIS.

As described in the 2020 SEIS/OEIS and summarized above, aircraft noise during training and testing under Alternative 1 may cause brief temporary changes in the behavior of marine mammals under certain conditions. Marine mammals at or near the water's surface may startle when an aircraft flies overhead at low altitude, divert their attention to the aircraft, or avoid the immediate area by swimming away or diving. These brief and infrequent behavioral responses, should they occur, would not lead to long-term consequences for affected individuals.

**Range Modernization and Sustainment.** Aircraft would not be used during range modernization and sustainment activities.

**Conclusion.** Consistent with previous MITT analyses, training and testing activities involving aircraft noise under Alternative 1 would have a reasonably foreseeable effect on some marine mammals. However, the degree of effect would be less than significant for the following reasons: (1) activities that include the use of aircraft would generate temporary and transient noise that would result in only minor disturbances; and (2) such disturbances are not expected

to interfere with feeding, reproduction, or other biologically important functions needed to sustain an individual or a population, and would not rise to the level of harassment under MMPA.

#### 3.4.2.1.1.4 Weapons Noise

Marine mammals may be exposed to sounds caused by the firing of weapons, objects in flight, and impact of non-explosive munitions on the water's surface during activities conducted at sea. This incidental noise is collectively called weapons noise. Impulsive noise from weapons firing may result in hearing loss, masking, physiological stress, or behavioral reactions in marine mammals. The brief and intermittent nature of most impulsive sounds would limit masking effects. Due to the rapid rise time and higher instantaneous peak pressure of impulsive noise, marine mammals close to the noise source are more likely to startle or avoid the area.

Different groups of marine mammals may respond in different ways to impulsive noise. Mysticetes are more likely to be affected due to the low frequency component of the impulsive noise, which propagates farther and overlaps with their range of best hearing. Mysticetes have shown a variety of responses to impulsive noise, including avoidance, habitat displacement, reduced surface intervals, altered swimming behavior, and changes in vocalization rates.

Most odontocetes are behaviorally less sensitive to impulsive noise than mysticetes, with responses occurring at much closer distances. Impulsive noise can result in hearing loss for VHF and HF odontocetes close to the noise source, with the VHF hearing group exhibiting greater sensitivity to noise. Masking effects are possible, but relief from masking during the silent period between impulsive sounds is likely to limit the effects.

The Action Proponents will implement activity-based mitigation to reduce potential effects from weapons noise on marine mammals (see Chapter 4).

**Training and Testing.** Training and testing activities using gunnery and other weapons that generate firing noise would be conducted as described in the activity descriptions in Appendix A. Table 3.0-12 and Table 3.0-14 show the numbers and types of non-explosive practice munitions and explosive munitions that would be fired during training and testing activities annually. As shown in Table 3.0-12, there are substantial reductions in the number of non-explosive large and medium caliber projectiles and rockets. Weapons noise from these larger munitions, both firing noise and impact noise, would decrease. Smaller munitions, such as small-caliber projectiles, which would increase compared to the 2020 SEIS/OEIS, are likely to produce lower impact noise as they strike a target or the water's surface.

As described in the 2020 SEIS/OEIS and summarized above, weapons noise during training and testing under Alternative 1 may cause brief, temporary changes in the behavior of marine mammals and would not meet the definition of take under the MMPA. Marine mammals may startle or avoid the immediate area. Because firing of medium and large caliber gunnery would occur greater than 12 NM from shore, with the exception of training and testing activities occurring on FDM, effects on coastal and island-associated species are unlikely.

**Range Modernization and Sustainment.** Weapons would not be used during range modernization and sustainment activities.

**Conclusion.** Consistent with previous MITT analyses, training and testing activities involving weapons noise under Alternative 1 would have a reasonably foreseeable effect on marine mammals; however, the degree of effect would be less than significant, for the following reasons: (1) activities that include the use of weapons would result in brief impulsive noise that may cause minor, temporary disturbances, such as a startle response, to marine mammals at the surface and close to either the firing location or impact site; and (2) even if a marine mammal is exposed to weapons noise, effects are not expected to interfere with feeding, reproduction, or other biologically important functions needed to sustain an individual or a population, and would not rise to the level of harassment under MMPA.

#### 3.4.2.1.2 Effects from Explosive Stressors

In-water explosives, which for the purposes of estimating effects includes explosives that detonate within 30 feet above the water's surface, are analyzed for effects on marine mammals. Background information on new applicable and emergent science regarding explosive effects is presented in U.S. Department of the Navy (2026b).

Due to updates to criteria and thresholds used to assess effects, densities (animals per unit area), acoustic effects modeling, and changes to the proposed use of explosives, the quantitative analyses of effects due to explosives in this section supplant the previous MITT analyses. The detailed assessment of explosive stressors under this Proposed Action is in U.S. Department of the Navy (2025a).

In addition to changes in the Proposed Action, changes in the predicted explosive effects since the 2020 SEIS/OEIS are due to the following:

- Updates to criteria used to determine if an exposure to explosive energy may cause auditory effects; non-auditory injury (including mortality); and behavioral responses. Changes to auditory criteria for explosives are the same as for other impulsive sounds. Behavioral response thresholds are related to TTS thresholds and were revised accordingly. Non-auditory injury criteria are unchanged, but the onset thresholds were applied instead of the mean thresholds. For additional details see *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase IV)* (U.S. Department of the Navy, 2025d).
- Revisions to the modeling of explosive effects in the Navy Acoustic Effects Model, including an updated explosive propagation model (U.S. Department of the Navy, 2024b).
- Updates to marine mammal densities, group size, and depth distribution. For additional details see (U.S. Department of the Navy, 2024d) and Oliveira et al. (2025).
- The number of model-predicted mortalities is not reduced due to activity-based mitigation, unlike in prior analyses.

For information on the location and quantity of explosives by NEW under each alternative, see Table 3.0-4.

**Effects of Explosives on Marine Mammals**: Explosions produce loud, impulsive, broadband sounds that are within the hearing range of all marine mammals. Potential impacts from explosive energy and sound include mortality, non-auditory injury, behavioral reactions, physiological stress

response, masking, and hearing loss (both AINJ and TTS). No mortality effects and two non-auditory injuries are predicted to result from training and testing using explosives.

Direct injury due to explosives depends on the charge size (i.e., NEW), the geometry of the exposure (e.g., distance and depth), and the size of the animal (larger animals are less likely to be injured). The intermittent nature of most impulsive sounds would result in very limited probability of any masking effects. Due to the rapid rise time and higher instantaneous peak pressure of impulsive noise, marine mammals closer to the detonation site are more likely to startle or respond by avoiding the area. At a greater distance from the site, a marine mammal may alert or not respond to the sound at all. Few studies on reactions to explosives exist, but responses to seismic surveys, pile driving, and other impulsive noises have been recorded. Different groups of marine mammals may respond in different ways to impulsive noise.

**Mysticetes**: The greater body mass of mysticetes makes them less vulnerable to injury and mortality from an explosion; however, mysticetes are more sensitive to lower frequency sounds, and the greatest amount of energy from an explosion is at frequencies below 500 Hz. Lower-frequency energy also propagates farther than higher-frequency components, potentially affecting mysticetes at greater distances from the source.

**Odontocetes**: Odontocetes are less massive than mysticetes and would be more vulnerable to injury and mortality closer to the detonation site. While most energy propagates at lower frequencies, energy from an explosion is present at frequencies exceeding 10 kHz, which is within hearing range of odontocetes. Detailed information describing effects on marine mammals from explosions is presented in the *Acoustic and Explosive Effects Analysis Technical Report* (U.S. Department of the Navy, 2025a).

The Action Proponents will implement activity-based mitigation and geographic mitigation to reduce potential adverse effects from explosive stressors on marine mammals, including within important marine mammal habitats (see Chapter 4). Detailed information on geographic mitigation areas is presented in Appendix I of the 2020 SEIS/OEIS.

**Training and Testing.** The use of in-water explosives would increase for some bins and decrease for other bins compared to the use of explosives proposed in the previous MITT analyses. Refer to Table 3.0-4 and Table 3.0-5 for changes in the use of explosive munitions at sea and at FDM, respectively, by individual bins.

Most activities involving in-water (including surface) explosives associated with large caliber naval gunfire, missiles, bombs, or other munitions are conducted more than 12 NM from shore. Sinking Exercises are conducted greater than 50 NM from shore and could be conducted 1–2 times annually by the Navy. Certain activities with explosives may be conducted close to shore at locations identified in Appendix A, including certain Mine Warfare activities. In the MIRC, explosive activities could occur at nearshore areas to include specified ranges and designated locations around Guam, including the Agat Bay Mine Neutralization Site, and designated locations in and near Apra Harbor (e.g., Outer Apra Harbor Underwater Detonation Site).

The number of effects on each species due to exposure to explosives and sonars combined during training and testing under Alternative 1 and Alternative 2 is shown in Table 3.4-2 for seven years of activities. The number of effects due to explosives alone annually and over seven

years is provided in the *Acoustic and Explosive Effects Analysis Technical Report* (U.S. Department of the Navy, 2025c). Depending on the species, effects on individuals may be permanent (AINJ) or temporary (TTS, stress, or behavioral response). Effects resulting in AINJ and non-auditory injury would persist with the individual, which would experience persistent injury or decreased hearing sensitivity in the affected frequency range. The *Acoustic and Explosive Effects Analysis Technical Report* provides additional details on predicted effects on each species, including seasons and regions in which effects are most likely to occur; which activities are most likely to cause effects; and analysis of effects in geographic mitigation areas, where applicable. Note that the number of effects on marine mammals due to the use of explosives are over-estimated in this analysis by modeling explosions that occur at or near the water surface as underwater explosions.

No mortalities are predicted, and two non-auditory injuries (one for Fraser's dolphin and one for Risso's dolphin) are predicted to occur due to the use of explosives over a seven year period. The behavioral patterns of a limited number of individuals exposed to energy from an explosion may be interrupted. Individuals or groups may temporarily avoid areas around explosive activities if multiple detonations occur. Activities would be relatively brief and occur over small areas relative to population ranges.

For activities using explosives, the Action Proponents will implement mitigation to relocate, delay, or cease detonations when a marine mammal is sighted within or entering a mitigation zone to avoid or reduce potential effects from explosives.

**Range Modernization and Sustainment.** Explosives would not be used during range modernization and sustainment activities.

**Conclusion.** Consistent with previous MITT analyses, training and testing activities involving the use of explosives under Alternative 1 would have a reasonably foreseeable effect on marine mammals; however, the degree of effect would be less than significant due to the following: (1) extensive pre- and during event visual observation for marine mammals; (2) implementation of mitigation measures to relocate, delay, or cease detonations when a marine mammal is sighted within or entering a mitigation zone; and (3) TTS and behavioral reactions of marine mammals would be short term, and no long-term consequences to individuals are expected. The majority of effects are not expected to interfere with feeding, reproduction, or other biologically important functions of marine mammals, and permanent effects (i.e., non-auditory injury or AINJ) would occur in low enough numbers such that the continued viability of populations is not threatened. Therefore, training and testing activities that include the use of explosives under Alternative 1 would result in less than significant effects on marine mammals.

#### 3.4.2.1.3 Effects from Physical Disturbance and Strike Stressors

Physical disturbance, including the potential for strike during military readiness activities within the Study Area could result from (1) vessels; (2) in-water devices; (3) MEM, including non-explosive practice munitions and fragments from high-explosive munitions; and (4) seafloor devices, including cables, targets, and equipment associated with range modernization and sustainment.

The way a physical disturbance may affect a marine mammal would depend in part on the relative size of the object, the speed of the object, the location of the marine mammal in the water column, and reactions of marine mammals to anthropogenic activity, which may include avoidance or attraction. It is not known at what point or through what combination of stimuli (visual, acoustic, or through detection in pressure changes) an animal becomes aware of a vessel or other potential physical disturbances before reacting or being struck. Refer to U.S. Department of the Navy (2025a) for further discussion of the potential for disturbance from acoustic stimuli.

A physical disturbance resulting from the proposed activities should be very rare and brief, the cost from the response is likely to be within the normal variation experienced by an animal in its daily routine unless the animal is struck by a vessel, another in-water device, or MEM. If a strike does occur, the cost to the individual could range from minor disturbance to mortality. For a summary of background studies on physical disturbance and strike stressors, refer to Appendix C.

#### 3.4.2.1.3.1 Vessels and In-Water Devices

Vessel strike to marine mammals is not associated with any specific training or testing activity but rather an inadvertent, limited, sporadic, and incidental result of Navy and USCG vessel movement within the Study Area. An examination of vessel traffic within the Study Area shows that military vessel traffic is orders of magnitude lower than commercial traffic in the same areas (Starcovic & Mintz, 2021), and this and other related studies also revealed that while commercial traffic is relatively steady throughout the year, Navy vessel use is episodic, based on specific exercises being conducted at different times of the year (Mintz, 2012; Mintz, 2016; Starcovic & Mintz, 2021). Aggregated data from 2014 to 2018 breaking down vessel traffic by the type of vessel, show that U.S. and foreign military vessels combined make up less than 2 percent of vessel traffic intensity in the Study Area. For comparison, commercial bulk carriers account for 56 percent of total vessel traffic, and cargo vessels account for 21 percent (Starcovic & Mintz, 2021). Based on the same data, the U.S. Navy and USCG combined make up less than 1 percent of total estimated vessel time in the Study Area.

There have been no vessels strikes on marine mammals by Navy or USCG vessels reported in the Study Area, and the Navy and USCG do not anticipate vessel strikes to be a significant threat to marine mammal populations within the Study Area. NMFS made the same determination in their 2020 Biological Opinion evaluating the activities proposed in the 2020 SEIS/OEIS (National Marine Fisheries Service, 2020a). Since there are no vessel strike data from the Study Area, the Poisson analysis used by Navy and NMFS in other study areas to estimate the probability of a vessel strike occurring in the Study Area over the 7-year MMPA permit period is not possible.

In-water devices could pose a collision risk to marine mammals when operated at high speeds or if they are unmanned. In-water devices, such as unmanned underwater vehicles, and in-water devices towed from unmanned platforms that move slowly through the water are highly unlikely to strike a marine mammal, because a highly mobile marine mammal could easily avoid the object. In-water devices towed by manned platforms would have observers stationed on the towing platform to implement mitigation and standard safety measures employed when towing in-water devices (see Chapter 4). Torpedoes (a type of in-water device) are generally

smaller than most vessels. The Navy reviewed torpedo design features and many previous anti-submarine warfare torpedo exercises to assess the potential of torpedo strikes on marine mammals. In thousands of exercises in which torpedoes were fired or in-water devices used, there have been no recorded instances of a marine mammal strike.

Since some in-water devices are identical to support craft, marine mammals could respond to the physical presence of the device similar to how they respond to the physical presence of a vessel. It is possible that marine mammal species that occur in areas that overlap with in-water device use and may experience some level of physical disturbance, but it is not expected to result in more than a momentary behavioral response.

**Training and Testing.** As shown in Table 3.0-10 in Section 3.0, the number of events that use vessels would decrease by about 50 percent compared with the 2020 SEIS/OEIS totals. The concentration of vessels in the Study Area and the manner of training and testing would remain consistent with the types of activities conducted in the Study Area over the last decade.

Physical disturbance and strike from large vessels and in-water devices would be more likely in waters closer to shore than in the open ocean farther from shore, because the concentration of vessel traffic and in-water device activities is higher and coincides with higher marine mammal densities for many cetacean species (e.g., dolphins) (U.S. Department of the Navy, 2024c). Marine mammal species that tend to occur over the continental shelf would therefore have a greater potential to be adversely affected. Large vessels may occasionally be required to operate at speeds that are higher than average operating speeds, which may pose a greater strike risk to marine mammals, because there would be less time for the vessel crew to detect a marine mammal and maneuver to avoid a strike. There would also be less time over a given distance for a marine mammal to react and avoid the vessel. Two of the three Navy vessel strikes of whales that occurred off California in 2023 were associated with vessels operating at higher speeds; however, the third strike occurred when a vessel was traveling at a relatively low speed. Vessel speed data reported by Starcovic and Mintz (2021) show that Navy vessels typically travel between 5 and 10 knots around Guam and the CNMI, and between 10 and 20 knots in offshore waters along routes towards Asia, Hawaii, and the U.S. West Coast.

The use of small crafts traveling at higher speeds (i.e., greater than 10 knots) during military readiness activities occurs more frequently, although not exclusively, in nearshore waters, ports, and harbors than in offshore waters. Nearshore waters in the Study Area are generally more confined waterways where species that prefer deep, offshore waters do not regularly occur. Odontocetes known to occur in nearshore waters, such as bottlenose dolphins and spinner dolphins, are not as susceptible to vessel strikes as mysticetes; although strikes are known to occur to these species (see U.S. Department of the Navy (2025b) for more information). No vessel strikes of marine mammals have been reported in the MITT Study Area due to Navy or USCG vessel activities in nearshore waters and ports and harbors.

Physical disturbance from small crafts operating at higher speeds would be limited to areas where those vessels tend to operate on a regular basis, specifically, closer to shore, in ports and harbors (see Table 3.0-8 and Table 3.0-9 for information on vessel types, sizes, and typical operating speeds). Marine mammal species with the highest densities in these areas (e.g., bottlenose dolphins and spinner dolphins) would have a higher potential for vessel strike by

small craft. Spinner dolphins resting in nearshore bays or coves during the day may be particularly susceptible to vessel strike. The Navy established a geographic mitigation area in nearshore waters of Agat Bay, a known spinner dolphin resting area, in the 2020 SEIS/OEIS that limits use of the area for certain Navy activities in part to reduce potential effects on spinner dolphins.

Military readiness activities involving vessels and in-water devices may occur year-round; therefore, adverse effects from physical disturbance would depend on each species' seasonal patterns of occurrence or degree of residency, primarily in the continental shelf portions of the Study Area. Refer to U.S. Department of the Navy (2025b) for species seasonal distribution patterns and migratory behavior. As previously indicated, any physical disturbance from vessel movements and use of in-water devices is not expected to result in more than a brief behavioral response (e.g., avoidance).

**Range Modernization and Sustainment.** Vessels would be used to deploy targets and bottom-placed instruments. During deployment the vessels would move very slowly (0-3 knots) and would not pose a collision risk to marine mammals occurring near the vessel. Activity-based mitigation would further reduce the potential for physical disturbance and strike.

**Conclusion.** Consistent with previous MITT analyses, military readiness activities involving the use of vessels and in-water devices under Alternative 1 would have a reasonably foreseeable effect on marine mammals; however, the degree of effect would be less than significant, because, as described above: (1) the likelihood of a vessel strike on a marine mammal remains low; (2) odontocetes are generally able to avoid an approaching vessel; and (3) behavioral effects due to disturbance are not expected to interfere with feeding, reproduction, or other biologically important functions such that the continued viability of the population would be threatened. Therefore, military readiness activities that include the use of vessels and in-water devices under Alternative 1 would result in less than significant effects.

A vessel strike on an individual marine mammal would be considered a significant adverse effect on the individual even if the strike does not result in mortality. However, as noted above, no vessel strikes of marine mammals due to Navy or USCG activities have been reported in the Study Area, including nearshore waters, ports, and harbors, so the Poisson probability analysis used by the Navy and NMFS, which is reliant on historical data, is not possible. Therefore, military readiness activities that involve the potential for strike from vessels and in-water devices under Alternative 1 are not likely to occur.

#### 3.4.2.1.3.2 Military Expended Materials

This section analyzes the strike potential to marine mammals from the following categories of MEM: (1) all sizes of non-explosive practice munitions, (2) fragments from high-explosive munitions, (3) expendable targets and target fragments, and (4) expended materials other than munitions. Activities that use MEM are shown in Appendix B, and quantities of expended items are shown in Table 3.0-12 through Table 3.0-15.

The primary concern is the potential for a marine mammal to be struck by MEM at or near the water's surface. While disturbance or strike from an item falling through the water column is

possible, it is not very likely given that objects designed to be aerodynamic generally sink slowly through the water and can be avoided by marine mammals.

The potential for marine mammals to be struck by MEM was evaluated using a statistical probability model to estimate direct strike exposures based on four scenarios developed using marine mammal densities and the dimensions of MEM types (e.g., bombs). The analysis is described in detail in Appendix F and briefly summarized here.

**Training and Testing.** Military readiness activities that involve MEM would occur in nearshore and offshore waters of the Study Area. The marine mammal species with the highest average annual density (the average of four seasonal densities) is pantropical spotted dolphin, with a density of 0.13498 animals per $km^2$. The probability of exposure to a direct strike, including a buffer area surrounding the animal, from MEM was calculated to be 0.0000004, and the number of predicted exposures was calculated to be 0.167236 per year. Predicted exposures for all other marine mammal species are lower, in many cases several orders of magnitude lower, mainly because densities for all other species are lower. For ESA-listed species, humpback whale had the highest probability of exposure at 0.000002, and the highest number of predicted exposures at 0.150217 per year.

The analysis is likely an overestimation of the probability of a direct strike for the following reasons: (1) it calculates the probability of a single military item (of all the items expended over the course of the year) hitting a single animal at its species' highest average annual density; (2) it does not take into account the possibility that an animal may avoid military activities occurring prior to the MEM impact; (3) it does not take into account the possibility that an animal may not be at the water surface; (4) it does not take into account that most projectiles fired during training and testing activities are fired at targets and only a very small portion of those projectiles would miss the target and hit the water with their maximum velocity and force; (5) the scenarios include a buffer area to account for an MEM missing the animal and striking the water's surface nearby and disturbing the animal; and (6) it does not quantitatively take into account the Navy avoiding animals that are sighted through the implementation of mitigation measures.

**Range Modernization and Sustainment.** Activities would include deploying, moving, and retrieving mine countermeasure targets and instrumentation on established ranges. Temporary training areas would be established by installing devices that could include hydrophones anchored to the seafloor similar to the way mine training shapes or other targets are anchored. Temporary range instrumentation is removed after completing the event. Some anchors may not be recovered and, in that case, would be considered MEM; however, anchors are analyzed as seafloor devices and would not pose a physical disturbance and strike risk to marine mammals.

**Conclusion.** Consistent with previous MITT analyses, military readiness activities involving the use of MEM under Alternative 1 would have a reasonably foreseeable effect on marine mammals; however, the degree of effect would be less than significant, because, as described above, (1) the probability of a direct strike is so low as to be discountable even for the most abundant species; (2) the predicted number of exposures to a disturbance or strike for the most abundant species rounds to zero; and (3) even if it were to occur, a direct strike on an individual

marine mammal may or may not result in injury or mortality, depending on the type of MEM (e.g., a large projectile is more likely to cause injury than a small decelerator/parachute) and the species (e.g., a large whale is less like to sustain injury than a small dolphin). Serious injury or mortality would be considered a significant effect on the individual; however, such an effect, even if it were to occur, is not expected to threaten the continued viability of a population.

#### 3.4.2.2 Effects on Marine Mammals under Alternative 2

Under Alternative 2, the number of activities with associated acoustic, explosive, and physical disturbance stressors would be equal to or increase compared to Alternative 1. However, as described above, the Action Proponents would implement SOPs (Section 2.3.3 of the 2020 SEIS/OEIS), activity-based mitigation, and geographic mitigation (Chapter 4) to reduce potential adverse effects from acoustic and explosive stressors on marine mammals, including within important marine mammal habitats. While the geographic mitigation areas are established for specific species, the limitations on sonar use defined in the mitigation measures would also benefit other marine species, including other marine mammals, occurring in the geographic mitigation areas. Detailed information on geographic mitigation areas is presented in Appendix I of the 2020 SEIS/OEIS. Although activities involving physical disturbance and strike would increase under Alternative 2, effects would not be measurably different than under Alternative 1 because more vessel movements do not necessarily equate to greater adverse effects. Additionally, the number of predicted exposures to MEM for pantropical spotted dolphin was calculated to be 0.204858 per year and 0.158934 for humpback whale under Alternative 2. As such, increases in military readiness activities would not result in substantive changes to the potential for or types of effects on marine mammals, and overall effects are not meaningfully different from those analyzed under Alternative 1.

Therefore, military readiness activities involving acoustic, explosive, and physical disturbance and strike stressors under Alternative 2 would result in less than significant effects on marine mammals.

#### 3.4.2.3 Summary of Potential Effects on Marine Mammals

The total number of effects on each marine mammal species due to exposure to both sonar and explosives during training and testing under Alternative 1 and Alternative 2 are shown in Table 3.4-2 for seven years of activities. Effects from vessel noise, aircraft noise, weapons noise, and physical disturbance and strike stressors; although reasonably foreseeable, would not rise to the level of take as defined under the MMPA.

## 3.5 SEA TURTLES

### 3.5.1 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on sea turtles found in Section 3.5 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020).

Information describing each sea turtle species, including species where NMFS has designated DPSs, is presented in the *Supplemental Biological Information Technical Report for the Mariana Training and Testing Study Area* (U.S. Department of the Navy, 2025b). The content of the

technical report is focused on information necessary to support the analysis of adverse effects on sea turtles from the Proposed Action.

### 3.5.1.1 Sea Turtles in the Study Area

There are five sea turtle species with known occurrence in the Study Area. These species include the green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), loggerhead sea turtle (*Caretta caretta*), olive ridley sea turtle (*Lepidochelys olivacea)*, and leatherback sea turtle (*Dermochelys coriacea*). Each species is ESA listed as endangered or threatened. Information on the occurrence of these species is in Table 3.5-1. The Navy is consulting with NMFS as required by section 7(a)(2) of the ESA.

Sea snake status and distribution was reviewed for updated literature since the 2020 SEIS/OEIS. There are no verified records of sea snakes in nearshore waters of the Mariana Islands.

#### 3.5.1.1.1 Critical Habitat in the Study Area

No critical habitat has been designated for ESA-listed sea turtle species in the Study Area. Both NMFS (88 FR 46472) and U.S. Fish and Wildlife Service (USFWS) (88 FR 46476) have issued proposed rules to designate critical habitat within the Study Area. A detailed description of the proposed critical habitat for the green sea turtle is included in the *Supplemental Biological Information Technical Report for the Mariana Training and Testing Study Area* (U.S. Department of the Navy, 2025b). NMFS declined to include nearshore waters of FDM within the proposed designation.

**Table 3.5-1: Sea Turtle Occurrence Within the Study Area**

| Species Name and Regulatory Status | | | | Presence in Study Area[1] | |
|---|---|---|---|---|---|
| Common Name | | Scientific Name | Endangered Species Act Status | Open Ocean/ Transit Corridor | Coastal/ Ocean |
| **Family Cheloniidae (hard-shelled sea turtles)** | | | | | |
| Green sea turtle[2] | Central West Pacific DPS[3] | *Chelonia mydas* | Endangered | Yes | Yes[4] |
| | East Indian-West Pacific DPS | | Threatened | | No |
| | Central North Pacific DPS | | Threatened | | No |
| Hawksbill sea turtle (throughout range) | | *Eretmochelys imbricata* | Endangered | Yes | Yes[4,5] |
| Loggerhead sea turtle | North Pacific DPS | *Caretta caretta* | Endangered[5] | Yes[6] | Yes[6] |
| Olive ridley sea turtle | | *Lepidochelys olivacea* | Endangered[7] | Yes[6] | Yes[6] |
| **Family Dermochelyidae (leatherback sea turtle)** | | | | | |
| Leatherback sea turtle | (throughout range) | *Dermochelys coriacea* | Endangered | Yes[6] | Yes[6] |

[1]MITT Study Area = Mariana Islands Training and Testing Study Area

[2]In 2015, NMFS published a final rule that classifies green sea turtles within the Study Area as part of the Western Pacific Distinct Population Segment. Green sea turtles within other DPS may occur within the Study Area—the East Indian-West Pacific DPS and the Central North Pacific DPS.

[3]In 2023, NMFS issued a proposed rule for green sea turtle critical habitat designation (88 FR 46372) containing four essential features, two of which overlap with the Central West Pacific DPS and Navy training and testing activities. A detailed description of the proposed critical habitat for the green sea turtle is included in the *Supplemental Biological*

| Species Name and Regulatory Status | | | Presence in Study Area[1] | |
|---|---|---|---|---|
| Common Name | Scientific Name | Endangered Species Act Status | Open Ocean/ Transit Corridor | Coastal/ Ocean |

*Information Technical Report for the Mariana Training and Testing Study Area* (U.S. Department of the Navy, 2025b).
NMFS declined to include nearshore waters of FDM within the proposed designation.
[4]Indicates nesting activity within the Study Area. Only green sea turtles and hawksbill sea turtles are known to nest in the Study Area.
[5]The Northeast Atlantic Ocean, Mediterranean Sea, North Indian Ocean, North Pacific Ocean, and South Pacific Ocean Distinct Population Segments are listed as Endangered; the Northwest Atlantic Ocean, South Atlantic Ocean, Southeast Indo-Pacific Ocean, and Southwest Indian Ocean Distinct Population Segments are listed as threatened.
[6]Species occurrence is only expected to be migratory and occur in extremely low densities.
[7]Separate populations of olive ridleys are listed as threatened or endangered, both likely occur within the Study Area.

### 3.5.2 Environmental Consequences

This SEIS/OEIS analyzes potential impacts of the Proposed Action on sea turtles and considers the same stressors as previous MITT analyses, which include (1) acoustic (sonar and other transducers, vessel noise, aircraft noise, and weapons noise), (2) explosive (explosions in-water), (3) energy (in-water electromagnetic devices, high-energy lasers), (4) physical disturbance and strike (vessels and in-water devices, MEM, seafloor devices), (5) entanglement (decelerators/parachutes, wires and cables), (6) ingestion (MEM), and (7) secondary stressors.

For each stressor, implementation of SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and activity-based mitigation measures (Chapter 4) established in previous consultations is considered part of the Proposed Action when determining if an if an effect is reasonably foreseeable (as described in Section 3.0.4). In general, the Navy's portfolio of mitigation measures are not specific to sea turtles; however, these measures would reduce the likelihood of adverse interactions with military readiness activities. Only green sea turtles and hawksbill sea turtles are expected to occur within nearshore waters of Guam and other islands in the Mariana Archipelago, where most of the mitigation zones are established as part of the Proposed Action.

Based on the framework presented in Section 3.0.4, the Navy concluded that, under the Proposed Action, effects from energy stressors, seafloor devices (a substressor of physical disturbance and strike stressors), entanglement stressors, ingestion, and secondary stressors on sea turtles would not be reasonably foreseeable. Table 3.0-20 summarizes these findings.

Effects on sea turtles from acoustic, explosive, and physical disturbance and strike (except for seafloor devices) stressors would be reasonably foreseeable; effects are considered significant if populations of sea turtles are impacted, areas used by sea turtles are denied, or habitat is physically altered to the point of no longer supporting sea turtles. The following sections analyze the effects of the Proposed Action on sea turtles and take into account the analysis presented in Section 3.5 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

#### 3.5.2.1 Effects on Sea Turtles Under Alternative 1

##### 3.5.2.1.1 Effects from Acoustic Stressors

This section summarizes the potential effects of acoustic stressors used during military readiness activities within the Study Area. The acoustic substressors included for analysis

include (1) sonar and other transducers, (2) vessel noise, (3) aircraft noise, and (4) weapons firing.

The types and quantities of sonar sources, the number of events using vessels and aircrafts, and the locations of those events under each alternative are shown in Section 3.0.4.1.1. The detailed assessment of these acoustic stressors under this Proposed Action is in Appendix C. Changes in the predicted acoustic effects are due to the following:

- Updates to criteria used to determine if acoustic stressors may cause auditory effects and behavioral responses. Changes to the auditory effects criteria include the weighted non-impulsive sound exposure level thresholds decreased by 22 decibels referenced to 1 micropascal squared seconds (dB re 1 $\mu Pa^2s$).
- Revisions to the modeling of explosive effects in the Navy Acoustic Effects Model. See the technical report *Acoustic and Explosive Concepts Technical Report* (U.S. Department of the Navy, 2026b).
- Updates to data on sea turtle presence, including estimated density of each species or stock (number of animals per unit area), group size, and depth distribution. For additional details see the technical reports *U.S. Navy Marine Species Density Database Phase IV for the Mariana Islands Training and Testing Study Area* (U.S. Department of the Navy, 2024d) and *Dive Distribution and Group Size Parameters for Marine Species Occurring in the U.S. Navy's Mariana Islands Training and Testing Study Areas* (Oliveira et al., 2025).
- Changes in the locations, numbers, and types of modeled military readiness activities as described in Chapter 2, and associated quantities (hours and counts) of acoustic stressors shown in Section 3.0.4.1.1.
- As discussed in Section 3.5.2.1, the Action Proponents will implement activity-based mitigation under Alternative 1 and Alternative 2 to reduce potential effects from acoustic stressors on sea turtles. However, the Action Proponents do not reduce the number of model-predicted effects, due to using activity-based mitigation.

#### 3.5.2.1.1.1 Sonars and Other Transducers

Sonars have the potential to affect sea turtles by causing a range of effects, from behavioral responses to AINJ. As discussed in the *Acoustic and Explosive Concepts Technical Repo*rt (U.S. Department of the Navy, 2026), sea turtle hearing is most sensitive from 100 to 400 Hz and limited over 1 kHz. Therefore, only sonars below 2 kHz, including low-frequency sonar, are analyzed for their effects on sea turtles. Modeling results showed no results for significant behavioral response, TTS, or auditory injury effects from sonar and other transducers under Alternative 1 and 2.

The Action Proponents will also implement geographic mitigation to reduce potential acoustic effects within sea turtle habitats supporting key biological behaviors, including breeding and resting behaviors (Chapter 4). While established for specific species, the limitations on sonar use defined in the mitigation measures would also benefit other marine species, including sea turtles, occurring in the geographic mitigation areas. Detailed information on geographic mitigation areas is presented in Appendix I of the 2020 SEIS/OEIS.

**Training and Testing**. Impacts from sonars to sea turtles within the Study Area would be limited to systems operating below 2 kHz, primarily from low-frequency sonars but could also include some broadband and lower mid-frequency sources (less than 2 kHz). These systems could be used throughout the MITT Study Area but are typically operated greater than 3 NM offshore. Although the use of low-frequency sonars has increased since the prior analysis, they are still used less than higher-frequency sources across the Study Area, resulting in a low overall risk of exposure. Low-frequency sonars are operated less often than mid- or high-frequency sources throughout the Study Area. Activities using sonar would generally occur within the MIRC, around inshore locations, and within Apra Harbor. Activities using sonar range from single-source, limited duration events to multi-day events with multiple sound sources on different platforms. The types of sonars and the way they are used differ between primary mission areas. This in turn influences the potential for effects on exposed sea turtles.

**Range Modernization and Sustainment.** Sonar would not be used during range modernization and sustainment.

**Conclusion.** Consistent with previous MITT analyses, training and testing activities involving sonars under Alternative 1 would have a reasonably foreseeable effect on sea turtles; however, the degree of effect would be less than significant, for the following reasons: (1) sea turtle hearing ability is limited to lower frequencies; and (2) no effects from sonars were predicted by the Navy's acoustic effects model, as discussed in the *Acoustic and Explosive Impacts Supporting Information* Technical Report.

#### 3.5.2.1.1.2 Vessel Noise

The broadband, non-impulsive, and continuous noise from vessels is within the hearing range of all sea turtles (Appendix C). Additional information on sea turtle hearing and potential impacts on sea turtles from non-impulsive broadband sound is discussed in the *Acoustic and Explosive Concepts Technical* Report (U.S. Department of the Navy, 2026a).

**Training and Testing**. Sea turtles may be exposed to vessel-generated noise throughout the Study Area (Table 3.0-10). Military readiness activities with vessel-generated noise would be conducted as described in the *Proposed Activities and Activity Descriptions* sections. Based on the updated background and analysis for training and testing under Alternative 1, vessel noise effects on sea turtles could include brief behavioral reactions and short periods of masking while in the proximity of a vessel.

**Range Modernization and Sustainment**. Vessel noise would be produced during range modernization and sustainment during target and instrument placement and recovery.

**Conclusion**. Consistent with previous MITT analyses, military readiness activities involving vessel noise under Alternative 1 would have a reasonably foreseeable effect on sea turtles; however, the degree of effect would be less than significant for the following reasons (1) activities that include the use of vessels would generate transient noise that would be temporary (lasting only while the vessel is transiting through the area; and (2) vessel noise may mask biologically important sounds, but would not measurably interfere with feeding, reproduction, or other biologically important functions needed to sustain an individual or a population.

#### 3.5.2.1.1.3 Aircraft Noise

Aircraft (i.e., fixed-wing and rotary-wing) are used for a variety of military readiness activities, and sea turtles may be exposed to aircraft-generated noise throughout the Study Area (Table 3.0-11). Additional information on the assessment of this acoustic stressor under the Proposed Action is in the *Acoustic and Explosive Concepts Technical Report*.

**Training and Testing**. Based on the updated background and analysis for training and testing under Alternative 1, aircraft noise effects on sea turtles would be limited to temporary (lasting up to several hours) behavioral and stress-startle responses to individual sea turtles found within localized areas. Sea turtles at or near the surface when an aircraft flies overhead at low altitude may startle, divert their attention to the aircraft, or avoid the immediate area by swimming away or diving.

**Range Modernization and Sustainment**. Aircraft noise would not be produced during range modernization and sustainment activities.

**Conclusion**. Consistent with previous MITT analyses, training and testing activities involving aircraft noise under Alternative 1 would have a reasonably foreseeable effect on some sea turtles. However, the degree of effect would be less than significant for the following reasons: (1) activities that include the use of aircraft would generate temporary and transient noise that would result in only minor disturbances, if any; and (2) such disturbances are not expected to interfere with feeding, reproduction, or other biologically important functions needed to sustain an individual or a population.

#### 3.5.2.1.1.4 Weapons Noise

Firing of guns, vibrations from the hull of ships, items that impact the water's surface, and items launched from underwater may produce weapons noise that are within the hearing range of all sea turtles.

**Training and Testing**. Sea turtles may be exposed to sounds caused by the firing of weapons, objects in flight, and impact of non-explosive munitions on the water surface during activities conducted at sea. This incidental noise is collectively called weapons noise. Training and testing activities using gunnery and other weapons that generate firing noise would be conducted as described in Chapter 2 and Appendix A.

Based on the updated background and analysis for training and testing under Alternative 1, the effect of weapons noise on sea turtles would be limited to temporary (lasting up to several minutes) behavioral and stress-startle responses to individual sea turtles found within localized areas. Because firing of medium- and large-caliber gunnery would occur greater than 12 NM from shore, with the exception of training and testing activities occurring on FDM, effects on coastal species are unlikely.

**Range Modernization and Sustainment**. Weapons noise would not be produced during range modernization and sustainment activities.

**Conclusion**. Consistent with previous MITT analyses, military readiness activities involving weapons noise under Alternative 1 would have a reasonably foreseeable effect on sea turtles; however, the degree of effect would be less than significant, for the following reasons: (1)

percussive noise generated by weapons firing noise would be temporary (lasting for a few seconds to several minutes); and (2) weapons firing noise may elicit startle responses, but normal behaviors (such as feeding and courtship in nearshore waters) would be expected to resume soon after a weapons firing event with no loss in population viability.

#### 3.5.2.1.2 Effects from Explosive Stressors

In-water explosives, which for the purposes of estimating effects includes explosives that detonate within 30 feet (ft.) above the water's surface, are analyzed for effects on sea turtles. Background information on new applicable and emergent science regarding explosive effects is presented in U.S. Department of the Navy (2025a).

In addition to changes in the Proposed Action, changes in the predicted explosive effects since the 2020 SEIS/OEIS are due to the following:

- Updates to criteria used to determine if an exposure to explosive energy may cause auditory effects, non-auditory injury or mortality, and behavioral responses. Changes to the auditory effects criteria include the weighted impulsive sound exposure level thresholds decreased by 20 dB re 1 $\mu Pa^2s$, and the impulsive sound pressure level thresholds decreased by 2 dB re 1 µPa.
- Revisions to the modeling of explosive effects in the Navy Acoustic Effects Model. See the technical report, *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase IV Training and Testing* (U.S. Department of the Navy, 2024b).
- Updates to data on sea turtle presence, including estimated density of each species or stock (number of animals per unit area), group size, and depth distribution. For additional details, see the technical report *Dive Distribution and Group Size Parameters for Marine Species Occurring in the U.S. Navy's Mariana Islands Training and Testing Study Areas* (Oliveira et al., 2025).
- Changes in the locations, numbers, and types of modeled military readiness activities as described in Chapter 2 and associated quantities of explosives (counts) shown in Section 3.0.4.1.2.
- As discussed in Section 3.5.2.1, the Action Proponents will implement activity-based mitigation under Alternative 1 and Alternative 2 to reduce potential effects from explosives on sea turtles. The Action Proponents will also implement geographic mitigation to reduce potential explosive effects, as identified in Chapter 4. Mitigation areas for seafloor resources, as described in Section 3.5.2.1, may also provide some level of protection from explosive effects for sea turtles that feed among, shelter, or otherwise inhabit these habitats.
- No reduction of model-predicted effects due to animal avoidance of a sound source, unlike in prior analyses.

The Action Proponents will implement activity-based mitigation and geographic mitigation under Alternative 1 and Alternative 2 to reduce potential adverse effects from explosives on sea turtles (refer to Chapter 4). Detailed information on geographic mitigation areas is presented in Appendix I of the 2020 SEIS/OEIS.

For information on the types and quantity of explosives by NEW under each alternative, see Table 3.0-4.

**Training and Testing**. The use of in-water explosives would increase for some bins and decrease for other bins compared to the use of explosives proposed in the previous MITT analyses. Refer to Table 3.0-4 and Table 3.0-5 for changes in the use of explosive munitions at sea and at FDM, respectively, by individual bins.

Most activities involving in-water (including surface) explosives associated with large caliber naval gunfire, missiles, bombs, or other munitions are conducted more than 12 NM from shore, where sea turtle densities are relatively lower than nearshore coastal environments in the Mariana Islands. Sinking exercises are conducted greater than 50 NM from shore and could be conducted 1–2 times annually by the Navy. Certain activities with explosives may be conducted close to shore at locations identified in Appendix A, including certain Mine Warfare activities. In the MIRC, explosive activities could occur at nearshore areas, to include specified ranges and designated locations around Guam, such as the Agat Bay Mine Neutralization Site, and designated locations in and near Apra Harbor (e.g., Outer Apra Harbor Underwater Detonation Site). In addition, bombing exercises and some gunnery and missile exercises can occur closer to shore at FDM, and misses and ricochets may cause in-water explosions in nearshore waters surrounding FDM.

The number of effects on each species due to exposure to explosives during training and testing under Alternative 1 is discussed in the *Acoustic and Explosive Effects Analysis Technical Report* U.S. Department of the Navy (2025a). This technical report provides additional details on modeled effects on each species, including seasons and regions in which effects are most likely to occur; which activities are most likely to cause effects; and analysis of effects in geographic mitigation areas, where applicable. The technical report also shows total effects to each species due to training or testing activities under this alternative and explains how effects are summed to estimate maximum annual and seven-year total effects. The number of effects on sea turtles are overestimated in this analysis by modeling explosions at or near the water surface as underwater explosions.

No mortalities are predicted, and just one non-auditory injury (for a green sea turtle) is predicted to occur due to the use of explosives over a seven-year period. For activities using explosives, the Action Proponents will implement mitigation to relocate, delay, or cease detonations when a sea turtle is sighted within or entering a mitigation zone to avoid or reduce potential effects from explosives.

Based on the updated background and analysis for training and testing under Alternative 1, effects on individuals may be permanent (auditory or non-auditory injuries) or temporary (TTS, masking, stress, or behavioral response). The behavioral patterns of a limited number of individuals may be interrupted. Individuals or groups may temporarily avoid areas around explosive activities if multiple detonations occur. Activities would be relatively brief and occur over small areas relative to population ranges.

**Range Modernization and Sustainment**. Explosives would not be used during range modernization and sustainment activities.

**Conclusion**. Consistent with previous MITT analyses, training and testing activities involving the use of explosives under Alternative 1 would have a reasonably foreseeable effect on sea turtles however, the degree of effect would be less than significant, based on the following: (1) estimated behavioral and TTS effects from explosives are expected to be short term and would not result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success, or species recruitment for an individual; (2) activities would not result in population-level effects; (3) low levels of estimated AINJ and injuries from explosives may have deleterious effects on the fitness of an individual turtle but are not expected to affect the fitness of enough individuals to cause population level effects; and (4) no mortalities from explosives were modeled. Additionally, SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and the mitigation measures described in Chapter 4 would be implemented.

#### 3.5.2.1.3 Effects from Physical Disturbance and Strike Stressors

The evaluation of the effects from physical disturbance and strike stressors on sea turtles focuses on proposed activities that affect sea turtles by an object that is moving through the water (e.g., vessels and in-water devices), dropped into the water (e.g., MEM), deployed on the seafloor (e.g., mine shapes, anchors, wires as part of range modernization actions), or propelled through the water column (e.g., explosive fragments).

Detailed information on physical disturbance effect categories, as well as effects specific to each substressor, is provided in Appendix F.

##### 3.5.2.1.3.1 Vessels and In-Water Devices

Vessel strike to sea turtles is not associated with any specific training or testing activity but rather an inadvertent, limited, sporadic, and incidental result of Navy and USCG vessel movement within the Study Area. There have been no vessel strikes on sea turtles by Navy or USCG vessels reported in the Study Area. The Navy and USCG do not anticipate vessel strikes to be a significant threat to sea turtle populations within the Study Area.

In-water devices could pose a collision risk to sea turtles when operated at high speeds or if they are unmanned. In-water devices, such as unmanned underwater vehicles, and in-water devices towed from unmanned platforms that move slowly through the water are highly unlikely to strike a sea turtle. In-water devices towed by manned platforms would have observers stationed on the towing platform to implement mitigation and standard safety measures employed when towing in-water devices (see Chapter 4).

Since some in-water devices are identical to support craft, sea turtles could respond to the physical presence of the device similar to how they respond to the physical presence of a vessel. It is possible that sea turtle species that occur in areas that overlap with in-water device use and may experience some level of physical disturbance, but it is not expected to result in more than a momentary behavioral response.

**Training and Testing**. Table 3.0-10 provides estimates of relative vessel use in the Study Area. The concentration of vessels in the open ocean areas of the Study Area and the manner of training and testing would remain consistent with the levels and types of activities undertaken in the Study Area over the last decade, as described in the previous MITT analyses. Alternative 1

includes an increase in small boat maneuvering within Apra Harbor, which may increase exposure to green sea turtles (and to a lesser extent, hawksbill sea turtles) to strike risk.

Vessel movement can be widely dispersed throughout the Study Area but is more concentrated near naval ports, piers, and range areas. Navy training vessel traffic would especially be concentrated near Apra Harbor. Smaller support craft usage would also be more concentrated in the coastal areas near naval installations, ports, and ranges.

Although the likelihood is low, a harmful interaction with a vessel or in-water device cannot be discounted, and sea turtle strikes in high vessel traffic areas (e.g., Apra Harbor) have been reported. Potential effects of exposure to vessels may result in substantial changes in an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Any strike at high speed is likely to result in significant injury. Potential effects of exposure to vessels are not expected to result in population-level effects for all sea turtle species. Under Alternative 1 training and testing activities, the Action Proponents will continue to implement activity-based mitigation to avoid or reduce the potential for vessel and in-water device strike of sea turtles (see Section 4.6.2). Within a mitigation zone of a vessel or in-water device, trained observers will relay sea turtle locations to the operators, who are required to change course when practical. A mitigation zone size is not specified for sea turtles to allow flexibility based on vessel type and mission requirements (e.g., small boats operating in a narrow harbor).

**Range Modernization and Sustainment**. Vessels would be used to deploy targets and bottom-placed instruments. During deployment the vessels would move very slowly (0–3 knots) and would not pose a collision risk to sea turtles occurring near the vessel. Activity-based mitigation would further reduce the potential for physical disturbance and strike.

**Conclusion**. Consistent with previous MITT analyses, military readiness activities involving the use of vessels and in-water devices under Alternative 1 would have a reasonably foreseeable effect on sea turtles; however, the degree of effect would be less than significant, because (1) the likelihood of a vessel strike on a sea turtles remains low; and (2) behavioral effects due to disturbance are not expected to interfere with feeding, reproduction, or other biologically important functions such that the continued viability of the population would be threatened.

#### 3.5.2.1.3.2 Military Expended Materials

This section analyzes the strike potential to sea turtles from the following categories of MEM: (1) all sizes of non-explosive practice munitions, (2) fragments from high-explosive munitions, (3) expendable targets and target fragments, and (4) expended materials other than munitions, such as sonobuoys, expended bathythermographs, and torpedo accessories. For a list of the types of activities that use MEM, refer to Appendix B, and for a discussion on where items would be used or expended under each alternative, see Table 3.0-12 through Table 3.0-15.

The primary concern is the potential for a sea turtle to be struck by MEM at or near the water's surface. While disturbance or strike from an item falling through the water column is possible, it is not very likely given that objects generally sink slowly through the water and can be avoided by sea turtles. Therefore, the discussion of MEM strikes focuses on the potential of a strike at the surface of the water.

**Training and Testing**. MEM that may cause physical disturbance or strike on sea turtles are listed in Table 3.0-12 through 3.0-15.

Appendix F includes more information on the type and quantities of MEM proposed to be used, and an analysis of potential strike risk of MEM on sea turtles. Green sea turtles, the sea turtle species with the highest average annual density (the average of four seasonal densities), was used to assess probability of MEM strike. Using four probability of strike scenarios (see Appendix F), the probability of exposure to a direct strike from training activities was calculated to be 0.084926 per year based on an average of the four probability of strike scenarios. For testing activities, the strike risk was lower, calculated to be 0.0361857.

The analysis in Appendix F is likely an overestimation of the probability of a direct strike for the following reasons: (1) it calculates the probability of a single military item (of all the items expended over the course of the year) hitting a single animal at its species' highest average annual density; (2) it does not take into account the possibility that a sea turtle may avoid military activities occurring prior to the MEM impact; (3) it does not take into account the possibility that a sea turtle may not be at the water surface; (4) it does not take into account that most projectiles fired during training and testing activities are fired at targets and only a very small portion of those projectiles would miss the target and hit the water with their maximum velocity and force; (5) the scenarios include a buffer area to account for an MEM missing the sea turtle and striking the water's surface nearby and disturbing the animal; and (6) it does not quantitatively take into account the Navy avoiding sea turtles that are sighted through the implementation of mitigation measures.

**Range Modernization and Sustainment**. No MEM would be expended during range modernization and sustainment activities. Some anchors may not be recovered and become MEM, but those are covered in the analysis of seafloor devices.

**Conclusion**. Consistent with previous MITT analyses, military readiness activities involving the use of MEM under Alternative 1 would have a reasonably foreseeable effect on sea turtles; however, the degree of effect would be less than significant because, as described above: (1) calculated strike risk probability is less than 0.1 for green sea turtles, the sea turtle species with the highest densities within the Study Area; (2) the analysis in Appendix F makes assumptions that likely overestimate the calculated probability (such as assuming that sea turtles are at the surface at all times, assuming sea turtles display no avoidance behavior, and not accounting for mitigation measures); and (3) the low probability of strike calculation may or may not result in injury or mortality, depending on the type of MEM (e.g., a large projectile is more likely to cause injury than a small decelerator/parachute).

#### 3.5.2.2 Effects on Sea Turtles Under Alternative 2

Under Alternative 2, the number of activities with associated acoustic, explosive, and physical disturbance stressors would be equal to or increase compared to Alternative 1. However, as described above, the Action Proponents would implement SOPs (Section 2.3.3 of the 2020 SEIS/OEIS), activity-based mitigation, and geographic mitigation (Chapter 4) to reduce potential adverse effects from acoustic and explosive stressors. The Navy's portfolio of mitigation measures is not specific to sea turtles; however, these measures would reduce the likelihood of

adverse interactions with military readiness activities. Detailed information on geographic mitigation areas is presented in Appendix I of the 2020 SEIS/OEIS.

Under Alternative 2, the use of sonar sources would not change from Alternative 1, and increases in other acoustic stressors would not result in substantive changes to the potential for or types of effects on sea turtles. The use of explosives during training and testing activities would be nearly identical to Alternative 1 and result in the same modeled effects for all sea turtle species (see the *Acoustic and Explosive Effects Analysis Technical Report* U.S. Department of the Navy (2025a)). Effects from activities involving physical disturbance and strike would not be measurably different than under Alternative 1 because more vessel movements do not necessarily equate to greater adverse effects, and the quantity of materials expended would increase, but not significantly (see Section 3.0.4.1.3). Additionally, the locations where military materials are expended would be the same as Alternative 1. As such, increases in military readiness activities would not result in substantive changes to the potential for or types of effects on sea turtles, and overall effects are not meaningfully different from those analyzed under Alternative 1.

Therefore, military readiness activities involving acoustic, explosive, and physical disturbance and strike stressors under Alternative 2 would result in less than significant effects on sea turtles.

## 3.6 SEABIRDS

### 3.6.1 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on seabirds found in Section 3.6 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020).

Information describing seabirds species and populations is presented in the Supplemental Biological Information Technical Report for the Mariana Training and Testing Study Area (U.S. Department of the Navy, 2025b). Within the Study Area, seabirds nest and visit FDM—these seabirds are addressed in Section 3.10 that includes a more focused analysis of potential effects on terrestrial biological resources on FDM.

Seabirds are some of the most threatened marine animals in the world, with 29 percent of species at risk of extinction (Spatz et al., 2014). In the marine environment, interactions with commercial fisheries, particularly longline operation (Bentley et al., 2021) pose significant risks of bycatch mortality for foraging albatrosses, petrels, and shearwaters (Bentley et al., 2021; Phillips et al., 2023; Raine et al., 2023). The pervasive issue of plastic pollution is another major concern, with seabirds succumbing to starvation or internal injury from ingesting plastic debris mistaken for prey, as well as entanglement in larger plastic items (Puskic, 2023; Rapp et al., 2017; Thiel et al., 2018). Oceanic warming and increased stratification are predicted to alter the abundance and distribution of critical prey species, while rising sea levels and increased storm-surge intensity directly threaten the viability of low-lying nesting colonies (Keogan et al., 2018; Young & VanderWerf, 2023).

In pelagic environments of the Study Area, other threats include interactions with commercial and recreational fishing gear and pollution, such as oil spills and plastic debris (Anderson et al.,

2007; Jeglinski et al., 2024; Jessup et al., 2009; North American Bird Conservation Initiative, 2022; North American Bird Conservation Initiative & U.S. Committee, 2010; U.S. Fish and Wildlife Service, 2005). Disease, volcanic eruptions, storms, and harmful algal blooms are also natural threats to seabirds (Anderson et al., 2007; Jeglinski et al., 2024; Jessup et al., 2009; North American Bird Conservation Initiative, 2022; North American Bird Conservation Initiative & U.S. Committee, 2010; U.S. Fish and Wildlife Service, 2005).

#### 3.6.1.1 Endangered Species Act-Listed Species

Three marine birds present in the Study Area are listed under the ESA; the short-tailed albatross (*Phoebastria albatrus*) and Hawaiian petrel (*Pterodroma sandwichensis*) are listed as endangered, and the Newell's shearwater (*Puffinus auricularis newelli*)[3] is listed as threatened (U.S. Fish and Wildlife Service, 2010, 2015). However, the Mariana Archipelago is considered peripheral or extralimital to the primary foraging ranges of these pelagic species, and their occurrence in the region is rare. The comprehensive Mariana Archipelago Cetacean Survey (MACS) conducted from May to July 2021 did not record any sightings of the short-tailed albatross, Newell's shearwater, or the Hawaiian petrel (Yano et al., 2022). Accordingly, there would be little to no overlap with at-sea training and testing activities.

#### 3.6.1.2 Species Not Listed under the Endangered Species Act

Other pelagic bird species not listed under the ESA are known to occur within the Study Area. These seabirds, which are highly adapted for an open ocean existence, utilize the region for foraging, migration, and breeding, contributing significantly to the archipelago's biodiversity. The composition and abundance of this avifauna are intrinsically linked to oceanographic conditions, resource availability, and seasonal cycles (Pratt et al., 2023).

The pelagic avifauna of the Mariana Islands is composed of several families, with Procellariidae (shearwaters and petrels) and Sulidae (boobies) being particularly prominent. The wedge-tailed Shearwater (*Ardenna pacifica*) is a common breeding species within the archipelago, establishing significant colonies on several of the northern islands (Raine et al., 2023). Migratory species are also a major component; for instance, the Short-tailed Shearwater (*Ardenna tenuirostris*) is observed in substantial numbers as it transits the region during its extensive north-south migrations (Pratt et al., 2023). Other notable procellariids recorded include the Bonin Petrel (*Pterodroma hypoleuca*) and the federally listed Newell's Shearwater (*Puffinus newelli*), although the latter's presence is less frequent (Pratt et al., 2023; U.S. Fish and Wildlife Service, 2021). For additional information on seabird occurrence within the Study Area, see Section 3.6 of the 2020 SEIS/OEIS.

### 3.6.2 Environmental Consequences

This SEIS/OEIS analyzes potential impacts of the Proposed Action on seabirds and considers the same stressors as previous MITT analyses, which include (1) acoustic (sonar and other

[3] The current taxonomic classification of this species holds that the Newell's shearwater is a subspecies of the Townsend's shearwater. In some instances, this subspecies is also named the Newell's Townsend's shearwater; however, both Newell's shearwater and Newell's Townsend's shearwater refer to the same subspecies (scientific name *Puffinus auricularis newelli*).

transducers, vessel noise, aircraft noise, and weapons noise), (2) explosive (explosions in air), (3) energy (in-water electromagnetic devices, high-energy lasers), (4) physical disturbance and strike (vessels and in-water devices, MEM, seafloor devices), (5) entanglement (decelerators/parachutes, wires and cables), (6) ingestion (MEM), and (7) secondary stressors

For each stressor, the implementation of SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and mitigation measures (Chapter 4) are considered as part of the Proposed Action when determining if an effect is reasonably foreseeable as described in Section 3.0.4.

Based on the framework presented in Section 3.0.4 and considering the analysis presented in Section 3.6 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS, the Navy concluded that effects from sonar and other transducers and vessel noise (both substressors of acoustic stressors), energy stressors, physical disturbance and strike, entanglement stressors, ingestion, and secondary stressors on seabirds would not be reasonably foreseeable. Table 3.0-20 summarizes these findings.

Effects on seabirds from acoustic (aircraft and weapons noise) and explosive stressors would be reasonably foreseeable; effects are considered significant if populations of seabirds are impacted, areas used by seabirds are denied, or habitat is physically altered to the point of no longer supporting seabirds. Under the Military Readiness Rule (50 CFR section 21.42, *Authorization of take incidental to military readiness activities*) and Migratory Bird Treaty Act (MBTA), if the Navy determines that, over the course of training and testing activities, the population of migratory birds would be significantly affected, the Navy would be required to confer and cooperate with the USFWS to develop and implement appropriate conservation measures to minimize or mitigate such significant adverse effects. The following sections analyze the effects of the Proposed Action on seabirds and take into account the analysis presented in Section 3.6 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

### 3.6.2.1 Effects on Seabirds Under Alternative 1

#### 3.6.2.1.1 Effects from Acoustic Stressors

This section summarizes the potential effects of acoustic stressors used during military readiness activities within the Study Area. More detailed information and analysis on acoustic stressors, as well as effects specific to each substressor, is provided in Appendix C.

##### 3.6.2.1.1.1 Aircraft Noise

Military readiness activities proposed in the Study Area involve various types of aircraft, including fixed-wing, and rotary-wing aircraft. Aircraft noise would be generated throughout the Study Area, contributing both airborne and underwater sound to the ocean environment. Most of the aircraft noise would be generated at air stations, which are outside the Study Area. Takeoffs and landings occur at established airfields as well as on vessels across the Study Area. Aircraft operations on and off Navy vessels produce in-water noise at specific locations for a brief period. Some bird species, particularly waders and shorebirds, could have greater exposure to aircraft noise because of the proximity of habitats (e.g., wetlands, estuaries) to airfields. Seabirds in pelagic habitats would likely experience fewer exposures because of the brief overflight time and the high altitude of the aircraft relative to the lower altitudes maintained by foraging seabirds.

A bird offshore could be exposed to transient noise from aircraft passing overhead and may respond by avoiding areas where aircraft operations are temporarily concentrated. Aircraft activity would be dispersed, and exposures would be infrequent and brief. This is true of fixed- or rotary-winged aircraft, though helicopters could hover for longer periods and helicopter activities would occur closer to the coast and inshore, and at times at lower altitudes than fixed wing aircraft, increasing the potential to expose seabirds to aircraft noise.

**Training and Testing**. Fixed- and rotary-wing (e.g., helicopters) aircraft are used for a variety of military readiness activities, and seabirds may be exposed to aircraft-generated noise throughout the Study Area (Table 3.0-11).

Sonic booms would also be generated during training and testing activities. Supersonic aircraft flights are not intentionally generated below 30,000 ft. unless over water and more than 30 NM from inhabited coastal areas or islands. Deviation from these guidelines may be approved for tactical missions that require supersonic flight, phases of formal training requiring supersonic speeds, research and test flights that require supersonic speeds, and for flight demonstration purposes when authorized by the Chief of Naval Operations (U.S. Department of the Navy, 2016). Outside of these authorized tactical missions, sonic booms would not likely disturb seabirds in these pelagic environments.

**Range Modernization and Sustainment**. Aircraft would not be used during range modernization and sustainment activities.

**Conclusion**. Consistent with previous MITT analyses, effects to seabirds from aircraft noise utilized during military readiness activities would be reasonably foreseeable; however, the degree of effect would be less than significant because (1) seabirds in nearshore environments (where the most aircraft noise exposures would occur) would likely be disturbed, however, any observable behavioral change would be temporary with normal activities quickly resuming after the aircraft has left the area; (2) the brief overflight time and the high altitude of the aircraft relative to the lower altitudes maintained by foraging seabirds; and (3) sonic booms would be generated at elevations sufficiently high enough where the noise generated by the sonic boom would be short in duration (a few seconds) and not likely discernable from ambient sounds in the pelagic environment.

#### 3.6.2.1.1.2 Weapons Noise

Seabirds may be exposed to sounds caused by the firing of weapons, objects in flight, and impact of non-explosive munitions on the water's surface during activities conducted at sea.

Firing of guns, vibrations from the hull of ships, items that affect the water's surface, and items launched from underwater may produce weapons noise and affect seabirds in air or underwater. Explosive and non-explosive munitions fired at land-based targets on FDM that unintentionally affect the nearshore area adjacent to FDM may result in impulsive sound propagating underwater. Unexploded and inert munitions have been documented in the shallow water habitat adjacent to the island (Smith, 2016), providing evidence that misses or ricochets off the land can occur; no training or testing activities intentionally release munitions or other MEM over water at FDM. While it is possible that munitions would impact in nearshore waters adjacent to FDM, the frequency of occurrence has historically been and is expected to

remain very low. The Action Proponents will implement terrestrial mitigation under Alternative 1 to reduce potential effects from weapons noise on seabirds on FDM.

**Training and Testing**. Most sounds generated by weapons platforms under the surface, on the surface, or in air would be brief, lasting from less than a second for a blast or inert impact to a few seconds for other launch and object travel sounds. Most incidents of impulsive sounds produced by weapons firing, launch, or inert object effects would be single events, with the exception of gunfire activities.

Use of weapons during training would typically occur in the range complexes, with fewer activities in the transit corridor. Most activities involving large-caliber naval gunfire or the launching of targets, missiles, bombs, or other munitions are conducted more than 3 NM from shore.

Birds that migrate or forage in open-ocean areas could be exposed to large-caliber weapons noise. All species could be exposed to small- and medium-caliber weapons noise that may occur closer to shore. Because weapons firing occurs at varying locations over a short time period and bird presence changes seasonally and on a short-term basis, individual seabirds would not be expected to be repeatedly exposed to weapons firing, launch, or projectile noise. Any effects on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be brief and infrequent.

**Range Modernization and Sustainment**. Weapons would not be used during range modernization and sustainment activities.

**Conclusion**. Consistent with previous MITT analyses, effects on seabirds from weapons noise during military readiness activities would be reasonably foreseeable; however, the degree of effect would be less than significant because (1) although a few individuals may experience long-term effects and potential mortality from military readiness activities that result in in-air explosions, population-level effects are not expected, and (2) terrestrial mitigations measures to reduce weapons firing noise on FDM described in Chapter 4 would be implemented.

#### 3.6.2.1.2 Effects from Explosive Stressors

In-air explosives (defined here as explosions above the water surface and down to a depth of 10 meters [m]) are analyzed for effects on seabirds. Background information on new applicable and emergent science regarding explosive effects is presented in Appendix C.

**Training and Testing**. Because most events involving in-air explosions would consist of a limited number of detonations, exposures would not occur over long durations; and since events occur at varying locations, it is expected there would be an opportunity to recover from an incurred energetic cost, and individual seabirds would not be repeatedly exposed to explosive detonations.

**Range Modernization and Sustainment**. Explosives would not be used during range modernization and sustainment activities.

**Conclusion**. Consistent with previous MITT analyses, effects on seabirds from explosions during military readiness activities would be reasonably foreseeable; however, the degree of effect would be less than significant because (1) although a few individuals may experience long-term effects and potential mortality from military readiness activities that result in in-air explosions,

population-level effects are not expected, and (2) mitigations measures described in and Chapter 4 would be implemented.

#### 3.6.2.2 Effects on Seabirds Under Alternative 2

Under Alternative 2, the number of activities with associated acoustic and explosive stressors would be equal to or increase compared to Alternative 1. However, increases in these stressors are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of seabird species at individual or population levels for the same reasons detailed above for Alternative 1. Additionally, the Action Proponents would implement SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and activity-based mitigation (Chapter 4) to reduce potential adverse effects from acoustic and explosive stressors. The Navy's portfolio of mitigation measures is not specific to seabirds; however, these measures would reduce the likelihood of adverse interactions with military readiness activities. As such, increases in military readiness activities would not result in substantive changes to the potential for, or types of, effects on seabirds; and overall effects are not meaningfully different from those analyzed under Alternative 1.

Therefore, military readiness activities involving acoustic and explosive stressors under Alternative 2 would result in less than significant effects on seabirds.

## 3.7 MARINE VEGETATION

### 3.7.1 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on marine vegetation found in Section 3.7 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020).

There is no new information on general threats, taxonomic groups, seagrasses, or mangroves in the MITT Study Area that would change the conclusions from the previous MITT analyses.

However, McKenzie et al. (2021) summarizes information on seagrasses in Pacific Island countries. This study found that only three species of seagrasses are found on three of the 14 islands, including *Enhalus acoroides* at Saipan, Tinian, and Rota. On both Tinian and Rota, *E. acoroides* only occurs in a single locations (Unai Chiget at Tinian and as a narrow band in the West Dock area at Rota) (McKenzie et al., 2021). The dominant seagrass in the shallow sandy nearshore waters of the Saipan Lagoon is *Halodule uninervis*, while *E. acoroides* is conspicuous at the mouths of streams emptying into the lagoon. *Halophila gaudichaudii* occurs along shallow lagoon waters near the coastline of Saipan, Tinian, and Rota (McKenzie et al., 2021). The lack of seagrasses on the other islands in the Marianas is likely due to a lack of habitat conducive for seagrass establishment and growth (McKenzie et al., 2021).

### 3.7.2 Environmental Consequences

This SEIS/OEIS analyzes potential impacts of the Proposed Action on marine vegetation and is focused on the same stressors as previous MITT analyses, which include (1) explosive (explosions in water), (2) physical disturbance and strike (vessels and in-water devices, MEM, seafloor devices, and personnel disturbance), and (3) secondary stressors.

For each stressor, the implementation of SOPs is considered part of the Proposed Action when determining if an effect is reasonably foreseeable (as described in Section 3.0.4).

Based on the framework presented in Section 3.0.4, the Navy concluded that effects from secondary stressors on marine vegetation would not be reasonably foreseeable. Table 3.0-20 summarizes these findings.

Effects from explosives, and physical disturbance and strike stressors on marine vegetation would be reasonably foreseeable; effects would be considered significant if they cause long-term changes to a population well outside the limits of natural variability, their habitats, or the natural processes sustaining them. The following sections analyze the effects of the Proposed Action on marine vegetation and take into account the analysis presented in Section 3.7 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

### 3.7.2.1 Effects on Vegetation Under Alternative 1

#### 3.7.2.1.1 Effects from Explosive Stressors

Explosive sources analyzed that could be used underwater or at the water surface are presented in Table 3.0-4. Detailed background information supporting the explosive stressor analysis is provided in Appendix C. Note that the use of explosives underwater has not been identified among the causes of decline in marine vegetation to date (U.S. Department of the Navy, 2025b).

As stated in the previous MITT analyses, the potential for an explosion to injure or destroy marine vegetation would depend on the amount of vegetation present, the number of munitions used, and their NEW. In areas where marine vegetation and locations for explosions overlap, marine vegetation on the surface of the water, in the water column, or rooted in the seafloor may be affected. Seafloor macroalgae and single-celled algae may overlap with underwater and sea surface explosion locations. Underwater explosions also may temporarily increase the turbidity (sediment suspended in the water) in nearby waters, incrementally reducing the amount of light available to marine vegetation. Reducing light availability decreases, albeit temporarily, the photosynthetic ability of marine vegetation.

**Training and Testing**. Under Alternative 1, the number of explosive ordnances used in the Study Area during military readiness activities would change compared to the number analyzed in the previous MITT analyses (Table 3.0-4). Under Alternative 1, underwater detonations for underwater demolition qualification/certification would be the same as the 2020 SEIS/OEIS. However, these activities would continue to occur in the same areas at the Agat Bay, Piti, and Outer Apra Harbor sites, and would have no appreciable change in the effects analysis or conclusions for explosive stressors as presented in the previous MITT analyses.

As described in the 2020 SEIS/OEIS, most explosive detonations during military readiness activities would occur in waters greater than 3 NM from shore and at deeper depths that are not known to support marine vegetation. The effects from explosives during military readiness activities would be minimal disturbances of floating algal mats at the surface and negligible effects on macroalgae from bottom-placed explosives in soft bottom habitat. Areas with special status algal species, such as seagrass beds, would be avoided to the greatest extent practicable.

**Range Modernization and Sustainment**. Explosives would not be used during range modernization and sustainment; therefore, there would be no explosives effects.

**Conclusions**. Consistent with previous MITT analyses, effects on marine vegetation from explosives utilized during military readiness activities would be reasonably foreseeable; however, the degree of effect would be less than significant because (1) the majority of underwater explosions occur at or near the surface at offshore locations greater than 3 NM from shore in water depths greater than 100 ft., where only floating seaweed would be affected; (2) explosions on or near the seafloor occur mostly in estuarine or shallow ocean waters, where vegetation (benthic macroalgae) is much less abundant compared to hard bottom areas and artificial structures; (3) if floating seaweed or benthic vegetation is in the immediate vicinity of an explosion, the taxa most likely affected are resilient to fragmentation and damage due to lack of vital organs, fast growth rate, and asexual reproduction; (4) most explosions would take place in soft-bottom habitats, and most bottom-placed explosions are detonated in the same established soft bottom locations where explosions would have very limited and localized (if any), temporary effects; and (5) areas with special status algal species, such as seagrass beds, would be avoided to the greatest extent practicable.

#### 3.7.2.1.2 Effects from Physical Disturbance and Strike Stressors

The physical disturbance and strike stressors that may affect marine vegetation include (1) vessels and in-water devices, (2) MEM, (3) seafloor devices, and (4) personnel disturbance. While the number of training and testing events would change under this SEIS/OEIS, the analysis presented in the previous MITT analyses remains valid. The changes in military readiness activities are not substantial and would not result in an overall change to existing environmental conditions or an increase in the level or intensity of physical disturbance and strike stressors within the Study Area. Supporting information on marine vegetation effects from physical disturbance and strike stressors are provided in Appendix C. Note that physical disturbance from human activities has been identified among the causes of decline in marine vegetation to date (U.S. Department of the Navy, 2025b).

The evaluation of the effects from physical disturbance and strike stressors on vegetation focuses on proposed activities that may cause marine vegetation to be damaged by an object that is moving through the water (e.g., vessels and in-water devices), dropped into the water (e.g., MEM), or deployed on the seafloor (e.g., mine shapes and anchors). Specific locations of activities are given in Appendix A. Wherever appropriate, specific geographic areas of potential effect are identified.

**Training and Testing**. Under Alternative 1, the combined number of proposed military readiness activities involving MEM (Table 3.0-12 through 3.10-15), and seafloor devices (Table 3.0-17) would change from those presented in the previous MITT analyses. Military readiness activities could cause damage to marine vegetation from an object that is moving through the water (e.g., vessels and in-water devices), dropped into the water (e.g., MEM), or deployed on the seafloor (e.g., mine shapes and anchors). Changes in physical disturbance and strike stressors, such as increases in MEM, could influence the level of effect on marine vegetation. Overall, these changes do not appreciably change the analysis or potential effects presented in the previous MITT documents because the effects analyses were based on the probability of an effect on a resource.

**Range Modernization and Sustainment**. Physical disturbance and strike from placement and retrieval of subsurface targets and instrumentation would only pose a threat to marine vegetation if anchors or instruments such as hydrophones are placed in shallow areas or harbors where most marine vegetation occurs. Since in-water devices would be placed primarily in soft bottom areas where most marine vegetation does not occur, effects on benthic vegetation would be less than significant.

**Conclusion**. Consistent with previous MITT analyses, effects on marine vegetation from physical disturbance and strike associated with military readiness activities would be reasonably foreseeable; however, the degree of effect would be less than significant because (1) vegetation on the sea surface such as marine algal mats would not likely be affected by seafloor devices; (2) seafloor devices use sandy substrates, devoid of marine vegetation, to the greatest extent practicable; (3) while It is possible that increases in suspended sediment during amphibious landing could affect vegetation in soft bottom habitats, these effects would be considered temporary and localized; and (4) population-level effects are unlikely because of the low frequency of military readiness activities in these small localized areas.

#### 3.7.2.2 Effects on Marine Vegetation Under Alternative 2

Under Alternative 2, the number of activities with associated explosive and physical disturbance and strike stressors would be equal to or increase compared to Alternative 1. However, increases in these stressors are not expected to yield any lasting effects on the survival or growth of marine vegetation at population levels for the same reasons detailed for Alternative 1. Additionally, the Action Proponents would implement SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and mitigation (Chapter 4) to reduce potential adverse effects on marine vegetation. As such, increases in military readiness activities would not result in substantive changes to the potential for or types of effects on marine vegetation, and overall effects are not meaningfully different from those analyzed under Alternative 1.

Therefore, military readiness activities involving explosive and physical disturbance and strike stressors under Alternative 2 would result in less than significant effects on marine vegetation.

## 3.8 MARINE INVERTEBRATES

### 3.8.1 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on marine invertebrates found in Section 3.8 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020).

#### 3.8.1.1 Sound Sensing and Production

Marine invertebrates have evolved around the extraction of information from soundscapes and are mainly sensitive to the particle motion of sound, rather than the sound pressure (Sole´ et al., 2023). Since marine invertebrates often live close to the seabed, they can be affected by substrate vibration, which usually involves particle motion (Hawkins et al., 2021). Sources of marine underwater anthropogenic noise that generate vibration include shipping (fishing boats, recreational motorboats, jet skis, trade vessels), oil and gas exploration and operation, the construction and operation of offshore wind farms and other renewable energy devices,

dredging, construction of bridges and harbors, commercial and military sonar, and underwater explosions for construction or ordnance disposal (Sole´ et al., 2023). Even with the addition of new noise information on marine invertebrates, this does not appreciably change the information or analyses presented in previous MITT analyses.

#### 3.8.1.2 General Threats

There is no new information on threats to marine invertebrates in the MITT Study Area that would change the conclusions from previous MITT analyses.

#### 3.8.1.3 Endangered Species Act-Listed Species

Table 3.8-1 presents ESA-listed marine invertebrates in the Study Area, including three coral species listed as threatened (*Acropora globiceps, A. retusa*, and *Seriatopora aculeata*) and giant clam species (*Hippopus hippopus*, *Tridacna derasa, T. gigas*, and *T. squamosa*). On August 15, 2025, NMFS issued a final rule designating critical habitat for five threatened coral species in U.S. waters in the Pacific Islands region, including *A. globiceps* (90 Federal Register 39339). Critical habitat includes Rota; Aguijan; Tinian; Saipan; Alamagan; Pagan; and Maug Islands, Asuncion and Uracas in the Mariana Trench Marine National Monument, as well as Guam. Detailed information on each ESA-listed species is presented in the Navy's Supplemental Biological Information Technical Report (U.S. Department of the Navy, 2025b).

**Table 3.8-1: Status of Endangered Species Act-Listed Species Within the Study Area**

| Species Name and Regulatory Status | | | Presence in Study Area | |
|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **Endangered Species Act Status** | **Open Ocean/ Transit Corridor** | **Coastal Ocean** |
| | *Acropora globiceps* | Threatened | No | Yes |
| | *Acropora retusa* | Threatened | No | Yes |
| Club finger coral | *Seriatopora aculeata* | Threatened | No | Yes |
| Horse's hoof, bear paw, strawberry clam | *Hippopus hippopus* | Proposed Threatened | No | Yes* |
| Smooth giant clam | *Tridacna derasa* | Proposed Endangered | No | Yes* |
| True giant clam | *Tridacna gigas* | Proposed Endangered | No | Yes* |
| Fluted giant clam | *Tridacna squamosa* | Proposed Threatened | No | Yes* |

* May be locally extirpated. Source: Sole´ et al. (2023)

#### 3.8.1.4 Taxonomic Groups

There is no new information on marine invertebrate taxonomic groups that would change the basis of the conclusions from the previous MITT analyses.

### 3.8.2 Environmental Consequences

This SEIS/OEIS analyzes potential impacts of the Proposed Action on marine invertebrates and considers the same stressors as previous MITT analyses, which include (1) acoustic (sonars), (2) explosive (explosions in water), (3) physical disturbance and strike (MEM, seafloor devices, and personnel disturbance), (4) entanglement (wires and cables, decelerators/parachutes), (5) ingestion (MEM), and (6) secondary stressors.

For each stressor, the implementation of SOPs is considered part of the Proposed Action when determining if an effect is reasonably foreseeable.

Based on the framework presented in Section 3.0.4, the Navy concluded that effects from acoustic, entanglement, ingestion, and secondary stressors on marine invertebrates would not be reasonably foreseeable. Table 3.0-20 summarizes these findings.

Effects on marine invertebrates from explosive and physical disturbance and strike stressors would be reasonably foreseeable; effects would be considered significant if they cause long-term changes to a population well outside the limits of natural variability, their habitats, or the natural processes sustaining them. The following sections analyze the effects of the Proposed Action on marine invertebrates and takes into account the analysis presented in Section 3.8 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

### 3.8.2.1 Effects on Marine Invertebrates Under Alternative 1

#### 3.8.2.1.1 Effects from Explosive Stressors

Explosive sources analyzed that could be used underwater or at the water surface are presented in Table 3.0-4. Supporting information on how explosives affect marine invertebrates is presented in U.S. Department of the Navy (2025b). Note that underwater explosions from human activities have not been identified among the causes of decline in marine invertebrate populations to date (U.S. Department of the Navy, 2025a).

**Training and Testing.** Under Alternative 1, the number of explosive ordnances used in the Study Area during military readiness activities would change compared to the number analyzed in the previous MITT analyses (Table 3.0-4). Under Alternative 1, underwater detonations for underwater demolition qualification/certification would be the same as the 2020 SEIS/OEIS. However, these activities would continue to occur in the same areas at the Agat Bay, Piti, and Outer Apra Harbor sites, and would have no appreciable change in the effects analysis or conclusions for explosive stressors as presented in the previous MITT analyses.

As described in the 2020 SEIS/OEIS, most explosive detonations during military readiness activities would occur in waters greater than 3 NM from shore, which are not known to support ESA-listed coral species. In addition, energy from an explosion at the surface would dissipate below detectable levels before reaching the seafloor and would not injure or otherwise affect deep-water, benthic marine invertebrates. However, various developmental stages such as eggs, sperm, early embryonic stages, and planula larvae of corals, as well as adults, could be affected in areas overlapping with other military readiness activities using explosives. Consequences of exposure to an explosive shock wave could include breakage, injury, or mortality. Many corals and hard-bottom invertebrates are sessile, fragile, and particularly vulnerable. Because exposures to explosive shock waves are brief, limited in number, and spread over a large area, no long-term effects are expected. Explosives may affect individual marine invertebrates and groups of marine invertebrates, but they are unlikely to affect populations or subpopulations.

The Navy will implement mitigation to avoid or reduce effects from explosives on seafloor resources in mitigation areas throughout the Study Area (see Chapter 4). For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within 350 yards of shallow-water coral reefs, artificial reefs, and shipwrecks, except at designated nearshore training areas around Guam and Apra Harbor, where these resources will be avoided to the

maximum extent practicable. This mitigation measure additionally avoids or reduces potential effects on marine invertebrates that inhabit these areas. There is also activity-based mitigation that affects "jellyfish aggregations," specifically for explosive torpedoes and sinking exercises (Section 4.6).

**Range Modernization and Sustainment.** Explosives would not be used during range modernization and sustainment; therefore, there would be no explosives effects.

**Conclusion.** Consistent with previous MITT analyses, explosives utilized during military readiness activities would have reasonably foreseeable effects on marine invertebrates; however, the degree of effect would be less than significant because (1) it is unlikely that the distribution of sensitive marine invertebrates (e.g., shallow-water coral reefs) would spatially coincide with explosive effects; (2) soft bottom communities more likely to be affected (e.g., worms, clams) would be expected recover quickly; (3) most local disturbances of the surface water or seafloor would only have short-term effects, with some temporary increases in suspended sediment in mostly shallow, soft bottom habitats; (4) behavioral responses would be short-term and brief; and (5) the Navy will implement mitigation to avoid or reduce effects from explosives on seafloor resources in mitigation areas throughout the Study Area, which will consequently help avoid or reduce potential effects on invertebrates that inhabit these areas.

#### 3.8.2.1.2 Effects from Physical Disturbance and Strike Stressors

The physical disturbance and strike stressors that may affect marine invertebrates include (1) MEM, (2) seafloor devices, and (3) personnel disturbance. While the number of training and testing events would change under this SEIS/OEIS, the analysis presented in the previous MITT analyses remains valid. The changes in military readiness activities are not substantial and would not result in an overall change to existing environmental conditions or an increase in the level or intensity of physical disturbance and strike stressors within the Study Area. Supporting information on marine invertebrate effects from physical disturbance and strike stressors are provided in U.S. Department of the Navy (2025b).

**Training and Testing.** Under Alternative 1, the combined number of proposed military readiness activities involving MEM (Table 3.0-12 through Table 3.0-15), and seafloor devices (Table 3.0-17) would change from those presented in the previous MITT analyses. However, these changes do not appreciably change the analysis or effect conclusions presented in the previous MITT analyses because the effects analysis was based on the probability of an effect on a resource.

As stated in previous MITT analyses, the effect of physical disturbance and strike stressors on marine invertebrates is likely to cause injury or mortality to individuals, such as corals on nearshore reefs, but effects on populations, including those that live in hydrothermal vents, are not expected because the area exposed to the stressor is extremely small (localized) relative to most marine invertebrates' ranges, and the activities are dispersed such that few individuals could conceivably be exposed to more than one event. Activities involving MEM, seafloor devices, and personnel disturbance are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all physical disturbance and strike

stressors could degrade habitat quality at some locations. In addition, combat swimmers and Marines may be required to walk through nearshore areas and reefs during these activities, potentially causing damage to coral species. As stated in previous MITT analyses, these activities could cause injury or mortality to individuals, but effects on marine invertebrate populations, including ESA-listed corals, are unlikely.

**Range Modernization and Sustainment.** Similar effects on marine invertebrates would occur during range modernization and sustainment activities, including injury or mortality to individuals. These effects would not affect populations and are considered less than significant.

**Conclusion.** Consistent with previous MITT analyses, MEM, seafloor devices, and personnel disturbance utilized during military readiness activities would have reasonably foreseeable effects on marine invertebrates; however, the degree of effect would be less than significant because (1) the area exposed to physical disturbance and strike stressors is localized relative to most marine invertebrates' ranges; (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event; (3) activities could cause injury or mortality to individuals, but effects on marine invertebrate populations, including ESA-listed corals, are unlikely; and (4) behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level are not anticipated.

#### 3.8.2.2 Effects on Marine Invertebrates Under Alternative 2

Under Alternative 2, the number of activities with associated explosive and physical disturbance and strike stressors would be equal to or increase compared to Alternative 1. However, increases in these stressors are not expected to yield any lasting effects on the survival or growth of marine invertebrates at population levels for the same reasons detailed for Alternative 1. Additionally, the Action Proponents would implement SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and geographic mitigation (see Chapter 4 and Appendix I of the 2020 SEIS/OEIS) to reduce potential adverse effects on marine invertebrates. As such, increases in military readiness activities would not result in substantive changes to the potential for or types of effects on marine invertebrates, and overall effects are not meaningfully different from those analyzed under Alternative 1.

Therefore, military readiness activities involving explosive and physical disturbance and strike stressors under Alternative 2 would result in less than significant effects on marine invertebrates.

## 3.9 FISHES

### 3.9.1 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on fishes found in Section 3.9 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020).

#### 3.9.1.1 Hearing and Vocalization

A summary of fish hearing and vocalizations is described in the previous MITT analyses. Due to the availability of new literature, including revised sound exposure criteria, new information to

supplement the previous MITT analyses for fishes is provided in the Navy's *Biological Resources Technical Report* (U.S. Department of the Navy, 2025a).

#### 3.9.1.2 General Threats

There is no new information on threats to fishes in the MITT Study Area that would change the conclusions from the previous MITT analyses.

#### 3.9.1.3 Endangered Species Act-Listed Species and Federally Managed Fish Species

ESA-listed fish species in the Study Area include the scalloped hammerhead shark (*Sphyrna lewini*), oceanic whitetip shark (*Carcharhinus longimanus*), and giant manta ray (*Mobula birostris*). Detailed information on each ESA-listed species is presented in the Navy's *Biological Resources Technical Report* (U.S. Department of the Navy, 2025a). Pursuant to the ESA, the Navy is consulting with NMFS on potential effects on ESA-listed fish species from military readiness activities, as required by section 7(a)(2) of the ESA.

Fish species managed by the Western Pacific Fishery Management Council as listed in Table 3.9-2 in the 2020 SEIS/OEIS have not substantially changed since the publication of the SEIS/OEIS and the information and analysis presented remains valid.

#### 3.9.1.4 Taxonomic Group Descriptions

A literature review found that the information on the taxonomic groups of fishes in the Study Area has not substantially changed from what is included in the previous MITT analyses and remains valid.

### 3.9.2 Environmental Consequences

This SEIS/OEIS analyzes potential impacts of the Proposed Action on fishes and considers the same stressors as previous MITT analyses, which include (1) acoustic (sonars, vessel noise, aircraft noise, and weapons noise), (2) explosive (in-water explosions), (3) energy (in-water electromagnetic devices and high-energy lasers), (4) physical disturbance and strike (vessels and in-water devices, MEM, seafloor devices), (5) entanglement (wires and cables, decelerators/parachutes), (6) ingestion (MEM), and (7) secondary stressors.

For each stressor, the implementation of SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and mitigation measures (Chapter 4) is considered part of the Proposed Action when determining if an effect is reasonably foreseeable.

Based on the framework presented in Section 3.0.4, the Navy concluded that effects from entanglement and secondary stressors on fishes would not be reasonably foreseeable. Table 3.0-20 summarizes these findings.

Effects on fishes from acoustic, explosive, physical disturbance and strike, energy, and ingestion stressors would be reasonably foreseeable; effects would be considered significant if they cause long-term changes to a population well outside the limits of natural variability, their habitats, or the natural processes sustaining them. The following sections analyze the effects of the Proposed Action on fishes and takes into account the analysis presented in Section 3.9 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

### 3.9.2.1 Effects on Fishes Under Alternative 1

#### 3.9.2.1.1 Effects from Acoustic Stressors

This section summarizes the potential effects of acoustic stressors used during military readiness activities within the Study Area. The acoustic substressors included for analysis are (1) sonar and other transducers, (2) vessel noise, (3) aircraft noise, and (4) weapons noise. Detailed information on acoustic impact categories in general, as well as effects specific to each substressor, is provided in the *Acoustic and Explosive Concepts Technical Report* (U.S. Department of the Navy, 2026b). For a listing of the types of activities that use or produce acoustic stressors, refer to Appendix A.

There are many factors that contribute to how a fish will respond to sound, such as the frequency and received sound level, the duration of the sound-producing activity, the animal's behavioral activity at the time of exposure (e.g., feeding, traveling, resting), and proximity of the animal to the source of the sound. In addition, fishes are not equally sensitive to sound at all frequencies. Most marine fishes are hearing generalists and primarily detect particle motion at frequencies below 2 kHz, while hearing specialists can detect low frequencies but also possess anatomical specializations to enhance hearing and are capable of sound pressure detection up to 10 kHz, or over 100 kHz in some species. Fishes with a swim bladder are generally more susceptible to TTS than those without a swim bladder, regardless of the sound source.

**Training and Testing.** Fishes may only detect the most powerful low-frequency sonars within a few kilometers; and most other, less powerful systems, at shorter ranges. Overall, TTS is not anticipated to occur in fishes exposed to low-frequency sonars as these systems generally lack the power necessary to generate hearing loss. Although unlikely, hearing specialists in proximity (tens of meters) to some mid-frequency systems may experience TTS. These individuals may experience a reduced ability to detect biologically relevant sounds until their hearing recovers (likely within a few minutes to hours depending on the amount of threshold shift). In addition, moderate- to low-level passive sound sources such as vessel noise are unlikely to cause any direct injury or trauma due to characteristics of the sounds and the moderate source levels. Furthermore, vessels are transient and would result in brief periods of exposure. Similarly, it is unlikely that most fish would respond to fixed-wing aircraft or transiting rotary-wing aircraft because noise may not be detectable beyond a short distance (10s of meters) beneath the flight path due to their low sound levels in water. Sound from weapons generally lack the duration and high intensity to cause mortality or injury.

**Range Modernization and Sustainment**. Except for vessel noise, no other acoustic substressors would occur during range modernization and sustainment activities.

**Conclusion**. Consistent with previous MITT analyses, effects on fishes from acoustic stressors including sonars, vessel noise, aircraft noise, and weapons noise utilized during military readiness activities would be reasonably foreseeable. However, the degree of effect would be less than significant because of (1) the limited to brief (seconds to minutes) periods of physiological or behavioral reactions to individual fish found within localized areas, (2) noise may not be detectable beyond a short distance (tens of meters), and (3) acoustic sources

generally lack the duration and high intensity to cause mortality or injury. Overall, it is unlikely that acoustic stressors would have long-term consequences for fish populations.

#### 3.9.2.1.2 Effects from Explosive Stressors

This section summarizes the potential effects of explosives used during military readiness activities within the Study Area. Due to updates to acoustic effects modeling, criteria and thresholds used to assess effects, and changes to proposed use of explosives, the analysis of effects due to explosives provided in this section supplant the analyses presented in the previous MITT documents (U.S. Department of the Navy, 2015a, 2020). Detailed information on acoustic impact categories in general, as well as effects specific to each substressor, is provided in the Navy's *Acoustic and Explosive Effects Analysis for Marine Species in the Mariana Training and Testing Study Area (Phase IV) Technical Report* (U.S. Department of the Navy, 2025a).

As detailed in the 2020 SEIS/OEIS, fishes may be exposed to sound and energy from explosions in the water and near the water surface associated with the proposed activities. Activities using explosives would be conducted as described in Chapter 2 and Appendix A. Most activities involving in-water (including at or near the surface) explosions associated with naval gunfire, missiles, bombs, and other munitions are conducted more than 3 NM from shore. While Surface-to-Surface Missile Exercises and Air-to-Surface Bombing Exercises are conducted in offshore locations, Sinking Exercises are only conducted greater than 50 NM from shore. However, some explosions may occur in shallower/nearshore areas such as Agat Bay Mine Neutralization Site, Outer Apra Harbor Underwater Detonation Site, and Piti Mine Neutralization Site.

Potential effects from explosive energy and sound on fishes include non-auditory injury (including mortality), auditory effects (auditory injuries and TTS), behavioral reactions, physiological response, and masking. Ranges to effects for mortality, non-auditory injury, and auditory effects are shown in U.S. Department of the Navy (2025a). Explosive noise is very brief and intermittent, and detonations usually occur in a limited area over a brief period rather than being widespread. The potential for masking is limited. Fishes may behaviorally respond, but responses to single detonations or small numbers of clusters may be limited to startle responses.

**Training and Testing.** Under Alternative 1, there would be a change in the number of explosive ordnances used in the Study Area during military readiness activities compared to the number analyzed in the previous MITT analyses (Table 3.0-4). Under Alternative 1, underwater detonations for underwater demolition qualification/certification would be the same as the 2020 SEIS/OEIS. However, these activities would continue to occur in the same areas at the Agat Bay, Piti, and Outer Apra Harbor sites, and would have no appreciable change in the effects analysis or conclusions for explosive stressors as presented in the previous MITT analyses.

The death of an animal would eliminate them from the population and impact future reproductive potential. Exposures that result in non-auditory injuries may limit an animal's ability to find food, communicate with other animals, interpret the surrounding environment, or detect and avoid predators. Impairment of these abilities can decrease an individual's chance

of survival or affect its ability to reproduce depending on the severity of the impact. Though TTS can impair an animal's abilities, individuals may recover quickly with little significant effect depending on the amount of threshold shift.

Fishes may also experience brief periods of masking, physiological response, or behavioral reactions, depending on the level and duration of exposure. However, due to the short duration of single explosive detonations, these effects are expected to be brief (seconds to minutes). Although multiple shots conducted during large events could lead to prolonged or repeated exposures within a short period of time (hours), military readiness activities involving explosions are generally dispersed in space and time. Consequently, repeated exposures over the course of a day or multiple days are unlikely and most behavioral effects are expected to be brief (seconds or minutes) and localized, regardless of the size of the explosion, and fish would likely return to their natural behavior shortly after exposure.

Based on the updated background and analysis for training and testing under Alternative 1, explosive effects on fishes could result in the death or injury of a small number of individual fish, as well as brief (seconds to minutes) periods of physiological or behavioral reactions of fish found within localized areas.

**Range Modernization and Sustainment**. Explosives would not be used during range modernization and sustainment activities.

**Conclusion**. Consistent with previous MITT analyses, explosives utilized during military readiness activities would have reasonably foreseeable effects on fishes; however, the degree of effect would be less than significant because (1) explosions are generally dispersed in space and time, (2) only a small number of individuals would overlap with where explosions occur, (3) most behavioral effects are expected to be short term (seconds or minutes) and localized. Although some individuals may be affected, long-term consequences to fish populations would not be expected.

#### 3.9.2.1.3 Effects from Energy Stressors

The potential adverse effects on fishes from energy stressors that can occur during military readiness activities within the Study Area are from (1) in-water electromagnetic devices and (2) high-energy lasers. The characteristics of energy introduced through military readiness activities and the relative magnitude and location of these activities that are the basis for analysis of potential effects on biological resources are provided in Section 3.0.4.1.3. The number and location of in-water electromagnetic devices and high-energy lasers events are provided in Table 3.0-6 and Table 3.0-7, respectively. Note that in-air electromagnetic stressors are not applicable to fishes because they are transmitted in the air and not underwater and will not be analyzed further in this section.

**Training and Testing**. Under Alternative 1, the number of proposed training and testing events involving the use of in-water electromagnetic devices (Table 3.0-6) and high-energy lasers (Table 3.0-7) would change in comparison to the previous MITT analyses. The activities would occur in the same locations and in a similar manner as were analyzed previously. Note that high-energy lasers were not in the 2015 EIS/OEIS.

As stated in the previous MITT documents, in-water electromagnetic devices would not result in any potential risk to fishes because (1) the range of effects (i.e., greater than earth's magnetic field) is small (i.e., 13 ft. from the source), (2) the electromagnetic components of these activities are limited to simulating the electromagnetic signature of a vessel as it passes through the water, and (3) the electromagnetic signal is temporally variable and would cover only a small spatial range during each activity in the Study Area.

The generation of electromagnetic fields during military readiness activities has the potential to interfere with prey detection and navigation in ESA-listed scalloped hammerhead sharks, oceanic white tip sharks, and giant manta rays, but any disturbance would be inconsequential

Fishes would not be exposed to the laser if the beam misses the target because the laser is designed to automatically shut down if target lock is lost, preventing the laser from striking anything but the target.

Activities that include the use of high-energy lasers would not have reasonably foreseeable adverse effects on fishes based on (1) the relatively low number of events, (2) the very localized potentially affected area of the laser beam, (3) the temporary duration of potential effects (seconds), and (4) the low likelihood of a fish surfacing at the precise time and location where a laser missed the target and hit the ocean surface.

**Range Modernization and Sustainment**. Range modernization and sustainment such as installation and maintenance of subsurface targets and instrumentation would not produce electromagnetic fields.

**Conclusion**. Consistent with previous MITT analyses, effects on fishes from energy stressors such as in-water electromagnetic devices associated with military readiness activities would have reasonably foreseeable effects on fishes; however, the degree of effect would be less than significant because: (1) physiological and behavioral effects would be unlikely at the electromagnetic field strengths that fishes encounter, as supported by a recent review (Copping et al., 2021), and (2) mitigation measures described in Chapter 4 would be implemented.

#### 3.9.2.1.4 Effects from Physical Disturbance and Strike Stressors

The physical disturbance and strike stressors that may affect fishes include (1) vessels and in-water devices, (2) MEM, and (3) seafloor devices. While the number of training and testing events would change under this SEIS/OEIS, the analysis presented in the previous MITT analyses remains valid, even with the addition of new military readiness activities. Supporting information on effects on fishes from physical disturbance and strike stressors are provided in U.S. Department of the Navy (2026b).

**Training and Testing**. Under Alternative 1, the combined number of proposed military readiness activities involving vessels and in-water devices (Table 3.0-10), MEM (Tables 3.0-12 through 3.0-15), and seafloor devices (Table 3.0-17) would change from those presented in the previous MITT analyses. Changes in physical disturbance and strike stressors, such as MEM, could influence the level of effect on some fishes. Analysis by individual category of expended items indicates that those items having the most potential to affect fishes have decreased. Overall, these changes do not appreciably change the analysis or effects conclusions presented

in the previous MITT documents because the effects analyses were based on the probability of an effect on a resource.

ESA-listed scalloped hammerhead sharks, oceanic whitetip sharks, and giant manta rays, would be able to sense pressure changes in the water column and swim quickly, and are likely to escape collision with vessels and in-water devices.

**Range Modernization and Sustainment**. Vessels would be used during range modernization and sustainment activities. The types of vessels, length, and speeds used (Table 3.0-8) during modernization and sustainment of ranges are typically much slower (ranging from 0 to 3 knots) and would not pose a collision threat to fishes.

**Conclusion**. Consistent with previous MITT analyses, effects on fishes from physical disturbance and strike stressors associated with military readiness activities would be reasonably foreseeable; however, the degree of effect would be less than significant because (1) the low likelihood for most fishes to be struck by a vessel, since most fish occupy waters below the surface, (2) the fact that fish typically display an avoidance response to an approaching vessel, and (3) the fact that most in-water devices move slowly and are closely monitored during deployment. In addition, mitigation measures described in Chapter 4 would be implemented. In addition, potential effects of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level effects.

#### 3.9.2.1.5 Effects from Ingestion Stressors

The various types of MEM used during military readiness activities within the Study Area may be broadly categorized as munitions and MEM other than munitions. Aspects of ingestion stressors applicable to marine organisms in general are presented in Section 3.0.4.1.3. Supporting information on ingestion stressors for fishes is provided in U.S. Department of the Navy (2026b).

It is reasonable to assume that any item of a size that can be swallowed by a fish could be eaten at some time; this analysis focuses on ingestion of materials in two locations: (1) at the surface or water column and (2) at the seafloor. The potential for fish to encounter and ingest expended materials is evaluated with respect to their feeding group and geographic range, which influence the probability that they would eat MEM.

**Training and Testing**. Under Alternative 1, the combined number of ingestion stressors would change compared to the number in the previous MITT analyses (see Tables 3.0-12 through 3.0-15). However, this does not appreciably change the effects analysis or conclusions presented in the previous MITT analyses.

As presented in the previous MITT documents, open-ocean predators and open-ocean planktivores are most likely to ingest materials in the water column, while coastal bottom-dwelling predators and estuarine bottom-dwelling predators could ingest materials from the seafloor. Open-ocean predators such as tunas and sharks may eat floating or sinking expended materials, while open-ocean planktivores, such as sardines and filter-feeding species such as whale sharks, may ingest floating expended materials incidentally as they feed in the water

column. Other fish species such as skates and rays forage on the seafloor and may ingest expended materials on the seafloor. Encounter rates for all these feeding guilds would be extremely low but may result in injury or death to individuals; however, population-level effects are not anticipated.

Potential effects of ingestion on some adult fishes are different than for other life stages (eggs, larvae, and juveniles) because early life stages for some species are too small to ingest any MEM except for chaff, which has been shown to have limited effects on fishes in the concentration levels that it is released at (Arfsten et al., 2002; U.S. Department of the Air Force, 1997; U.S. Department of the Navy, 1999). Therefore, except for later stage larvae and juveniles that could ingest microplastics, no ingestion effects on early life stages are expected.

Overall, the potential effect of ingesting MEM such as munition fragments or other expended materials such as chaff and flare end caps and pistons, would be limited to individual fish that might suffer a negative response from a given ingestion event. While ingestion of MEM could result in sublethal or lethal effects on a small number of individuals, the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might "taste" an item, then expel it (Felix et al., 1995), in the same manner that a fish would take a lure into its mouth then spit it out.

**Range Modernization and Sustainment**. Activities during range modernization and sustainment such as installation and maintenance of subsurface targets and instrumentation would not produce MEM that could be ingested by fishes.

**Conclusion**. Consistent with previous MITT analyses, effects on fishes from ingestion stressors associated with military readiness activities would be reasonably foreseeable; however, the degree of effect would be less than significant because (1) the likelihood of ingestion is low based on the dispersed nature of the materials and the limited exposure of those items at the surface/water column or seafloor; and (2) if ingested, a fish would temporarily take the expended material into its mouth, then spit it out. In addition, mitigation measures described in Chapter 4 would be implemented. Therefore, the number of fishes potentially affected by ingestion of munitions or fragments from munitions would be assumed to be low, and population-level effects would not be expected.

#### 3.9.2.2 Effects on Fishes Under Alternative 2

Under Alternative 2, the number of activities with associated acoustic, explosive, energy, physical disturbance and strike, and ingestion stressors would be equal to or increase compared to Alternative 1. However, increases in these stressors are not expected to yield any lasting effects on the survival of fishes at population levels for the same reasons detailed for Alternative 1. Additionally, the Action Proponents would implement SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and mitigation (Chapter 4); while the Navy's portfolio of mitigation measures is not specific to fishes, these measures would reduce the likelihood of adverse interactions with military readiness activities. As such, increases in military readiness activities would not result in substantive changes to the potential for or types of effects on fishes, and overall effects are not meaningfully different from those analyzed under Alternative 1.

Therefore, military readiness activities involving acoustic, explosive, energy, physical disturbance and strike, and ingestion stressors under Alternative 2 would result in less than significant effects on fishes.

## 3.10 TERRESTRIAL SPECIES AND HABITATS

### 3.10.1 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on terrestrial species and habitats found in Section 3.10 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020). Similar to the 2020 SEIS/OEIS, FDM is the only land area considered in this analysis; Guam, Tinian, Saipan, and Rota were addressed in the 2015 EIS/OEIS.

Since the publication of the 2020 SEIS/OEIS, Joint Region Marianas completed an updated Integrated Natural Resources Management Plan for all Navy-owned and leased properties on Guam and within the CNMI, including FDM. Summaries of the major components of the terrestrial environment on FDM are included in *Supplemental Biological Information Technical Report for the Mariana Training and Testing Study Area* (U.S. Department of the Navy, 2025b)

Since 1971, the U.S. military has used FDM as a bombing range under a long-term lease, a practice that has significantly transformed the island's ecology from closed-canopy forest to an open, cratered landscape favored by opportunistic plants. While continuous live-fire training causes direct mortality and habitat destruction for significant seabird colonies, the island remains a critical nesting ground for 12 migratory bird species and supports an isolated population of Micronesian megapodes on the island, as well as providing potential temporary stopover habitat for Mariana fruit bat and birds moving through the archipelago.

FDM's vegetation appears to have undergone significant changes since the island was leased by the Department of Defense and the subsequent bombardment for military training. The most intensive bombardment to date of FDM occurred during the Vietnam War era, when as many as 22 tons of ordnance per month were dropped on the island (Lusk et al., 2000). Based on early 20th century descriptions of FDM vegetation and aerial photographs of the island prior to military bomb activities, island tree height and canopy cover have been greatly reduced (Lusk et al., 2000; Mueller-Dombois & Fosberg, 1998; Mueller-Dombois & Fosberg, 2013). The earliest published description of FDM's vegetation, dating back to 1902, noted that the upland area was covered by brush approximately 4 m tall, as reported in Naval Facilities Engineering Command Marianas (2022).

#### 3.10.1.1 Endangered Species Act Listed Species

There are two ESA-listed species known to occur on FDM, the Micronesian megapode (*Megapodius laperouse*) and the Mariana fruit bat (*Pteropus mariannus mariannus*) (see Table 3.10-1). Megapodes are believed to persist on FDM, while Mariana fruit bats, if they occur at all, would likely only use FDM's relatively more intact canopy on the northern end of the island, as a stopover location as they transit through the island chain.

**Table 3.10-1: Endangered Species Act Listed Species on Farallon de Medinilla**

| Species Name and Regulatory Status | | | Presence in Study Area[1] | |
|---|---|---|---|---|
| Common Name | Scientific Name | Endangered Species Act Status | Open Ocean | Visitor/Breeding on FDM |
| Micronesian megapode (Sasangat) | *Megapodius laperouse laperouse* | Endangered | No | Yes |
| Mariana fruit bat (Fanihi) | *Pteropus mariannus mariannus* | Threatened | Yes | Yes, likely transient |

[1]Study Area = Mariana Islands Training and Testing Study Area. Note: FDM = Farallon de Medinilla

In 2015, the Navy consulted with USFWS for training activities on FDM included in this SEIS/OEIS (U.S. Fish and Wildlife Service, 2015). At the conclusion of the formal consultation, the USFWS provided the Navy with a Biological Opinion and Incidental Take Statement with an indefinite timeline, as long as no reinitiation triggers. The incidental take statement authorized take of two pairs of Micronesian megapodes per year, and one Mariana fruit bat every five years on FDM as a result of bombing, gunnery, and missile exercises analyzed in the 2015 EIS/OEIS. USFWS considered that the proposed activities, and associated adverse effects on the listed species, would continue for an indefinite period of time. The Action Proponents will continue to implement SOPs on FDM, along with the terms and conditions specified in the current Biological Opinion.

The Navy conducted a review of criteria that would reinitiate consultation with USFWS, specified in 50 CFR section 402.16. Upon review, the Navy determined that reinitiation of consultation was not warranted, and the current Biological Opinion remains valid.

### 3.10.1.2 Species Not Listed under the Endangered Species Act

FDM is recognized by regional ornithologists as an important bird area for many species of marine birds and migrant shorebirds, and it supports a limited number of terrestrial bird species. The 2020 SEIS/OEIS included an assessment by Camp et al. (2015) which published this peer-reviewed information. During the 159 counts conducted between February 1997 and August 2014, the numbers detected during each count ranged from 0 to 447 for brown booby, 6 to 404 for masked booby, and 42 to 915 for red-footed booby. From 1997 to 2014, there is some evidence that masked and red-footed booby populations on FDM have declined, while brown booby populations have increased. However, the general conclusion is that all three species exhibited population fluctuations over time. Combined with the level of variability observed in the count data, this precluded any definite conclusions about long-term population trends (i.e., the data showed no statistically significant trends) (Camp et al., 2015). Breeding has been reported on FDM for seven seabird species: black noddies (*Anous minutus*), brown noddies (*Anous stolidus*), brown boobies, masked boobies, red-footed boobies, white terns (*Gygis alba*), and great frigatebirds (*Fregata minor*). Booby species are the most readily identifiable due to their numbers and individual sizes. The other species breeding locations are either dispersed or breeding activity is sporadic. The great frigatebird may occasionally nest on FDM, which is one of only two small breeding colonies known to exist within the Mariana Islands (the other is located on Maug in the northern portion of the archipelago). The majority of the bird species observed on FDM are protected under the MBTA.

Under the military readiness rule, the Navy may take migratory birds incidental to military readiness activities described in this SEIS/OEIS, provided that the Navy's actions do not result in a significant adverse effect on a population of birds protected under the MBTA. Consistent with past analyses involving the same training activities on FDM, the Navy has determined that the

Proposed Action would not result in a significant adverse effect on a population of a migratory bird species. If over the course of training and testing activities, the Navy determines that a population of migratory birds would be significantly affected, the Navy would be required to confer and cooperate with the USFWS to develop and implement appropriate conservation measures to minimize or mitigate such significant adverse effects.

### 3.10.2 Environmental Consequences

This SEIS/OEIS analyzes potential impacts of the Proposed Action on terrestrial species and habitats and considers the same stressors as previous MITT analyses, which include (1) acoustic (weapons firing noise and noise generated from explosive detonations); (2) explosive (explosions within the impact zones directly affecting biological resources); and (3) physical disturbance and strike (direct strike and habitat degradation resulting from munitions use).

For each stressor, the implementation of SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and mitigation measures (Chapter 4) is considered part of the Proposed Action when determining if an effect is reasonably foreseeable (as described in Section 3.0.4).

Based on the framework presented in Section 3.0.4, the Navy concluded that effects on terrestrial species and habitats from acoustic, explosives, and physical disturbance and strike stressors would be reasonably foreseeable; effects would be considered significant if the Proposed Action ceased FDM's ability to support populations of nesting seabirds or other native wildlife that visit or reside on the island. Range modernization and sustainment activities would not be conducted on FDM and therefore are not analyzed further in this section. The best available science, presented below and in the *Biological Resources Technical Report* (U.S. Department of the Navy, 2025c), indicates that FDM continues to support stable seabird nesting and resident ESA-listed species populations. This stability persists despite decades of training activities, largely due to the targeting and munitions restrictions detailed in Chapter 4. The following sections analyze the effects of the Proposed Action on terrestrial species and habitats and take into account the analysis presented in Section 3.10 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

#### 3.10.2.1 Effects on Terrestrial Species and Habitats Under Alternative 1

##### 3.10.2.1.1 Effects from Acoustic Stressors

Noise can result from direct munitions effects (one object striking another), blasts (explosions that result in shock waves), bow shock waves (pressure waves from projectiles flying through the air), and substrate vibrations (combinations of explosion, recoil, or vehicle motion with the ground). Noise may be continuous (lasting for a long time without interruption), or impulsive (lasting for only a short duration). Continuous impulses (e.g., helicopter rotor noise, bursts from rapid-fire weapons) represent an intermediate type of sound and, when repeated rapidly, may resemble continuous noise. These types of sounds are distinguished here as they differ in their effects. Continuous and impulsive sounds can result in hearing damage, while shorter duration, less frequent, or lower sound levels typically elicit physiological or behavioral responses. Some birds may be killed or injured during these activities, or expend energy stores needed for migration to avoid or reduce perturbations generated by explosions.

FDM has three impact areas, a special use area on the northern portion of the island, and a special use area on the land bridge. Targeting of areas inside of the special use areas and other areas outside of impact areas are prohibited. In other words, all areas outside of the impact areas are considered "no-fire areas." Any ordnance that inadvertently lands outside of impact areas, including special use areas and in water, must be reported to MIRC Operations, in accordance with Commander, U.S. Naval Forces Marianas Instruction 3500.4A (U.S. Department of the Navy, 2011). The impact areas and special use areas are shown on Figure 3.10-1 and described below:

- **Northern Special Use Area**. Reserved for direct action (tactical air control party) type exercises and personnel recovery. This area is about 41 acres (ac.) (17 hectares [ha]) and includes a landing zone. Weapons may be fired from the special use area into impact areas, such as small-caliber rounds, grenades, and mortars.
- **Impact Area 1**. This area contains high-fidelity target structures of varying shapes and sizes, and is made up of four vehicles and six targets comprised of shipping containers. Impact Area 1 is about 22 ac. (9 ha).
- **Impact Area 2**. Impact Area 2 may be used for both live and inert ordnance. Strafing is permitted in this area. Impact Area 2 is about 22 ac. (9 ha).
- **Land Bridge**. The land bridge is designated as a "no target zone." Operators are required to report ordnance observed impacting the land bridge.
- **Impact Area 3**. This area is south of the land bridge and authorized for inert ordnance, although live ordnance may be used only with prior approval from Joint Region Marianas. Strafing is permitted in this area. Impact Area 3 is about 11 ac. (4.5 ha).

Both alternatives analyzed in this SEIS/OEIS propose an overall reduction in the number of ordnance expended on FDM, a reduction in the number of explosive events on FDM, and a reduction in the cumulative NEW expended on FDM (Table 3.10-2 and Table 3.10-3). As a result, the Proposed Action is anticipated to have fewer effects on the listed species or habitat than what was analyzed previously. There would be s a net decrease of 11 percent in the number of events and a 12 percent decrease in the number of munitions proposed to occur under both alternatives presented in this SEIS/OEIS compared to what was analyzed previously in the previous MITT analyses. Most of these decreases are in large explosive munitions, as shown in Table 3.10-3, which shows a 27 percent decrease in NEW compared to what was previously analyzed.

**Training and Testing**. As shown in Table 3.10-2 and Table 3.10-3, the number, type, and amount of munitions that would introduce noise into the terrestrial environment of FDM would decrease. These activity changes should lessen the effects of acoustic stressors on birds and ESA-listed species on the island; however, harmful effects would continue from military use of FDM. Mitigation measures and standard operating procedures (Chapter 4) would continue to further reduce adverse effects to the maximum extent practicable.

In the USFWS's 2015 Biological Opinion, two pairs of Micronesian megapodes per year were estimated to be taken as a result of bombing, gunnery, and missile exercises proposed in the 2015 EIS/OEIS. The best available science indicates that general habitat conditions can be derived from periodic and recent surveys on the island. Surveys for megapodes have been

conducted intermittently on FDM since 1996, with the most recent available data from a 2023 survey. Starting in 2013, the Navy implemented a consistent point count survey protocol restricted to trails cleared of unexploded ordnance, allowing for more direct comparison of results (Naval Facilities Engineering Command Marianas, 2022).

Results from the consistent point count surveys show variability in megapode detections. The total number of individuals detected was 11 in 2013, 23 in 2019, 10 in 2021, and 16 in the most recent 2023 survey (Naval Facilities Engineering Command Marianas, 2021; Naval Facilities Engineering Systems Command Marianas, 2023). The significant decrease in detections between 2019 (23 birds) and 2021 (10 birds) may be due to environmental factors, such as significantly higher wind speeds and a later survey start time during the 2021 event, which might have reduced the effectiveness of the playback recordings. The 2023 survey's minimum detection of 16 individuals represents an increase from the 2021 survey, falling within the historic range of observations for the island.

The location of megapode sightings in relation to the live-fire zones on FDM is variable, yet the data suggests the limited continued use of areas near or within the Impact Areas. Megapode detections have been recorded within and near Impact Area 1 (inert ordnance only) and Impact Area 2 (live/inert ordnance) across all survey years. In the 2023 survey, the highest percentage of detections (69 percent) were located in or near Special Use Area 1, which is designated a no-targeting/no-ordnance zone intended to alleviate direct impacts on the birds. Conversely, only 15 percent of detections in 2023 were associated with Impact Area 1, and 15 percent were associated with Impact Area 2 (Naval Facilities Engineering Systems Command Marianas, 2023). Despite the ongoing use of the live-fire range, the number of megapodes detected within or near Impact Areas 1 and 2 does not appear to show a significant decline over time when compared across the different survey methods, suggesting that military activity may not be causing a significant localized decline in the number of birds in those specific areas.

Due to the proposed reduction in the munitions used at FDM, biological resources such as nesting seabirds, resident landbirds, and ESA-listed species on FDM will face decreased exposure from the proposed additional ordnance to be expended.

## Table 3.10-2: Number of Events and Munitions by Activity Type on FDM

| Activity | Number of Events | | | Number of Munitions | | | |
|---|---|---|---|---|---|---|---|
| | 2015 EIS/OEIS | Alt 1, 2026 Draft SEIS/OEIS | Percent changed from 2015 EIS/OEIS to 2026 SEIS/OEIS | Munitions Type | 2015 EIS/OEIS | Alt 1, 2026 Draft SEIS/OEIS | Percent changed from 2015 EIS/OEIS to 2026 SEIS/OEIS |
| Bombing Exercise (A-G) | 2,300 | 1,910 | -17% | NEPM Rounds | 1,800 | 4,210 | 134% |
| | | | | Explosive Rounds | 6,242 | 4,530 | -27% |
| Gunnery Exercise (A-G) | 96 | 175 | 82% | Small-cal Rounds | 24,000 | 25,300 | 5% |
| | | | | Med-cal Rounds | 94,150 | 63,350 | -33% |
| | | | | Explosive Med-cal Rounds | 17,350 | 12,620 | -27% |
| | | | | Explosive Large-cal Rounds | 200 | 9 | -96% |
| Missile Exercise (A-G) | 85 | 125 | 47% | Explosive Rockets | 600 | 1,240 | 106% |
| | | | | Explosive Missiles | 85 | 141 | 66% |
| | | | | Non-Explosive Missiles | 0 | 100 | N/A |
| Naval Surface Fire Support | 10 | 5 | -50% | Explosive Rounds | 1,000 | 450 | -55% |
| Direct Action – Tactical Air Control Party | 18 | 18 | 0% | Small-cal Rounds | 18,000 | 30,000 | 67% |
| | | | | Explosive Med-cal Rounds | 0 | 1,000 | N/A |
| | | | | Explosive Rounds (grenade/mortar) | 600 | 1,000 | 67% |

Notes: MITT = Mariana Islands Training and Testing, EIS = Environmental impact Statement, OEIS = Overseas Environmental Impact Statement, SEIS = Supplemental Environmental Impact Statement, A-G = Air to Ground, NEPM = Non-explosive Practice Munitions

**Table 3.10-3: Munitions Use and Net Explosive Weight Comparisons on FDM**

| Explosive Munitions used at FDM | NEW Range | 2015 EIS/OEIS | | 2026 Draft SEIS/OEIS Alternative 1 | | | |
|---|---|---|---|---|---|---|---|
| | | Number of Munitions | NEW | Number of Munitions | NEW | Percent of Total NEW | % NEW changed from 2015 EIS/OEIS to 2026 SEIS/OEIS |
| Medium Caliber Projectiles | 0.1–0.25 | 17,350 | 1,735–4,338 | 14,070 | 1,507–3,768 | < 1% | -13% |
| Rockets | > 0.5–2.5 | 600 | 300–1,500 | 1,240 | 620–3,100 | < 1% | 206% |
| Large Caliber Projectiles | > 5–10 | 1,200 | 6,000–12,000 | 459 | 2,295–4,590 | < 1% | -62% |
| Missiles | > 10–20 | 85 | 850–1,700 | 141 | 1,410–2,820 | < 1% | 166% |
| Bombs | > 60–1,000 | 6,242 | 374,520–6,242,000 | 4,530 | 271,800–4,530,000 | > 95% | -27% |

Note: NEW=Net Explosive Weight, units measured in pounds

**Conclusion**. Consistent with previous MITT analyses, acoustic stressors would have reasonably foreseeable effects on FDM's terrestrial species and habitats; however, the degree of effect would be less than significant because (1) effects on terrestrial biological resources from acoustic stressors used in training activities are not expected to differ from what was previously analyzed due to the decrease in total NEW used under Alternative 1; and (2) the continued use of targeting and munitions use restrictions, substantiated by periodic surveys that assess the general condition of vegetation and wildlife communities on FDM, has not resulted in habitat loss or decrease in ESA-listed Micronesian megapodes or overall population decreases in breeding seabird populations.

#### 3.10.2.1.2 Effects from Explosive Stressors

The training activities that have the greatest effect on vegetation and wildlife communities within the impact areas on FDM are those that result in percussive force from the use of explosive munitions. Training activities that involve high explosive detonations on FDM introduce the potential for wildfires on the island. Cluster bombs, live cluster weapons, live scatterable munitions, fuel-air explosives, incendiary devices, and bombs greater than 2,000 lb. NEW. are prohibited on FDM. It should be noted that some munitions contain a small amount of phosphorous for spotting charges, and smoke markers are used in some direct-action training activities. Phosphorous is not a main constituent to any munitions used on FDM. As noted above, the live-fire weapons allowed are only targeted at impact areas authorized for live and inert ordnance. The areas for target placement support only low-growing vegetation because of long-term training with explosives. Dense vegetation in the northern special use area presents a wildfire risk from potential weapon misfires. Explosions may ignite fires in impact areas, which may spread to higher stature fine fuels outside of impact areas, endangering the remnant forest portions on the northern side of the island and the Megapode population. Besides direct burns, wildfires can potentially cause respiratory distress from

smoke. However, the dense vegetation and shaded canopy of trees in the northern portion of the island likely increases the moisture content of vegetation, which should decrease the ability of fires to spread into the special use area (U.S. Fish and Wildlife Service, 2015).

**Training and Testing**. As shown in Table 3.10-3, the number, type, and amount of munitions that would introduce explosive stressors into the terrestrial environment of FDM would decrease under Alternative 1. These activity changes should lessen the effects on vegetation communities, nesting seabirds and other resident land birds, and ESA-listed species on the island; however, harmful effects would continue from military use of FDM. Mitigation measures (Chapter 4) would continue to further reduce adverse effects.

**Conclusion**. Consistent with previous MITT analyses, explosive stressors would have reasonably foreseeable effects on FDM's terrestrial species and habitats; however, the degree of effect would be less than significant because (1) effects on terrestrial biological resources from explosive stressors used in training activities are expected to be reduced from what was previously analyzed due to the decrease in total NEW used under Alternative 1; and (2) the continued use of targeting and munitions use restrictions, substantiated by periodic surveys that assess the general condition of vegetation and wildlife communities on FDM, has not resulted in habitat loss or decrease in ESA-listed Micronesian megapodes or overall population decreases in breeding seabird populations.

#### 3.10.2.1.3 Effects from Physical Disturbance and Strike Stressors

The potential for effects on vegetation communities and wildlife resources, including the Micronesian megapode, Mariana fruit bats that may occur on the island, land bird species, and nesting seabird species associated with direct strike from inert munitions is considerably lower than the potential for blast effects associated with explosive munitions. A direct strike, however, of any animal would likely result in death or serious injury leading to mortality. No bird strikes have been reported from support work at FDM involving fixed or rotary-winged aircraft.

**Training and Testing**. As shown in Table 3.10-3, the number, type, and amount of munitions that would introduce explosive stressors under Alternative 1 into the terrestrial environment of FDM would decrease. These activity changes should lessen the effects on vegetation communities, birds and ESA-listed species on the island; however, harmful effects would continue from military use of FDM. Mitigation measures (Chapter 4) would continue to further reduce adverse effects to the maximum extent practical.

Other physical disturbance stressors include activities associated with helicopter landings and training activities involving pedestrian on the ground movement of personnel. Some of these activities are range clearance surveys and cleanup and biological surveys. Direct Action and Tactical Air Control Party training activities require helicopter landings on FDM at a landing zone within the "no target area." Marines and special warfare personnel would then disembark and conduct Direct Action training activities, where vegetation may be trampled. Because of unexploded ordnance clearance requirements, only marked trails (laid out by explosive ordnance disposal specialists prior to range clearance activities) are used, which reduces the potential for vegetation trampling (as well as nest trampling) in areas away from access trails.

As shown in Table 3.10-3, the number of Direct Action training activities on FDM would not change compared to what was previously analyzed.

**Conclusion**. Consistent with previous MITT analyses, physical disturbance and strike stressors would have reasonably foreseeable effects on FDM's terrestrial species and habitats; however, the degree of effect would be less than significant because (1) effects on terrestrial biological resources from physical disturbance and strike stressors are not expected to differ from what was previously analyzed due to the decrease in the number of activities; and (2) the general condition of vegetation and wildlife communities on FDM, substantiated by periodic and repeated surveys on FDM, shows that habitat loss or decrease in ESA-listed Micronesian megapodes or overall population decreases in breeding seabird populations are not occurring.

#### 3.10.2.2 Effects on Terrestrial Species and Habitats Under Alternative 2

Under Alternative 2, the number of activities with associated acoustic, explosive, and physical disturbance and strike stressors would be equal to Alternative 1 and are not expected to yield any lasting effects on the survival of terrestrial species and habitats at population levels for the same reasons detailed above. The Action Proponents would implement SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) and terrestrial mitigation (Chapter 4) to reduce potential effects on terrestrial species and habitats.

Therefore, military readiness activities involving acoustic, explosive, and physical disturbance and strike stressors under Alternative 2 would result in less than significant effects on fishes.

## 3.11 CULTURAL RESOURCES

### 3.11.1 Regulatory Framework

NEPA and Section 106 of the NHPA are the guiding mandates and apply to U.S. territorial waters (within 12 NM); only potential impacts on World Heritage sites will be addressed in areas beyond 12 NM. Following the 2020 SEIS/OEIS, two Programmatic Agreements (PAs) regarding Training and Testing (PATTs) were developed in consultation for military readiness activities within the MITT Study Area: the P*rogrammatic Agreement Between the Commander, Joint Region Marianas (JRM) and the Guam State Historic Preservation Officer, regarding Military Training and Testing on and within the Surrounding Waters of the Island of Guam* (2020 Guam PATT); and the *Programmatic Agreement Between the Commander, JRM and the CNMI State Historic Preservation Officer, regarding Military Training and Testing on and within the Surrounding Waters of the Islands of the CNMI* (2022 CNMI PATT). The Navy is meeting its responsibilities pursuant to Section 106 of the NHPA for the Proposed Action in accordance with stipulations in the 2020 Guam PATT and the 2022 CNMI PATT. In order to account for the new military readiness activities, the Navy will initiate Section 106 consultation and follow the process to amend the existing PATTs in accordance with Stipulation XIII of the 2020 Guam PATT and Stipulation XIV of the 2022 CNMI PATT.

In compliance with NHPA and Archaeological Resources Protection Act, the Navy adheres to confidentiality restrictions to prevent the inappropriate release of locational data for archaeological sites and traditional cultural places (TCPs). Accordingly, this SEIS/OEIS does not contain detailed descriptions or figures showing the specific locations of certain submerged cultural resources or TCPs.

## 3.11.2 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on cultural resources found in Section 3.11 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020).

Section 3.11.1.1 of the 2015 EIS/OEIS provides an explanation of the procedures associated with the preservation of cultural resources. Previously identified historic properties, as defined under the National Historic Preservation Act (NHPA) of 1966, within the Study Area are described in Section 3.11.1 in the 2020 SEIS/OEIS.

### 3.11.2.1 Guam

As presented in the previous MITT analyses, geospatial data provided by NOAA documented the presence of several wrecks, obstructions, or occurrences in the waters around Guam (Figure 3.11-1). Newly identified submerged cultural resources are described below but are not depicted in the figure since the associated Geographic Information Systems data is not publicly available.

Following a literature review, additional submerged cultural resources have been identified around Guam. In 2019 and 2022, a maritime archeological remote sensing survey was conducted by the University of Hawaii, Hilo on behalf of JRM to investigate cultural heritage sites in Apra Harbor and the offshore submerged lands. The survey was divided into multiple volumes, of which Volumes 1 and 3 identified additional cultural resources within the Study Area. In addition to investigating previously recorded resources, surveys conducted during Volume 1 identified four new discrete sites, including three WWII barges, one Landing Craft Utility, and a wooden hulled sailing ship (possibly nineteenth century) (Carrell et al., 2020).

Volume 3 of the maritime archaeological remote sensing survey investigated previously identified resources, as well as a newly identified WWII pontoon barge (not NRHP-eligible) and a WWII Japanese aircraft wreck (NRHP-eligible). The survey also documented the nineteenth century wooden-hulled sailing ship (NRHP-eligible). Additionally, three wrecks in Inner Apra Harbor were determined not NRHP-eligible (Carrell et al., 2023).

In 2023, a two-part survey within the War in the Pacific National Historical Park identified additional submerged cultural resources associated with the U.S. invasion of the then-Japanese-occupied island of Guam (National Oceanic and Atmospheric Administration, 2023b). The survey findings resulted in the identification of WWII artifacts within the barrier reef of Asan and Agat beaches and in the deep water outside the barrier reef. Military readiness activities within these locations are not the types of activity to affect historic properties; therefore, cultural resources identified during the 2023 NOAA survey are not considered further in this analysis.

In 2025, an underwater archaeological survey in Outer Apra Harbor investigated approximately 20 potential cultural resources, including four U.S. Navy Lighterage Pontoons, one amphibious vehicle, one Japanese seaplane, four metal debris, five anchors with chains, and two suspected shipwrecks. One of the pontoons and the Japanese seaplane were recommended as eligible for NHRP listing. Two of the sites need additional investigation to determine site integrity and significance. The remaining 16 sites are either not historic or do not retain integrity (Burkhard et al., 2025).

### 3.11.2.2 Commonwealth of the Northern Marianas Islands

#### 3.11.2.2.1 Farallon de Medinilla

Following a literature review, no submerged cultural resources, land-based archaeological sites[4], or isolated non-modern artifacts have been identified around or on FDM. A survey conducted in 2025 around FDM utilized aerial photogrammetry, multispectral imaging, multibeam echosounder, magnetometer, and side-scan sonar to identify historic properties around FDM. The aerial surveys successfully covered 100 percent of the island and did not identify any potential cultural resources. The submerged surveys covered 79 percent of its Study Area; dangerous conditions and geological magnetic interference hampered access to some of the Study Area. The survey did not find any cultural resources requiring NRHP evaluation. One acoustic contact identified just outside the Study Area was classified as a possible wreck; however, geological interference may have skewed the readings. As such, the information presented in the previous MITT analyses is still valid and the most current.

#### 3.11.2.2.2 Tinian

As presented in the previous MITT analyses, geospatial data provided by NOAA documented the presence of several wrecks, obstructions, or occurrences in the waters around Tinian (Figure 3.11-1).

Following a literature review, no additional submerged cultural resources have been identified around Tinian. As such, the information presented in the previous MITT analyses is still valid and the most current. Traditional cultural places identified on Tinian are described in Section 3.11.2.3.1.

#### 3.11.2.2.3 Saipan

As presented in the previous MITT analyses, geospatial data provided by NOAA documented the presence of several wrecks, obstructions, or occurrences in the waters around Saipan (Figure 3.11-1).

Following a literature review, additional submerged cultural resources have been identified in the waters around Saipan. Newly identified submerged cultural

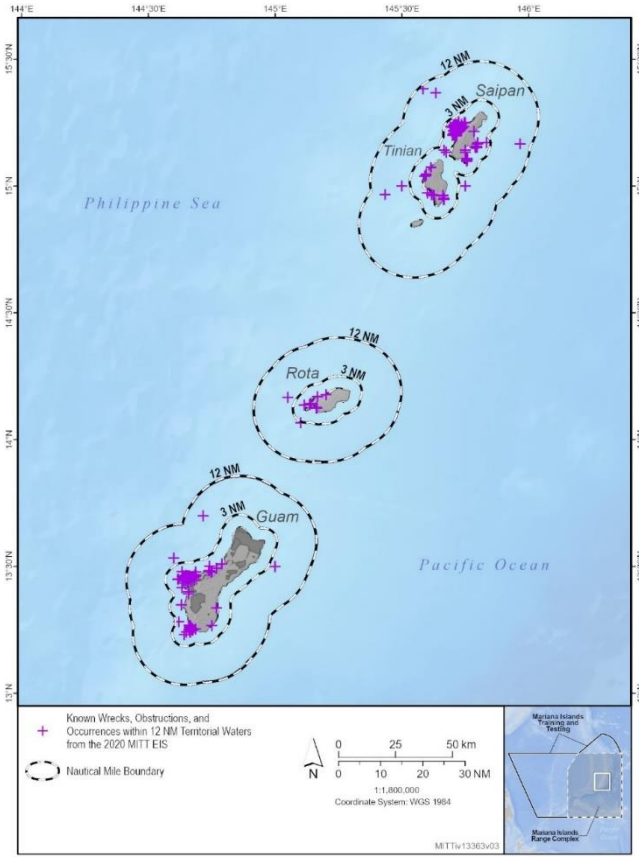


**Figure 3.11-1: Known Wrecks, Obstructions, or Occurrences Within the U.S. Territorial Waters Around Guam and CNMI**

[4] Land elevation and submerged land bathymetry data for CNMI and FDM can be access at the following link: https://coast.noaa.gov/dataviewer/#/lidar/search/-23817161.261553798,1802345.213255328,-23812746.984076977,1811951.0330138607/details/9510

resources are described but are not depicted in Figure 3.11-1 since the associated Geographic Information Systems data is not publicly available. In April and May of 2023, NOAA conducted surveys to investigate and document remains of the underwater battlefield from WWII's Battle of Saipan. Surveys identified submerged amphibious landing vehicles, iron anchor chains, a seaplane, a dump site containing multiple WWII vehicles, ordnance, iron plating, and other battle-related items. During the surveys, divers also conducted conservation and photogrammetric surveys of 15 previously identified sites that are on the Battle of Saipan's Maritime Heritage Trail in the shallow waters of Saipan Lagoon (National Oceanic and Atmospheric Administration, 2023a).

In 2022, two new cultural resources were identified during a NOAA survey in the Saipan Channel. However, military readiness activities that would be conducted in the Saipan Channel would only consist of vessel movement. Due to the depth of the water where these vessels transit, cultural resources identified during the 2022 survey would not be affected and therefore are not considered further in this analysis.

#### 3.11.2.2.4 Rota

As presented in the previous MITT analyses, several wrecks, obstructions, or occurrences are present in the waters around Rota (Figure 3.11-1).

Following a literature review, no additional submerged cultural resources have been identified around Rota. As such, the information presented in the previous MITT analyses is still valid and the most current.

### 3.11.2.3 Cultural/Traditional Practices and Beliefs

Chamorros and Carolinians (Refaluwasch) have a unique cultural history in the Marianas, with which they are closely connected. As far back as 4,000 years ago, the Chamorros migrated from Southeast Asia to the Mariana Islands. Their people and culture experienced centuries of change, from Spanish occupation in the 16th and 17th centuries, to European-introduced diseases and conflict over land in the 18th century, to Japanese occupation during World War II. Today, Chamorros and Carolinians strive to maintain their ancestral heritage, cultural traditions, and language.

As described in the 2020 SEIS/OEIS, public comments received on the Draft 2020 SEIS/OEIS refer to the history of displacement and marginalization the Chamorros and Carolinians experienced. Commenters stated that military training and testing activities within the Mariana Islands are believed to hinder cultural beliefs, access to cultural sites, and the ability to practice cultural traditions. While specific practices were not described, cultural traditions include (but are not limited to) resource collection for traditional events or ceremonial purposes, seafaring customs, and practices related to traditional and familial roles.

#### 3.11.2.3.1 Tinian Traditional Cultural Places

Three TCPs have been identified on Tinian as eligible for listing on the National Register of Historic Places. A TCP is a building, structure, object, site, or district that may be National Register of Historic Places-listed or -eligible for its "significance to a living community because of its association with cultural beliefs, customs, or practices that are rooted in the community's

history and that are important in maintaining the community's cultural identity" (National Park Service, 2024). The three TCPs on Tinian are the shore-based Chamorro fishing areas of Unai Chulu, Unai Dankulo, and Puntan Masalok (also called Unai Masalok). These sites are considered significant under Criterion A (36 CFR section 60.4 ) for their association and contribution to Chamorro history—namely the historic and continued practices of *chenchulu* (Chamorro net fishing), *lulay* (hook-and-line pole fishing), and other traditional fishing techniques that are important to local subsistence, culturally important fiestas, and Chamorro cultural identity (U.S. Department of the Navy, 2025e).

Accessibility to TCPs is analyzed in Section 3.11.2.2.1 below. Accessibility related to commercial, recreational, and subsistence fishing is analyzed in Section 3.12.2.1.

### 3.11.2.4 Marianas Islands Training and Testing Transit Corridor

The length and variable width of the MITT transit corridor is so vast and deep (sometimes over 18,000 ft. [5,486 m]), that it precludes systematic survey for submerged cultural resources. In accordance with Section 402 of the NHPA regarding international federal activities affecting historic properties, the World Heritage List was reviewed, and no known natural/cultural resources were identified within the MITT transit corridor.

## 3.11.3 Environmental Consequences

This SEIS/OEIS analyzes potential impacts of the Proposed Action on cultural resources and considers the same stressors as previous MITT analyses, which includes (1) explosives (in-water explosions), (2) physical disturbance and strike (vessels and in-water devices, MEM, seafloor devices, and personnel disturbance), and (3) accessibility.

For each stressor, the implementation of minimization measures and best management practices listed in Table 3.11-1 are considered as part of the Proposed Action when determining if an effect is reasonably foreseeable.

Based on the framework presented in Section 3.0.4, the Navy concluded that effects from explosives stressors on cultural resources would not be reasonably foreseeable. Table 3.0-20 summarizes these findings.

Based on the framework presented in Section 3.0.4, the Navy concluded that effects from physical disturbance and strike and accessibility stressors on cultural resources would be reasonably foreseeable; effects would be considered significant if (1) cultural resources or historic properties are physically destroyed, damaged, or altered in a manner that compromises the integrity of the resource; or (2) public access to TCPs is permanently restricted. The following sections analyze the effects of the Proposed Action on cultural resources and takes into account the analysis presented in Section 3.11 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

**Table 3.11-1: List of Minimization Measures and Best Management Practices for Cultural Resources**

| Applicable Stressor | Minimization or BMP | Requirements Summary and Protection Focus |
|---|---|---|
| Explosives; physical disturbance and strike | Minimization | • The Action Proponents will not detonate explosives on or near the seafloor (e.g., explosive bottom-laid or moored mines) within a horizontal distance of 350 yards (320 meters) from shipwrecks (except at designated nearshore training areas, where these resources will be avoided to the maximum extent practicable).<br>• The Action Proponents will not place non-explosives on or near the seafloor within a horizontal distance of 350 yards from shipwrecks (except at designated nearshore training areas, where these resources would be avoided to the maximum extent practicable).<br>• The Action Proponents will not set vessel anchors within the anchor swing circle radius from shipwrecks (except at designated anchorages and nearshore training areas around Guam and within Apra Harbor, where these resources would be avoided to the maximum extent practicable).<br>• The Action Proponents will not position precisely placed non-explosive seafloor devices directly on shipwrecks.<br>• The Action Proponents will avoid positioning precisely placed non-explosive seafloor devices near shipwrecks by the largest distance that is practicable to implement based on mission requirements. |
| Explosives; physical disturbance and strike | BMP | Military readiness activities are only conducted in locations where no cultural resources are known to exist. |
| Explosives; physical disturbance and strike | BMP | The military routinely avoids submerged cultural resources during at-sea activities by utilizing sonar and seafloor maps. |
| Physical disturbance and strike; in-water devices | BMP | Military readiness activities associated with towed systems are conducted in areas where the sea floor is deeper than the length of the tow lines; towed in-water devices are designed and operated within the water column and do not contact the seafloor. |
| Seafloor Devices | BMP | Seafloor devices are laid out to avoid known cultural resources. |
| Accessibility | BMP | Beach and road closures during amphibious training activities on Tinian would only last for the duration of the activity and are coordinated with the relevant CNMI government offices to avoid scheduling training on holidays, festivals, and other important days when public access within the Military Lease Area is desired. |
| Education | BMP | Units would complete cultural awareness training prior to conducting military readiness activities. |

Note: BMP = Best Management Practice

### 3.11.3.1 Effects on Cultural Resources Under Alternative 1

#### 3.11.3.1.1 Effects from Physical Disturbance and Strike Stressors

The evaluation of the effects from physical disturbance and strike stressors on cultural resources focuses on proposed activities that may cause cultural resources to be damaged by an object that is moving through the water (e.g., vessels and in-water devices), dropped into or propelled through the water (e.g., MEM), or deployed on the seafloor (e.g., mine shapes and

anchors). Detailed information on physical disturbance and strike stressors and substressors can be found in Section 3.0.4.1.3 of this SEIS/OEIS.

**Training and Testing**. Under Alternative 1, the number of proposed training and testing events for activities that result in physical disturbance and strike stressors (see Tables 3.0-10, Table 3.0-12 through 3.0-15, Table 3.0-17, and Table 3.0-18) would change compared to the numbers analyzed in the 2020 SEIS/OEIS.

Physical disturbance and strike from vessels and in-water devices can occur as some smaller craft, in-water devices, and amphibious vessels can come into contact with the seafloor in the nearshore environment, potentially affecting submerged cultural resources by striking them or causing nearby sediment displacement. However, the number of events using vessels and in-water devices under the Proposed Action would decrease from what was considered in the 2020 SEIS/OEIS.

The deposition of non-explosive practice munitions, sonobuoys, and MEM other than munitions could affect submerged cultural resources via strike or by causing sediment displacement if such resources are located nearby. Most of the anticipated MEM would be small objects and fragments that lose velocity as they descend through the water column. It is possible that larger and heavier objects associated with MEM could strike the ocean surface with greater velocity and affect a submerged cultural resource site by creating sediment and artifact displacement.

Physical disturbances from activities using seafloor devices such as precision anchoring, targets or mines resting on the ocean floor, moored mines, bottom-placed instruments, and bottom crawlers (unmanned underwater vehicles) could create sediment and artifact displacement, or damage or destroy submerged cultural resources if such resources are located nearby.

Training and testing activities involving personnel disturbance could affect submerged cultural resources as personnel move along the nearshore seafloor in a shallow or amphibious environment. Amphibious training activities would continue to occur at the beaches at Unai Babui, Unai Chulu, and Unai Dankulo on Tinian. Unai Chulu and Unai Dankulo have been identified as TCPs (see Section 3.11.2.3.1). Physical disturbance and strike from amphibious vessels and personnel coming ashore could result in disturbance to the environmental setting of the TCP. However, amphibious activities currently take place at these beaches and would continue to avoid the fringing reef, and therefore would not affect character--defining features of the TCPs. Any impacts on soft substrate (sandy bottom) where amphibious activities occur would be temporary and consistent with natural disturbances caused by tidal action. Additionally, any measures to avoid, minimize, or resolve adverse effects on historic properties resulting from ongoing Section 106 consultations, as stipulated in the 2020 Guam PATT and the 2022 CNMI PATT, would be implemented.

**Range Modernization and Sustainment**. Vessels used to deploy mine countermeasure targets, bottom equipment, and equipment tethered to the seafloor associated with range modernization and sustainment in the MITT Study Area could come into contact with the seafloor and potentially affect submerged cultural resources by striking them or causing nearby sediment displacement.

**Conclusion**. Consistent with previous MITT analyses, military readiness activities involving physical disturbance and strike stressors under Alternative 1 of the Proposed Action would have a reasonably foreseeable effect on cultural resources. However, the degree of effect would be less than significant because: (1) vessels and in-water devices are operated in a manner that avoids known submerged cultural resources; (2) amphibious activities only occur in designated areas where no known submerged cultural resources are present; (3) prior to deploying a towed device, there is a standard operating procedure to search the intended path of the device for potential surface obstructions; (4) towed in-water devices are designed and operated within the water column and thus would not contact submerged resources on the seafloor; (5) most anticipated MEM would be small objects and fragments that lose velocity after striking the ocean surface and drift to the seafloor; (6) activities that result in larger MEM would take place in water of greater depths, resulting in a reduction of velocity as the object descends to the seafloor; (7) seafloor devices are either stationary or move very slowly along the bottom; (8) seafloor devices are laid out to avoid known cultural resources; (9) military readiness activities would be conducted in accordance with the minimization measures and best management practices (Section 2.3.3 of the 2020 SEIS/OEIS) that minimize and avoid effects on cultural resources; and (10) any measures to avoid, minimize, or resolve adverse effects on historic properties resulting from ongoing Section 106 consultations, as stipulated in the 2020 Guam PATT and the 2022 CNMI PATT, would be implemented.

#### 3.11.3.1.2 Effects from Accessibility Stressors

The evaluation of the effects from accessibility stressors on cultural resources focuses on proposed activities that may temporarily limit access to TCPs.

**Training and Testing.** Under Alternative 1, beach road access would be temporarily closed, and Broadcast Notice to Mariners (BNMs) would be issued to restrict public access to the beaches and surrounding nearby water during amphibious training activities conducted on Tinian.

**Range Modernization and Sustainment.** There would be no effects on accessibility under Alternative 1 during range modernization and sustainment activities.

**Conclusion.** Military readiness activities involving accessibility stressors under Alternative 1 of the Proposed Action would have a reasonably foreseeable effect on cultural resources. However, the degree of effect would be less than significant because the following reasons: (1) closures would be temporary and limited to the duration of the training event; (2) closures are coordinated with the relevant CNMI government offices to avoid scheduling training on holidays, festivals, and other important days when public access within the Military Lease Area is desired; (3) any measures to avoid, minimize, or resolve adverse effects on historic properties resulting from ongoing Section 106 consultations, as stipulated in the 2020 Guam PATT and the 2022 CNMI PATT, would be implemented. Further discussion on accessibility related to cultural practices such as recreational and subsistence fishing is analyzed in Section 3.12.2.1.1.

### 3.11.3.2 Effects on Cultural Resources Under Alternative 2

Under Alternative 2, the number of activities with associated physical disturbance and strike and accessibility stressors would be equal to or increase compared to Alternative 1. However, increases in these stressors are not expected to compromise the integrity of historic properties or

permanently restrict access to TCPs for the same reasons detailed above for Alternative 1. Additionally, the Action Proponents would implement minimization measures and best management practices (Chapter 4; and Section 2.3.3 of the 2020 SEIS/OEIS) that minimize and avoid effects on cultural resources. As such, increases in military readiness activities would not result in substantive changes to the potential for or types of effects on cultural resources, and overall effects are not meaningfully different from those analyzed under Alternative 1.

Therefore, military readiness activities involving physical disturbance and strike and accessibility stressors under Alternative 2 would result in less than significant effects on cultural resources.

## 3.12 SOCIOECONOMIC RESOURCES

Consistent with previous MITT analyses, this SEIS/OEIS considers four broad socioeconomic elements (commercial transportation and shipping; commercial and recreational fishing; traditional fishing practices; and tourism and recreational use) based on their association with human activities and livelihoods in the Study Area. These four elements were chosen as the focus of the analysis in this section because of their importance to the local economy and the way of life on Guam and the CNMI, and the potential for these elements to be affected by the proposed military readiness activities.

### 3.12.1 Affected Environment

This section provides new data available since the 2020 SEIS/OEIS to supplement the effects analysis on socioeconomic resources found in Section 3.12 of the previous MITT analyses (U.S. Department of the Navy, 2015a, 2020).

The primary area of interest for assessing potential effects on socioeconomic resources is the U.S. territorial waters (seaward of the mean high-water line to 12 NM) of Guam and the CNMI. Figures A-2 through A-5 in Appendix A of this SEIS/OEIS outline the 3 NM and 12 NM territorial limits for Guam, Tinian, Saipan, Rota, and FDM. Limited socioeconomic resources outside this area of interest (i.e., that portion of the EEZ between 12 and 200 NM from shore) are also described when relevant to human activities.

The Center for Naval Analyses (CNA) characterized military and non-military vessel traffic within the Study Area. Data is based on a four-year average (2014–2018) acquired from approximately one billion positional vessel data records. Data indicate that non-military vessels account for 98 percent of vessel traffic in the MITT Study Area, whereas military vessels (Navy and USCG vessels) account for 2 percent of traffic (Starcovic & Mintz, 2021). Most vessel traffic in the Study Area was attributed to bulk tankers (56 percent), followed by cargo (21 percent) and tankers (14 percent). The CNA report indicates that majority of military vessel traffic was concentrated in the surrounding areas around the Mariana Islands, particularly near Naval Base Guam. To a lesser extent, traffic was concentrated in the west and northwest Philippine Sea due to transiting vessels.

#### 3.12.1.1 Commercial Transportation and Shipping

##### 3.12.1.1.1 Ocean Transportation

Commercial transportation and shipping, including port usage and vessel transits, remains generally consistent with previous MITT analyses. Fluctuations in port usage and vessel transit volumes would not be expected to appreciably change the information or analysis conclusions

presented in Section 3.12.2 of this SEIS/OEIS. Refer to Section 3.12.2.1 of the 2015 EIS/OEIS and Section 3.12.1.1 of the 2020 SEIS/OEIS for additional information on commercial transportation and shipping practices and their economic contributions in the region.

Since 2021, the waters adjacent to the Mason Live-Fire Training Range Complex have been designated as a Danger Zone (DZ) (33 CFR Part 334), which is in addition to the existing Orote Point Small Arms Firing Range and Finegayan Small Arms Firing Range off the coast of Guam. These DZs serve to intermittently restrict vessel access for public safety during active live-fire training exercises. When the ranges are not in use, these areas are open to maritime traffic. A discussion of DZs and restricted areas located in the Study Area is provided in Chapter 2 of this SEIS/OEIS, as well Chapter 2 of the 2015 EIS/OEIS and 2020 SEIS/OEIS.

#### 3.12.1.1.2 Air Transport

No changes to existing special use airspace are proposed in this SEIS/OEIS. While there may be changes to airspace associated with other projects on Guam and the CNMI, general air traffic conditions and use of airspace for commercial and recreational purposes would not be expected to appreciably change the information or analysis conclusions presented in Section 3.12.2 of this SEIS/OEIS.

Current military projects, such as the Pacific Deterrence Initiative, are enhancing military capabilities through construction and restoration work in the CNMI, including at the Palau and Tinian Airfields. This effort may increase military use of commercial airports in the region. As discussed in the 2020 SEIS/OEIS, training and testing activities are conducted at commercial airports with appropriate planning and coordination with the local port authorities and the Federal Aviation Administration (FAA). For example, on Tinian, the military conducts aviation training in the military lease area by delivering personnel and cargo to maneuver areas and providing various support functions to forces already on the ground. Refer to Section 3.12.2.1.2 (Air Traffic) of the 2015 EIS/OEIS and Section 3.12.1.1.2 (Air Traffic) of the 2020 SEIS/OEIS for additional information regarding military air transit in the CNMI, including the use of restricted airspace on FDM. A detailed discussion of special use airspace located in the Study Area is also provided in Chapter 2 of this SEIS/OEIS, as well Chapter 2 of the 2015 EIS/OEIS and 2020 SEIS/OEIS.

### 3.12.1.2 Commercial and Recreational Fishing

The dominant fishery on Guam and the CNMI is a small-boat fishery targeting bottom, reef, and nearshore pelagic species. Commercial fishing takes place throughout the Study Area from nearshore waters adjacent to Guam and the CNMI, offshore banks, and pelagic waters. Sportfishing peaks in summer (June through August) when popular sport fish, including blue marlin and yellowfin tuna, are most abundant.

Additional information on commercial and recreational fishing practices on Guam and the CNMI, including gear types, target species, charter fishing, commonly used harbors and marinas, and popular fishing sites, is presented in Section 3.12.2.2 of the 2015 EIS/OEIS and Section 3.12.1.2 of the 2020 SEIS/OEIS.

#### 3.12.1.2.1 Guam

On Guam, most small boat fisheries are comprised of a mix of commercial and non-commercial fishing (Western Pacific Fishery Management Council, 2024). The total average number of small boat-based fishing trips on Guam from 2018 through 2022 was estimated as 9,266 trips (Chan, 2024). Based on available information, the total estimated ex-vessel revenue for small-boat fisheries on Guam in 2019 was estimated at over $490,000 (Chan, 2024). A total of 25,713 lb. of the Guam Bottomfish Management Unit Species (BMUS) stock were landed in 2023; however, no commercial catch trends were reported for the stock complex due to data confidentiality rules. Additionally, Guam has continued to experience high levels of commercial activity targeting reef fish, predominantly carried out by migrants from the Federated States of Micronesia often hired by retail shops (Western Pacific Fishery Management Council, 2024).

Based on the Western Pacific Fisheries Information Network best estimated total commercial landings for all species, the value and quantity (lb.) of commercial landings on Guam has fluctuated but gradually declined over the years (Figure 3.12-1). The declining trend in fisheries landings is consistent with the results presented by Weijerman et al. (2016), which documented a decline of over 60 percent in the annual catch of reef fish around Guam between the years 1985 and 2012. In 2021, both the total lb. landed (58,592 lb.) and the value of landings ($157,091) hit their lowest point over the 23-year period in Guam, likely due to the effects of the COVID-19 pandemic. Total commercial landings were estimated at 135,019 lb. and valued at $596,703 in 2023, representing over a 279 percent increase in commercial value from 2021 totals (Pacific Islands Fisheries Science Center, 2023).

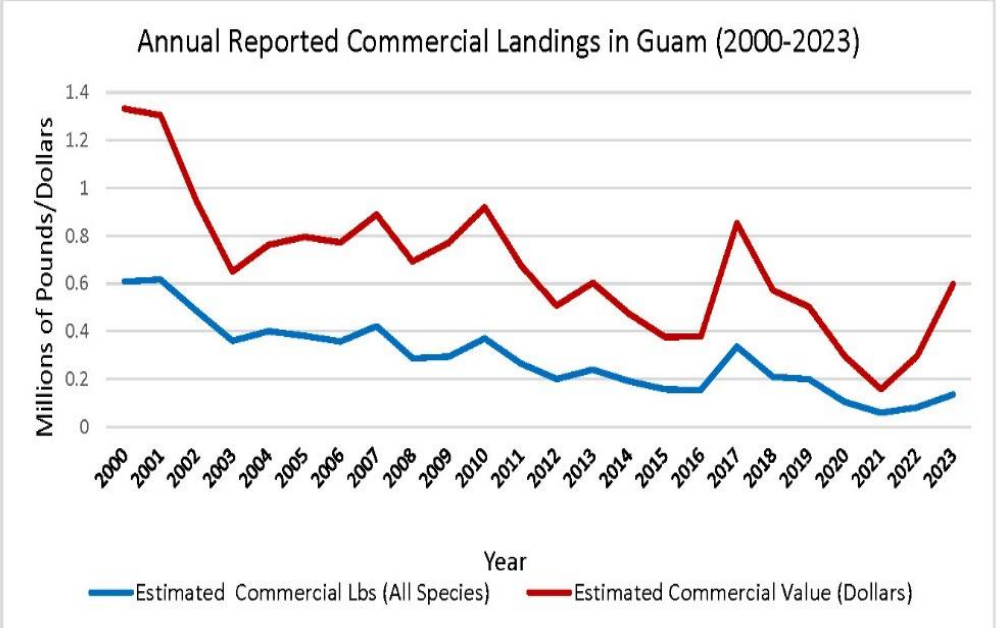


**Figure 3.12-1: Annual Reported Commercial Landings for All Species on Guam (2000–2023)**

It is estimated that 38 to 58 percent of catch on Guam is intended for sale, while the rest of catch supports important social and cultural practices in fishing communities (Western Pacific Fishery Management Council, 2024). The report estimates non-commercial catch (calculated as total estimated catch from boat and shore-based creel surveys minus dealer-reported commercial catch) for the Guam BMUS stock complex as 33,348 lb. in 2022, representing 91 percent of the total catch estimate for the year.

#### 3.12.1.2.2 Commonwealth of the Northern Mariana Islands

The total average number of small boat-based fishing trips (commercial and non-commercial) in the CNMI was estimated as 3,573 trips from 2018 through 2022 (Chan, 2024). Recent data presented in (Chan, 2024) estimates that a total of 5,213 lb. of the CNMI BMUS stock complex were sold for a revenue of $28,519 in 2023. The report also estimates that 29,672 lb. of the top 10 CNMI Ecosystem Component species were commercially landed and sold for a revenue of $108,939 in the same year.

Based on the Western Pacific Fisheries Information Network best estimated total commercial landings for all species in the CNMI, the value and quantity (lb.) of commercial landings has significantly fluctuated throughout the years (Figure 3.12-2). In 2023, The total lb. landed for all species (218,102 lb.) and the total value of landings ($528,485) reached their lowest levels recorded over the 23-year period. This decrease is likely attributed to Typhoon Mawar, as well as infrastructure issues (e.g., congested boat ramps and influx of boats) and high fuel prices (Ayers, 2024). Although there have been fluctuations in the value and quantity (lb. of landings, landing values have continued to surpass the total pounds caught, indicating that the types of species landed in the CNMI remain economically valuable.

It is estimated that 56 to 84 percent of catch in the CNMI is intended for sale, while the rest of the catch supports important social and cultural practices in fishing communities (Western Pacific Fishery Management Council, 2024). The report estimates non-commercial catch (total estimate catch from boat and shore-based creel surveys minus dealer-reported commercial catch) for the CNMI BMUS in 2023 as 30,859 lb., representing 36 percent of the total catch estimate for the year.

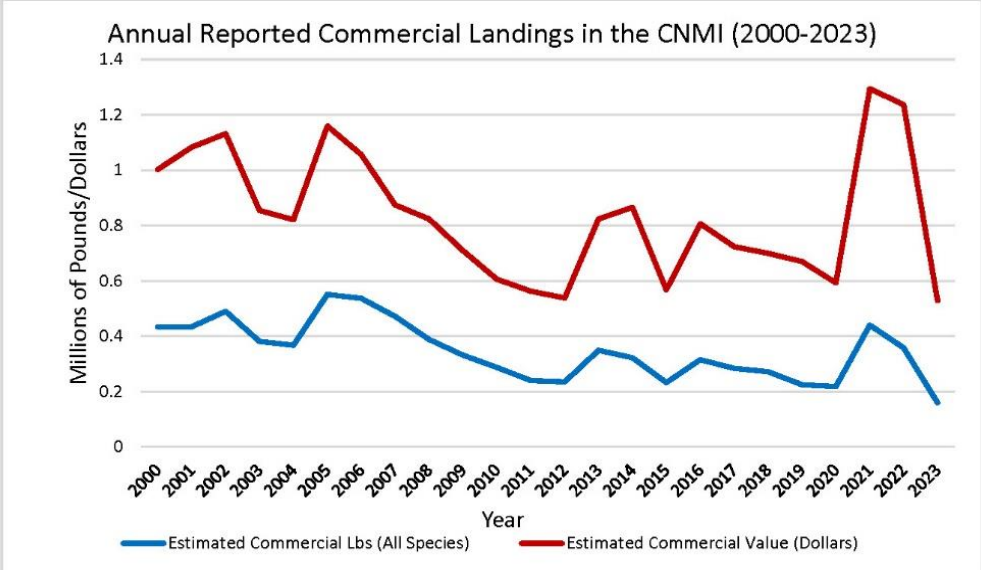


**Figure 3.12-2: Annual Reported Commercial Landings for All Species in the CNMI (2000–2023)**

#### 3.12.1.2.3 Transit Corridor

There are no data on commercial or recreational fishing within the transit corridor. Due to the distance from shore and a lack of known fishing areas within the corridor, it is assumed that there is limited to no commercial and recreational fishing activity within the transit corridor.

### 3.12.1.3 Tourism and Recreational Use

Tourism is a major source of revenue for the economy on Guam and the CNMI. Tourism and recreational activities remain generally consistent with previous MITT analyses. Fluctuations in tourism and recreation would not be expected to appreciably change the information or

analysis conclusions presented in Section 3.12.2 of this SEIS/OEIS. Refer to Section 3.12.2.4 of the 2015 EIS/OEIS and Section 3.12.1.3 of the 2020 SEIS/OEIS for additional information on tourism and recreation in the Study Area.

### 3.12.1.4 Traditional Fishing Practices

#### 3.12.1.4.1 Guam

Traditional fishing practices on Guam often involve nearshore or small boat fishing targeting pelagic, bottom fish, and coral reef fish. Most bottomfish fishing around Guam takes place on offshore banks. Galvez Bank is the closest and most accessible offshore bank, and consequently, continues to be fished most frequently (Western Pacific Fishery Management Council, 2024). There is limited information describing the conditions of offshore banks on Guam; however, based on anecdotal information, it is likely that most of the offshore banks remain in good condition because of their isolated locations (Western Pacific Fishery Management Council, 2024).

The 2019 NMFS stock assessment report for the bottomfish fishery on Guam concluded that the Guam BMUS was in an overfished state, but was not undergoing overfishing at that time (Langseth et al., 2019). An assessment conducted in 2024 indicated that the Guam BMUS is no longer in an overfished state and not subject to overfishing. Although the stock has exceeded the minimum stock size threshold, it has not yet reached its rebuilt state (Western Pacific Fishery Management Council, 2024).

Coral reef fisheries support most subsistence and traditional fishing in the Study Area. To further understand the status reef species on Guam, the NOAA Fisheries Pacific Islands Regional Office and Pacific Islands Fisheries Science Center conducted an evaluation of the status of 7 reef species identified as priority species by Guam's Department of Agriculture Division of Aquatic and Wildlife Resources (Ahrens & Nadon, 2023). The assessment results concluded that longface emperor and blacktail snapper may be experiencing overfishing (Ahrens & Nadon, 2023). As described in the 2020 SEIS/OEIS, as the availability of target species in the reef fish fishery continues to decline, the annual catch from traditional fishers would also be expected to decline. While target fish species may be less available, which may have a greater effect on the success of traditional practices like subsistence fishing.

#### 3.12.1.4.2 Commonwealth of the Northern Mariana Islands

As discussed in Section 3.11 of this SEIS/OEIS, three TCPs have been identified on Tinian as eligible for listing in the NRHP. These TCPs are the shore-based Chamorro fishing areas known as Unai Chulu, Unai Dankulo, and Puntan Masalok (also referred to as Unai Masalok). Further discussion regarding the accessibility and availability of ocean space for traditional fishing practices, including nearshore environments in the Study Area, can be found in Section 3.12.2.1. For additional information concerning TCPs identified in the Study Area, see Section 3.11.

The 2019 NMFS stock assessment report for the bottomfish fishery in the CNMI concluded that the CNMI BMUS was determined to not be overfished and was not experiencing overfishing (Langseth et al., 2019). Additionally, creel survey data have indicated that coral reef fisheries have been generally steady in recent years relative to previous decades (Western Pacific Fishery Management Council, 2024). However, as discussed in the 2020 SEIS/OEIS, the catch from the

non-commercial reef fish fishery in the CNMI has historically been in decline since the late 1970s based on data from a new reporting system introduced at that time (Cuetos-Bueno & Houk, 2014). Similar to traditional fishing practices on Guam, if the availability of target species in the reef fish fishery in the CNMI continues to decline, the annual catch from traditional fishers is likely to decline. Traditional fishers that are more dependent on a successful catch (e.g., subsistence fishers) may be affected to a greater degree than fishers who engage in traditional practices for social and cultural reasons.

#### 3.12.1.4.3 Transit Corridor

There are no data on traditional fishing practices occurring in the transit corridor. It is assumed that traditional fishing practices do not typically occur within the transit corridor, because the corridor is a transoceanic route and the majority of traditional fishing typically occurs in nearshore waters.

### 3.12.2 Environmental Consequences

This SEIS/OEIS analyzes potential impacts of the Proposed Action on socioeconomic resources and considers the same stressors as previous MITT analyses, which include (1) accessibility (availability of access to ocean and airspace), (2) airborne acoustics (weapons firing, in-air explosions, aircraft, and vessel noise), (3) physical disturbance and strike aircraft, vessels and in-water devices, MEM), and (4) secondary stressors.

For each stressor, the implementation of SOPs is considered as part of the Proposed Action when determining if an effect is reasonably foreseeable.

Based on the framework presented in Section 3.0.4, the Navy concluded that effects on socioeconomic resources from accessibility, airborne acoustics, and physical disturbance and strike stressors would be reasonably foreseeable; effects would be considered significant if it results in the long-term loss of income, revenue, or employment; or if it permanently degrades the quality of experience for tourism and recreational activities. The following sections analyze the effects of the Proposed Action on socioeconomic resources and takes into account the analysis presented in Section 3.12 of the 2015 EIS/OEIS and the 2020 SEIS/OEIS.

#### 3.12.2.1 Effects on Socioeconomic Resources Under Alternative 1

#### 3.12.2.1.1 Effects from Accessibility Stressors

**Training and Testing**. Under Alternative 1, the number of training and testing activities that have the potential to affect accessibility would change compared to the 2020 SEIS/OEIS. However, the stressors associated with these activities remain the same as those evaluated in previous MITT analyses, and the changes in the number of activities would not be expected to appreciably affect existing conditions within the Study Area. Therefore, the potential impacts pertaining to accessibility, as presented in the 2015 EIS/OEIS (Section 3.12.3.1) and 2020 SEIS/OEIS (Section 3.12.2.1), remain valid and are summarized below.

Generally, activities involving the use of aircraft, vessels, or in-water devices may temporarily limit accessibility to parts of the Study Area. This analysis includes data on BNMs and the annual number of days affected by military readiness activities from 2020 through 2024, supplementing the data from 2010 through 2019 presented in previous MITT analyses. For

purposes of this analysis, if any restriction or closure was issued for any part of a particular day, then the entire day was considered to be affected by that closure. When a BNM is issued, it specifies the time of day and the length of time that a particular area is restricted or closed to the public. Data indicate that the number of days per year affected by military readiness activities for FDM and W-517 has fluctuated; however, there is an overall decline in annual affected days, suggesting increased availability of these areas for public access (Figure 3.12-3). For W-517, the average number of affected days from 2020 through 2024 was 64, representing almost a 38 percent decrease from the average of 103 recorded between 2015 and 2019. For FDM, accessibility (between 3 and 12 NM from shore) was restricted for an average of 82 days per year from 2020 through 2024. Since the 2020 SEIS/OEIS was completed, the Navy has been working with the CNMI government to consider whether access/non-access interests for various reasons (sustainable resources, fishing interests, science projects) outweigh the safety need that led to the full closure of the 3 NM area around FDM due to potential unexploded ordnance from historical misfires. While the Navy will continue this dialogue in parallel to this Proposed Action, at present the area remains restricted from access.

The observed decrease in the utilization of W-517 in recent years may be attributable to a corresponding increase in the use of W-11, W-12, and W-13 for training and testing activities. The operational tempo in W-13 resulted in an average of 89 days affected annually from 2020 to 2024, compared to 18 days for W-11 and 15 days for W-12 (Figure 3.12-4). Furthermore, the establishment and use of the DZs for the Orote, Mason, and Finegayan firing ranges has affected accessibility in those specific areas. The number of days affected by the activities from 2022 through 2024 for the Orote DZ was an average of 256, compared to 27 for Mason and 6 for Finegayan in those same years (Figure 3.12-5).

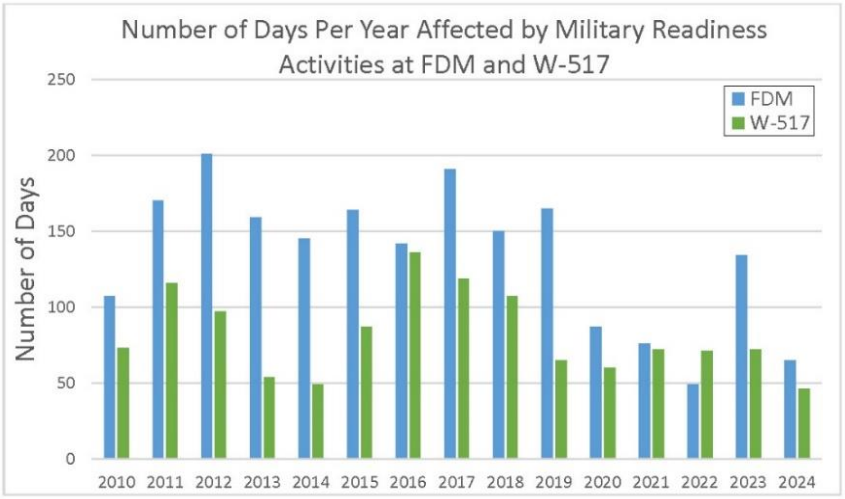


**Figure 3.12-3: Number of Days per Year Affected by Military Readiness Activities at FDM and W-517**

Although socioeconomic resources could be present throughout the Study Area, there is a demonstrably greater potential for perceived effects on accessibility within 3 NM. This is due to high concentrations of public presence and marine-based activities within the nearshore environment, leading to more opportunities for spatial and temporal conflicts with training and testing activities. Increases in certain activities, such as amphibious vehicle maneuvers/rehearsals in Apra Harbor, would affect accessibility within 3 NM as temporary closures of areas may be required for public safety.

Beach road access at the Chamorro fishing areas of Unai Chulu and Unai Dankulo would be closed, and BNMs would be issued to restrict public access to the beaches and surrounding

nearby water during amphibious training activities. However, closures would be limited to the duration of the training event and are coordinated with the relevant CNMI government offices to avoid scheduling training on holidays, festivals, and other important days when public access within the Military Lease Area is desired.

BNMs and Notices to Airmen (NOTAMs) are issued at least 72 hours in advance of training and testing activities in the Study Area. These temporary clearance procedures are established and implemented for the safety of the public and military personnel and have been employed regularly over time without substantial effects on socioeconomic resources in the region. The locations of restricted areas are published and available to mariners and pilots, who typically review such information before boating or flying in any area.

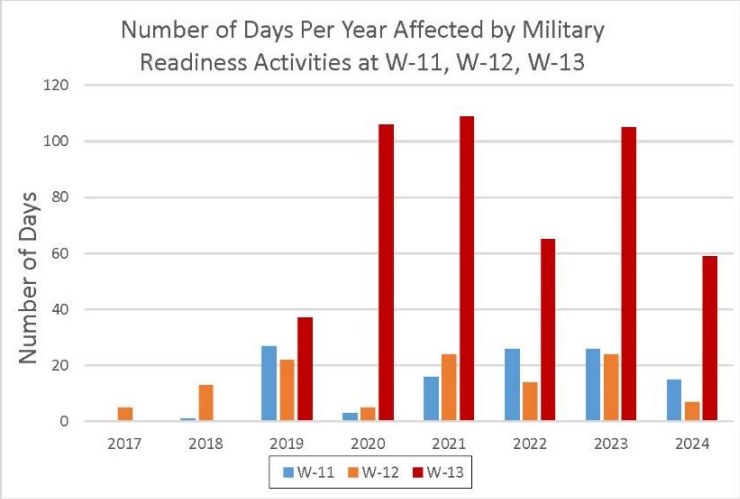


**Figure 3.12-4: Days Per Year Affected by Military Readiness Activities at W-11, W-12, W-13**

To help manage competing demands and maintain public access in the Study Area, the military would continue to conduct its offshore military readiness activities in a manner that reduces restrictions to commercial fisherman. Prior to initiating an activity, standard operating procedures would be followed to visually scan an area to ensure that nonparticipants are not present. If nonparticipants are present, the Action Proponents delay, move, or cancel the activity. Limited military readiness activities are expected to restrict accessibility within 3 NM, where most recreational and traditional fishing is anticipated to occur. The addition of nine new training and testing activities associated with Proposed Action would not be expected to incrementally affect accessibility to the ocean space for recreational and traditional fishing practices. Traditional fishing practices typically occur in the same general areas as recreational fishing (Allen, 2013), which is close to shore and far from most training and testing activities that would limit access to an area (with the exception of activities at FDM). Additionally, data

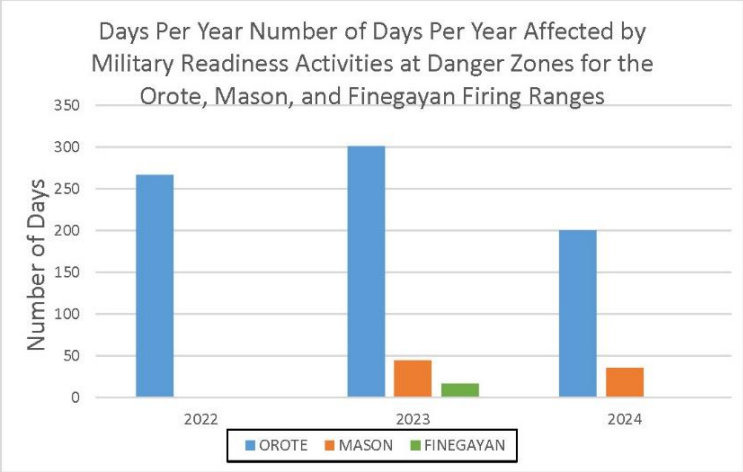


**Figure 3.12-5: Number of Days per Year Affected by Military Readiness Activities at Danger Zones for the Finegayan, Orote, & Mason Firing Ranges**

presented in Section 3.12.1 show no discernable correlation between fluctuations in fishery landings and military readiness activities that have been ongoing in the Study Area for decades.

Notification methods associated with the announcements of scheduled training and testing activities have been updated from previous MITT analyses. In addition to issuing BNMs and NOTAMs to announce scheduled training and testing activities, upcoming events are communicated to stakeholders (e.g., Guam and CNMI local mayors, Guam legislators, resources agencies, and fishers) via e-mail distribution developed by JRM with stakeholder input. In the scoping period of this SEIS, the Navy heard fishing community interest for other means of accessible closure notification (signs at known fishing fleet harbors, social media methods), which the Navy will continue to explore as this Proposed Action is further evaluated. Upon completion of training and testing activities, restrictions are lifted, and commercial and recreational fishers (and other non-military vessels) and non-military aircraft would be able to return to transit through the area.

**Range Modernization and Sustainment**. Effects on accessibility under Alternative 1 would be associated with the installation and maintenance of temporary subsurface targets and instrumentation. Although this activity is expected to occur nearshore, it would only occur once or twice annually under Alternative 1. Accessibility to airspace would not be affected since aircraft would not be used for this specific activity. Notification methods associated with the announcements of scheduled modernization and sustainment activities would be the same as described above.

**Conclusion**. Consistent with previous MITT analyses, changes in accessibility as a result of military readiness activities under Alternative 1 would be reasonably foreseeable; however, as summarized above, the degree of effects would be less than significant because (1) closures are temporary, and the large expanse of the Study Area would remain available to the public for commercial and recreational use; and (2) the overall access to airspace and the ocean by the public in the Study Area would remain consistent with the level of accessibility in the recent past and advance notice of pending closures to areas used by the military through BNMs and NOTAMs will help to avoid or reduce effects.

#### 3.12.2.1.2 Effects from Airborne Acoustics Stressors

**Training and Testing**. Under Alternative 1, the number of training and testing activities that have the potential to generate airborne acoustics would change compared to the numbers analyzed in the 2020 SEIS/OEIS. However, the stressors associated with these activities remain the same as those evaluated in previous MITT analyses, and the changes in the number of activities would not be expected to appreciably affect existing conditions within the Study Area. Therefore, the potential impacts pertaining to airborne acoustics, as presented in the 2015 EIS/OEIS (Section 3.12.3.2) and 2020 SEIS/OEIS (Section 3.12.2.2), remain valid and are summarized below.

Generally, activities involving the use of aircraft, vessels, or explosive munitions may generate airborne acoustics detectable by the public in areas of the Study Area where military and civilian activities occur in close proximity. Noise interference has the potential to decrease public enjoyment of tourism and recreational activities. Socioeconomic resources potentially affected by airborne acoustics associated with military readiness activities include commercial

and recreational fishing, traditional fishing practices, and tourism. Airborne noise associated with military readiness activities would not be expected to affect or interfere with commercial transportation and shipping practices in the Study Area and is not analyzed further.

**Range Modernization and Sustainment**. Potential airborne acoustic effects under Alternative 1 would be associated with vessel use during the temporary installation and maintenance of subsurface targets and instrumentation near Apra Harbor.

**Conclusion**. Consistent with previous MITT analyses, airborne acoustics as a result of military readiness activities under Alternative 1 are reasonably foreseeable; however, the degree of effects would be less than significant because (1) most military readiness activities occur well out to sea, while most tourism and recreational activities occur nearshore; (2) although certain activities would occur inshore, noise would be infrequent, short term, and temporary, lasting for the duration of the activity; (3) vessel noise would not be expected to deter a resident or tourist from participating in a recreational activity (e.g., a fishing trip) in nearshore or offshore areas; (4) infrequent exposure to airborne noise would not result in a direct loss of income, revenue, employment, resource availability, or quality of experience; (5) because airborne acoustics do not substantially impact fish or invertebrates (refer to Sections 3.8 and 3.9), the availability of species for commercial, recreational, and traditional fishing in the region would remain unaffected; and (6) SOPs are implemented to avoid effects on civilian activities and would require that the area is clear of nonparticipants before initiating an activity.

#### 3.12.2.1.3 Effects from Physical Disturbance and Strike Stressors

**Training and Testing**. Under Alternative 1, the number of training and testing activities that have the potential to result in physical disturbance and strike would change compared to the numbers analyzed in the 2020 SEIS/OEIS. However, the stressors associated with these activities remain the same as those evaluated in previous MITT analyses. Therefore, the potential impacts pertaining to physical disturbance and strike, as presented in the 2015 EIS/OEIS (Section 3.12.3.3) and 2020 SEIS/OEIS (Section 3.12.2.3), remain valid and are summarized below.

The evaluation of effects on socioeconomic resources from physical disturbance and strike focuses on physical encounters with objects dropped or fired into the water (e.g., non-explosive practice munitions, other MEM, and ocean bottom-deployed devices), or resting on the ocean floor (e.g., anchors, mines, targets) that may damage or encounter civilian equipment. Direct encounters and collisions with MEM and other objects were determined to not be reasonably foreseeable due to SOPs in place to ensure an area is clear of all non-participating vessels and aircraft before training and testing activities take place.

**Range Modernization and Sustainment**. Potential physical disturbance and strike stressors under Alternative 1 would be associated with vessel and in-water devices, and seafloor device use during the temporary installation and maintenance of subsurface targets and instrumentation.

**Conclusion.** Consistent with previous MITT analyses, physical disturbance and strike stressors associated with military readiness activities under Alternative 1 are reasonably foreseeable; however, effects would be less than significant because (1) most military readiness activities involving munitions or other expended materials occur beyond 3 NM, where limited recreational and traditional fishing practices would be conducted; (2) many practice munitions

are recovered after an activity concludes and unrecoverable pieces of targets are typically small or are designed to sink to the seafloor after use and would not be expected to damage civilian equipment if encountered; and (3) the Action Proponents would continue to implement mitigation to avoid or reduce effects from physical disturbance and strike stressors on seafloor resources, which are valuable assets for tourism and recreation.

#### 3.12.2.2 Effects on Socioeconomic Resources Under Alternative 2

Under Alternative 2, the number of activities with associated accessibility, airborne acoustics, and physical disturbance and strike stressors would be equal to or increase compared to Alternative 1. However, increases in these stressors are not expected to result in a long-term loss of income, revenue, or employment; or permanently degrade the quality of experience for tourism and recreational activities for the same reasons detailed for Alternative 1. Additionally, the Action Proponents would implement SOPs (Section 2.3.3 of the 2020 SEIS/OEIS) that minimize and avoid effects on socioeconomic resources. As such, increases in military readiness activities would not result in substantive changes to the potential for or types of effects on socioeconomic resources, and overall effects are not meaningfully different from those analyzed under Alternative 1.

Therefore, military readiness activities involving accessibility, airborne acoustics, and physical disturbance and strike stressors under Alternative 2 would result in less than significant effects on socioeconomic resources.

### 3.13 PUBLIC HEALTH AND SAFETY

There have been no updates to the affected environment of public health and safety since the 2020 SEIS/OEIS. The analysis of effects on Public Health and Safety under the Proposed Action remains consistent with previous analyses presented in the 2015 EIS/OEIS and the 2020 SEIS/OEIS. There is no new information, science, or regulations that would change the analysis or conclusions. Public access to FDM and its nearshore waters within a 3 NM radius of FDM is permanently restricted for commercial or recreational activities and would not change.

The Navy maintains its commitment to safety through established Safety and Inspection Procedures, which are fully detailed in Section 3.13 of the 2015 EIS/OEIS and 2020 SEIS/OEIS and would continue to be implemented. These procedures include coordination with the USCG and FAA, consideration of activity location, and ensuring training and testing areas are clear of non-participants before commencement.

This SEIS/OEIS analyzes potential impacts of the Proposed Action on public health and safety and considers the same stressors as previous MITT analyses, which include (1) in-water energy (sonar and in-water explosives), (2) in-air energy (high-energy lasers and microwaves), (3) physical interactions (aircraft, vessels, in-water devices/targets, munitions, seafloor devices), and (4) secondary stressors (effects on water quality from explosives [in-air explosives and in-water explosives] and explosion byproducts, metals, chemicals other than explosives, and other materials).

Based on the framework presented in Section 3.0.4, the Navy concluded that effects from in-water energy, in-air energy, and physical interactions stressors are not expected to have reasonably foreseeable effects on public health and safety. Table 3.0-20 summarizes these findings.

# 4 MITIGATION

## 4.1 Introduction

The terms “mitigation” and “mitigation measures” mean actions taken to completely avoid, partially reduce, or minimize the potential for a stressor to affect a resource. This chapter describes and assesses mitigation the Action Proponents will implement under Alternatives 1 or 2 of the Proposed Action. Mitigation was designed to be implemented under every action alternative carried forward. Additionally, the Action Proponents developed mitigation in coordination with regulators and cooperating agencies, including NMFS. Mitigation is designed to achieve one or more of the following overarching benefits: (1) ensure that the Proposed Action has a negligible effect on marine mammal species and stocks, and effects the least practicable adverse effect on marine mammal species or stocks and their habitat (as required under the MMPA); (2) ensure that the Proposed Action does not jeopardize the continued existence of endangered or threatened species, or result in destruction or adverse modification of critical habitat (as required under the ESA); (3) avoid or minimize adverse effects on Essential Fish Habitat and habitats that provide critical ecosystem functions (as required under the Magnuson-Stevens Fishery Conservation and Management Act); (4) avoid adversely affecting historic shipwrecks (as required under the Abandoned Shipwreck Act and National Historic Preservation Act)

For requirements under the MMPA, NMFS has supported the position that the reduction of effects on marine mammal stocks and species (e.g., effects on reproductive success or survivorship) may accrue through the application of mitigation that limits effects on individual animals (National Marine Fisheries Service, 2023). Mitigation developed for the following types of effects is thought to have greater value in reducing the likelihood or severity of adverse effects on marine mammal populations (National Marine Fisheries Service, 2023): (1) avoiding injury or mortality; (2) limiting interruption of known feeding, breeding, mother/young, or resting behaviors; (3) minimizing abandonment of important habitat (temporally and spatially); (4) minimizing the number of individuals subjected to these types of disruptions; and (5) limiting degradation of habitat.

NMFS has also described species-correlated factors that may (alone, or in combination) result in mitigation having a greater benefit towards reducing potential effects on marine mammal species or stocks: (1) the stock is known to be decreasing or status is unknown, but believed to be declining; (2) the known annual mortality (from any source) is approaching or exceeding the potential biological removal level (as defined in section 3(20) of the MMPA); (3) the species or stock is a small, resident population; or (4) the stock is involved in an unusual mortality event or has other known vulnerabilities, such as recovering from an oil spill. Activity-based mitigation and geographic mitigation (which can include year-round or seasonal measures to reduce effects on marine mammals or their prey and physical habitat), particularly within feeding, breeding, mother/young, migration, and resting areas (National Marine Fisheries Service, 2023), are relevant to achieving the mitigation goals described above. Using this guidance from NMFS, the Action Proponents considered the potential benefits of mitigation for marine mammals in terms of the degree, likelihood, and context of the anticipated avoidance of effects to individuals (and how many individuals), and within the context of the species-correlated

factors. Similar considerations were applied to mitigation developed for ESA-listed species, including sea turtles, fish, birds, and corals.

The Navy standardizes its mitigation across the Atlantic, Hawaii-California, Mariana Islands, Northwest, and Gulf of Alaska Study Areas to the maximum extent practical. Mitigation is tailored to each Study Area as needed and appropriate based on the following: (1) the Proposed Action; (2) best available science on species occurrence and potential effects from the Proposed Action; (3) expected mitigation benefits; (4) operational practicality assessments; (5) consultations and coordination with regulatory agencies or departments, such as NMFS, the NOAA, the USFWS, Coastal Zone Management program offices, and State Historic Preservation Officers; (6) consultations and coordination with Alaska Native federally recognized tribes, Native Hawaiian organizations, and Native American Tribes, nations, and tribal organizations; and (7) suggestions received through public comments during scoping and on the Draft SEIS/OEIS.

Mitigation was initially developed for Phase I of at-sea environmental planning (2009 to 2014) and subsequently revised for Phase II (2013 to 2018) and Phase III (2020 to 2027 for the MITT SEIS/OEIS). This SEIS/OEIS (which represents Phase IV) uses mitigation from the 2020 SEIS/OEIS as the baseline for refining mitigation specific to the Proposed Action. For additional information about the at-sea environmental planning process, see Chapter 1.

This Phase IV SEIS/OEIS also addresses military readiness activities on FDM. Similar to at-sea measures, terrestrial mitigation measures on FDM are based on the 2020 SEIS/OEIS baseline. The Navy's mitigation measures on FDM primarily involve access, targeting, and ordnance restrictions, as detailed in Section 4.8. The terrestrial mitigation measures discussed in this SEIS/OEIS were originally developed for past environmental compliance documents in coordination with the USFWS. Data inputs for assessing and developing terrestrial mitigation included the operational data described in Table 4.1-1, the best available science discussed in Chapter 3, published literature, and consultation with the USFWS. Terrestrial mitigation measures are designed to avoid or reduce potential effects on ESA-listed species and their habitats, and roosting seabirds; and to minimize physical damage to the island itself. The benefits of terrestrial mitigation measures are discussed qualitatively.

**Table 4.1-1: Practicality Assessment Criterion**

| Criterion | Description of Practicality Assessment Criterion |
|---|---|
| Criterion 1. Safety: Implementing mitigation must be safe | Assessments considered if mitigation would increase safety risks to personnel, equipment, or the public through:<br>– Increased fatigue of pilots or other personnel<br>– Accelerated fatigue-life of vessels, aircraft, and other systems or platforms<br>– Increased distance to aircraft emergency landing fields, critical medical facilities, and search and rescue capabilities<br>– Exceedance of aircraft fuel restrictions (e.g., lengthened event duration, increased distance to refueling stations)<br>– Exceedance of space restriction on visual observation platforms<br>– Decreased ability to de-conflict sea space or airspace conflicts (e.g., ensuring military readiness activities do not affect each other, avoiding interaction with established commercial air traffic routes, commercial vessel shipping lanes, and areas used for energy exploration or alternative energy development)<br>– Decreased ability for Lookouts to safely and effectively maintain situational awareness while observing the mitigation zones during typical activity conditions<br>– Decreased ability for Lookouts to safely perform other assigned job responsibilities<br>– Decreased proficiency in the use of sensors and weapon systems, or reduced ability to complete shipboard maintenance, repairs, or testing prior to at-sea use (which would result in a significant risk to personnel or equipment safety during training, testing, and real-world missions) |

| Criterion | Description of Practicality Assessment Criterion |
|---|---|
| | – Increased administrative burden that would significantly distract from safe conduct of primary mission objectives |
| Criterion 2. Sustainability: Implementing mitigation must be sustainable for the duration of the Proposed Action | • Assessments considered if mitigations would be unsustainable for the duration of the Proposed Action by:<br>– Requiring personnel to spend an inordinate amount of time on station or away from their homeport<br>– Requiring the use or obligation of additional resources (i.e., personnel and equipment) in excess of what is available<br>– Requiring expenditure of additional funding for increased operations costs associated with higher fuel consumption, additional maintenance of existing equipment, or acquisition of new equipment<br>– Reducing efficiency in travel time and associated costs by increasing distance between activities and homeports, home bases, associated training ranges, testing facilities, air squadrons, and existing infrastructure (e.g., instrumented underwater ranges) |
| Criterion 3. Mission: Implementing mitigation must allow for the Action Proponents to continue meeting mission objectives and statutory mandates | • Assessments considered if mitigation would modify military readiness activities in a way that would prevent them from meeting mission objectives, and the implications for the ability to continue meeting statutory mandates. Example barriers to meeting mission objectives and statutory mandates include:<br>– Degraded training or testing realism<br>– Decreased ready access to ranges, operating areas (OPAREAs), airspace, or sea space with a variety of realistic tactical oceanographic and environmental conditions (e.g., variations in bathymetry, topography, surface fronts, and sea surface temperatures) that are extensive enough to allow for completion of activities without physical or logistical obstructions, to provide personnel the ability to develop competence and confidence in their capabilities across multiple types of weapons and sensors, and the ability to train to communicate and operate in a coordinated fashion as required during real-world missions and to avoid observation by potential adversaries<br>– Decreased proficiency, erosion of capabilities, or reduction in perishable skills related to the use of sensors or weapon systems<br>– Decreased ready access to facilities, range support structures, or systems command support facilities that provide critical infrastructure support and technical expertise necessary to conduct testing<br>– Reduced ability to meet individual training and testing schedules, pre-deployment certification requirements, deployment schedules, and to deploy on time (factoring in variables such as maintenance and weather when scheduling event locations and timing) with the required level of skill and flexibility to accomplish any tasking by Combatant Commanders, national command authorities, or other national security tasking, including responding to national emergencies or emerging national security challenges<br>– Reduced ability to conduct accurate oceanographic or acoustic research to meet research objectives, validate acoustic models, and conduct accurate engineering tests of acoustic sources, signal processing algorithms, and acoustic interactions<br>– Reduced ability to ensure the safety, functionality, and accuracy of systems, platforms, and components through maintenance, repairs, or testing prior to use at sea as needed or required by acquisition milestones<br>– Reduced ability to effectively test systems, platforms, and components before full-scale production or delivery in order to validate whether they perform as expected to determine whether they are operationally effective, suitable, survivable, and safe for their intended use by the fleet<br>– Increased administrative burden that would significantly distract from efficient and effective conduct of primary mission objectives<br>– Increased national security concerns related to providing advance notification of specific times and locations of platforms, such as those using active sonar<br>– Measures that extend outside of the Action Proponents' legal authority to implement |

## 4.2 Mitigation Dissemination

The Action Proponents will publish, broadcast, disseminate, or distribute mitigation instructions through pre-event briefs, governing instructions, broadcast messages, the Protective Measures Assessment Protocol, or other established internal processes. The Protective Measures Assessment Protocol is a software program accessed by appointed personnel during pre-event planning (Figure 4.2-1). The program provides operators with the required mitigation measures applicable to a particular training or testing event, as well as a visual display of the planned event location overlaid with relevant environmental data. Its text and mapping data will be updated to align with best available science and the final mitigation that results from this SEIS/OEIS and associated consultation documents.

Mitigation requirements are mandatory for the Action Proponents when conducting activities under the Proposed Action. In furtherance of national security objectives, foreign militaries may participate in multinational training and testing events in the Study Area. See Section 2.3.1 for a discussion of foreign military activities that would be considered as part of the Proposed Action. During U.S.-led training events within the U.S. territorial seas (0 to 12 NM from shore), the Action Proponents will request a foreign military unit's voluntary compliance with the applicable mitigations. When a foreign military unit participates in a training event with the Action Proponents beyond the U.S. territorial seas but within the U.S. EEZ (12 to 200 NM from shore), the Action Proponents will encourage that unit's voluntary compliance with the mitigation when practical.

**Figure 4.2-1: Protective Measures Assessment Protocol Home Screen**

## 4.3 Personnel Training

As described in Section 2.3.3 of the 2020 SEIS/OEIS, underway surface ships operated by or for the Action Proponents have personnel assigned to stand watch at all times (day and night) for safety of navigation, collision avoidance, range clearance, and man-overboard precautions. Personnel underway on small boats (e.g., crewmembers responsible for navigation) fulfill similar watch standing responsibilities to those positioned on surface ships. To qualify to stand watch as a Lookout, personnel undertake a training program that includes computer-based training, on-the-job instruction, and a formal qualification program. Lookouts are trained in accordance with the *U.S. Navy Lookout Training Handbook* or equivalent to use correct scanning procedures while monitoring assigned sectors, to estimate the relative bearing, range, position angle, and target angle of sighted objects, and to rapidly communicate accurate sighting reports. The *U.S. Navy Lookout Training Handbook* was updated in 2022 to include a more robust chapter on environmental compliance, mitigation, and marine species observation tools and techniques (NAVEDTRA 12968-E). Environmental awareness and education training is also provided to personnel through the Afloat Environmental Compliance Training program (described below) or equivalent. Training is designed to help personnel gain an understanding of their personal environmental compliance roles and responsibilities (including mitigation implementation). Upon reporting aboard and annually thereafter, appointed personnel must complete training identified in their career path training plan.

**Introduction to Afloat Environmental Compliance.** Developed in 2014, the introduction module provides information on at-sea environmental laws, regulations, and compliance roles.

**Marine Species Awareness Training. This** module was developed by civilian marine biologists employed by the Navy and was reviewed and approved by NMFS. It provides information on marine species sighting cues, visual observation tools and techniques, and sighting notification procedures. It is a video-based complement to the *U.S. Navy Lookout Training Handbook* or

equivalent. Since 2007, this module has been required for commanding officers, executive officers, equivalent civilian personnel, and personnel who will stand watch as a Lookout.

**Protective Measures Assessment Protocol.** This module provides information on how personnel should access and operate the Protective Measures Assessment Protocol. Since 2014, this module has been required for personnel tasked with generating mitigation reports.

**Sonar Positional Reporting System and Marine Mammal Incident Reporting.** This module provides information on sonar reporting requirements and marine mammal incident reporting procedures, which are described in Section 4.4. Since 2014, this module has been required for personnel tasked with preparing, approving, or submitting applicable reports.

## 4.4 Reporting

Reporting requirements are designed to track compliance with MMPA and ESA authorizations. They also provide the Action Proponents and regulators with sufficient information to consider if changes to mitigation, monitoring, or reporting requirements might be appropriate. Report content and submission details will be included in the NMFS MMPA Regulations and Letters of Authorization. The Navy developed a classified data repository known as the Sonar Positional Reporting System to maintain internal records of in-water sound source use and to facilitate reporting pursuant to its MMPA Regulations and Letters of Authorization. Applicable data is provided to the NMFS Office of Protected Resources with annual reports describing the level of training and testing conducted in the Study Area and the special reporting mitigation areas described in Section 4.7. The reports include additional information for major training exercises, and the Sinking Exercise, such as records of individual marine mammal sightings when mitigation was implemented during the events. The Action Proponents will also submit an annual report to NMFS on monitoring conducted under the U.S. Navy Marine Species Monitoring Program (described in Section 4.5). Unclassified reports submitted to NMFS are available on the NMFS Office of Protected Resources (https://www.fisheries.noaa.gov/about/office-protected-resources).

### 4.4.1 Incident Reporting

As needed, the Action Proponents will follow established internal communication methods directed by Office of Chief of Naval Operations Instruction 3100.6 (series) if reportable incidents applicable to their activities are observed. Further, the Action Proponents will: (1) Notify the appropriate regulatory agency, which may include NMFS or the USFWS, immediately (or as soon as operational security considerations allow) if a vessel strike, injury, or mortality of a marine mammal or sea turtle occurs that is (or may be) attributable to activities conducted under the Proposed Action. The notification will include relevant information pertaining to the incident, including, but not limited to, vessel speed or event type. (2) Comply with the communication protocol for incidents involving marine mammals under NMFS' jurisdiction as outlined in the Notification and Reporting Plan, which will be publicly available on the NMFS Office of Protected Resources webpage. (3) Comply with the reporting requirements for incidents involving ESA-listed species under NMFS' jurisdiction, as outlined in the NMFS Biological Opinion. (4) Comply with the reporting and response requirements for incidents involving ESA-listed species under USFWS' jurisdiction, as outlined in the USFWS consultation documents. (5) Commence consultation with the appropriate State Historic Preservation Officer

or Tribal Historic Preservation Officer in accordance with 36 CFR section 800.13(b)(3) in the event a submerged historic property (e.g., archaeological resource) is found to have been incidentally affected during a training or testing event.

## 4.5 Monitoring, Research, and Adaptive Management

The Navy is one of the nation's largest sponsors of scientific research on, and monitoring of, protected marine species (Marine Mammal Commission, 2023). Through the Action Proponents' environmental offices and programs, the U.S. Navy Marine Species Monitoring Program, the Living Marine Resources Program, and the ONR, the Action Proponents have been sponsoring research and monitoring for over 30 years in areas where they conduct military readiness activities. Additionally, the USCG spends tens of millions of dollars annually protecting living marine resources through its maritime response, prevention, and law enforcement missions, which have a direct and positive effect on the maritime environment.

Thanks in part to advancements in science from these programs, the understanding of military readiness activity effects on protected marine species continues to evolve. The programs have also made significant advancements in research on and development of emergent mitigation technologies, such as thermal detection systems, infrared systems, radar systems, passive acoustic range instrumentation, and autonomous and unmanned platforms with automated passive acoustic detection capabilities. Technological advancements are also being made through research conducted by private industry (e.g., commercial off-the-shelf products). While these technologies have not reached the level of performance needed for deployment during military readiness activities, the Action Proponents plan to continue researching, testing, and developing them. If mitigation technologies mature to the state where they are determined to be sufficiently effective at mitigating marine mammal effects when considering the range of environmental conditions analogous to where the Action Proponents train and test, the species that could co-occur in space and time with the activities, and the characteristics of the sound sources and platforms used during the activities, then the Action Proponents will assess their compatibility with military readiness applications. This would include a practicality assessment of the budget and acquisition process (including costs associated with designing, building, installing, maintaining, and manning equipment), the logistical and physical considerations for retrofitting platforms with the appropriate equipment and their associated maintenance, repairs, or replacements (e.g., conducting engineering studies to ensure compatibility with existing shipboard systems), the resource considerations for training personnel to effectively operate the equipment, and the potential security and classification issues.

The Action Proponents will continue to host marine species monitoring technical review meetings with NMFS, to include researchers and the Marine Mammal Commission. Additionally, routine Adaptive Management meetings will continue to be held with NMFS and the Marine Mammal Commission as a systematic approach to help account for advancements in science and technology made after the issuance of MMPA Regulations and Letters of Authorization. The Action Proponents will provide information about the status and findings of sponsored mitigation technology research and any associated practicality assessments at these meetings. Through Adaptive Management: decisions, policies, or actions can be adjusted as the science and outcomes from management actions become better understood over time (Williams et al., 2009).

## 4.6 Activity-Based Mitigation

Activity-based mitigation was referred to as "Procedural Mitigation" in the 2020 SEIS/OEIS. Activity-based mitigations are fundamentally consistent across stressors; however, there are activity-specific variations to account for differences in platform configurations, event characteristics, and stressor types. These mitigations have a primary objective of reducing overlap of individual marine mammals and sea turtles (and in some instances, ESA-listed fish and birds) in real time with stressors that have the potential to cause injury or mortality.

Observations for "indicator species" are also conducted to offer an additional layer of protection for marine mammals and sea turtles. Floating vegetation can be an indicator of potential marine mammal or sea turtle presence because these animals have been known to seek shelter in, feed on, or feed among concentrations of floating vegetation. For example, young sea turtles have been known to hide from predators and eat the algae associated with floating concentrations of floating vegetation. For mitigation purposes, the term "floating vegetation" refers to floating concentrations of detached kelp paddies or other vegetation. For events with the largest NEW, indicator species also include other prey species or co-feeding species, such as jellyfish aggregations, large schools of fish, or flocks of seabirds, depending on the event and observation platforms involved.

Visual observations will be conducted by trained Lookouts. For mitigation purposes, the minimum number of Lookouts required is provided in Table 4.6-1 through Table 4.6-2. Some events may have additional personnel (beyond the minimum number of required Lookouts) who are already standing watch in or on the platform conducting the event or additional participating platforms and would have eyes on the water for all or part of an event. For example, Bridge Watch Teams on underway surface ships typically include numerous personnel on the bridge, bridge wings, and aft deck. These additional personnel will serve as members of the "Lookout Team" for all acoustic, explosive, and physical disturbance and strike stressor mitigation categories. While performing their primary duties, the Lookout Team will perform ad hoc visual observations before, during, or after events as a secondary task when doing so is compatible with, and does not compromise, safety and primary duty performance.

Lookouts may be positioned on surface vessels, aircraft, piers, or the shore. Lookouts positioned on U.S. Navy surface vessels (including surfaced submarines) will be solely dedicated to visually observing their assigned sectors. Lookouts on vessels with limited crew may fulfill additional duties. For example, a Lookout on a small boat may also be responsible for navigation or personnel supervision. A Lookout in an aircraft is typically an existing crewmember such as a pilot or Flight Officer whose primary duty is navigation or other mission-essential tasks. Observation platforms will be positioned according to safety, mission, and environmental conditions. For example, small boats observing explosive mine events would always be positioned outside of the detonation plume and human safety zone.

Lookouts will employ standard visual search techniques using naked-eye scanning, potentially in combination with the use of handheld binoculars, high-powered "big-eye" binoculars mounted on the deck of a surface ship (depending on the event and observation platform), and night search techniques (e.g., the use of night vision devices) if events occur after sunset or prior to sunrise. Lookouts will be advised that personal use of polarized sunglasses, when

available, may help reduce sea surface glare, which could improve the sightability of marine resources. Prior to the start of an event (or use of a stressor) and throughout the duration of the event (or stressor use), Lookouts will observe a "mitigation zone" and the sea space surrounding the mitigation zone; within the direct path of underway vessels, unmanned surface or underwater vehicles that are already being escorted and operated under positive control by manned surface vehicles, or towed in-water devices; and throughout the range of visibility (e.g., to the horizon, depending on weather and observation platform characteristics). Mitigation zones are distances from a stressor (typically a radius measured in yards [yd.]), as specified in Table 4.6-1 and Table 4.6-2. The specified mitigation zones are the largest areas Lookouts can reasonably be expected to observe during typical activity conditions and that are practical to implement from an operational standpoint. Lookouts may be responsible for observing multiple mitigation zones. For example, a Lookout positioned on a surface ship during an explosive large-caliber gunnery event may be responsible for observing both the weapon firing noise mitigation zone and the mitigation zone around the intended detonation location.

Lookouts will immediately relay relevant sightings information (e.g., animal or indicator species type, bearing, distance, direction of travel or drift, position relative to the mitigation zone) to the appropriate watch station through established communication methods. Lookouts will continue to observe for new sightings while maintaining situational awareness of the originally sighted animal or indicator species' position relative to the mitigation zone (to the extent possible). Lookouts will immediately relay any relevant new or updated information to the watch station. The watch station will disseminate relevant information to other participating assets as needed for their situational awareness. When passive acoustic devices are required for an event, or are already being used in an event, acoustic operators will relay information about any passive acoustic detections of marine mammals to Lookouts prior to or during an event (when applicable, as indicated in Table 4.6-1 and Table 4.6-2) using established communication methods. Lookouts will use the information received to help inform their visual observation of mitigation zones.

### 4.6.1 Mitigation Specific to Acoustic Stressors, Explosives, and Non-Explosive Ordnance

The mitigation measures described below will be implemented (as appropriate) in response to an applicable sighting within or entering the relevant mitigation zone for acoustic stressors, explosives, and non-explosive practice munitions.

Prior to the initial start of an event (or stressor use), the Action Proponents will: (1) relocate the event to a location where applicable species are not observed, or (2) delay the initial start of the event (or stressor use) until one of the "Mitigation Zone All-Clear Conditions" has been met.

During the event (i.e., during use of a stressor), the Action Proponents will (until one of the Mitigation Zone All-Clear Conditions has been met): (1) power down or shut down active acoustic transmissions, (2) cease weapon firing or ordnance deployment, or (3) cease explosive detonations or fuse initiations.

Mitigation Zone All-Clear Conditions indicate that the mitigation zone is determined to be free of applicable species. The conditions include: (1) a Lookout observes the applicable species exiting the mitigation zone; (2) a Lookout determines the applicable species has exited the mitigation zone based on its observed course and speed relative to the mitigation zone; (3) a Lookout affirms the mitigation zone has been clear from additional sightings for an applicable

"wait period"; or (4) for mobile events, the stressor has transited a distance equal to double the mitigation zone size beyond the location of the last sighting. Wait periods were established because events cannot be delayed or ceased indefinitely for the purpose of mitigation due to effects on safety, sustainability, and the ability to meet mission requirements. Wait periods are designed to allow animals the maximum amount of time practical to resurface (i.e., become available to be observed) before activities resume. The assumption that mitigation may need to be implemented more than once was factored when developing wait period durations. Wait periods are 10 minutes when events involve aircraft that are typically fuel constrained (e.g., rotary-wing aircraft, fighter aircraft), or 30 minutes when events involve only vessels or aircraft that are not typically fuel constrained.

#### 4.6.1.1 Additional Details for Acoustic Stressors

Additional details on the activity-based mitigation requirements for acoustic stressors are described in Table 4.6-1. Activity-based mitigation will not apply to: (1) sources not operated under positive control; (2) sources used for safety of navigation; (3) sources used or deployed by aircraft operating at high altitudes; (4) sources used, deployed, or towed by unmanned platforms except when escort vessels are already participating in the event and have positive control over the source; (5) sources used by submerged submarines; (6) *de minimis* sources; (7) unattended sources, such as moored buoys used for acoustic and oceanographic research; (8) vessel-based, unmanned vehicle-based, or towed in-water sources when marine mammals (e.g., dolphins) are determined to be intentionally swimming at the bow or alongside or directly behind the vessel, vehicle, or device (e.g., to bow-ride or wake-ride); and (9) sources above 2 kHz for sea turtles (based on their hearing capabilities).

#### 4.6.1.2 Additional Details for Explosives

Additional details on the activity-based mitigation requirements for explosives are described in Table 4.6-1. Activity-based mitigation will not apply to explosives (1) deployed by aircraft operating at high altitudes; (2) deployed by submerged submarines, except for explosive torpedoes; (3) deployed against aerial targets; (4) during vessel- or shore-launched missile or rocket events; (5) used at or below the *de minimis* threshold; and (6) deployed by unmanned platforms except when escort vessels are already participating in the event and have positive control over the explosive. Post-event observations are intended to aid incident reporting requirements for marine mammals and sea turtles. Practicality and the duration of post-event observations will be determined on site by fuel restrictions and mission-essential follow-on commitments.

#### 4.6.1.3 Additional Details for Non-Explosive Ordnance

Additional details on the activity-based mitigation requirements for non-explosive ordnance are described in Table 4.6-1. Explosive aerial-deployed mines do not detonate upon contact with the water surface and are therefore considered non-explosive when mitigating the potential for a mine shape to strike a marine mammal or sea turtle at the water surface. Mitigation for the explosive component of aerial-deployed mines is described in Table 4.6-1. Activity-based mitigation does not apply to non-explosive ordnance deployed: (1) by aircraft operating at high altitudes, (2) against aerial targets and land-based targets, (3) during vessel- or shore-launched missile or rocket events, and (4) by unmanned platforms except when escort vessels are already participating in the event and have positive control over ordnance deployment.

## Table 4.6-1: Activity-Based Mitigations for Acoustic, Explosive, and Non-Explosive Ordnance Stressors

| Mitigation Category | Mitigation Zones | Mitigation Requirements | Mitigation Requirement Timing | Wait Period |
|---|---|---|---|---|
| **Acoustic Stressors** | | | | |
| **Active Acoustic Sources** | | | | |
| • Active acoustic sources with power down and shut down capabilities:<br>– Low-frequency active sonar ≥200 dB<br>– Mid-frequency active sonar sources that are hull mounted on a surface ship (including surfaced submarines)<br>– Broadband and other active acoustic sources >200 dB | • 200 yd. from active acoustic sources (shut down)<br>• 500 yd. from active acoustic sources (power down of 10 dB total)<br>• 1,000 yd. from active acoustic sources (power down of 6 dB total) | • One Lookout in/on one of the following:<br>– Aircraft<br>– Pierside, moored, or anchored vessel<br>– Underway vessel with space/crew restrictions (including small boats)<br>– Underway vessel already participating in the event that is escorting (and has positive control over sources used, deployed or towed by) an unmanned platform<br>• Two Lookouts on an underway vessel without space/crew restrictions<br>• Lookouts would use information from passive acoustic detections to inform visual observations when passive acoustic devices are already being used in the event | • Immediately prior to the initial start of using active acoustic sources (e.g., while maneuvering on station), observe for:<br>– Marine mammals<br>– Sea turtles (for sources <2 kHz)<br>– Floating vegetation<br>• During use of active acoustic sources, observe for:<br>– Marine mammals<br>– Sea turtles (for sources <2 kHz) | • 10 or 30 minutes (depending on fuel constraints of the platform) |
| • Active acoustic sources with shut down (but not power down) capabilities:<br>– Low-frequency active sonar <200 dB<br>– Mid-frequency active sonar sources that are not hull mounted on a surface ship (e.g., dipping sonar, towed arrays)<br>– High-frequency active sonar<br>– Broadband and other active acoustic sources <200 dB | • 200 yd. from active acoustic sources (shut down) | | | |
| **Weapon Firing Noise** | | | | |
| • Explosive and non-explosive large-caliber gunnery firing noise (surface-to-surface and surface-to-air) | • 30 degrees on either side of the firing line out to 70 yd. from the gun muzzle (cease fire) | • One Lookout on a vessel | • Immediately prior to the initial start of large-caliber gun firing (e.g., during target deployment) observe for:<br>– Marine mammals<br>– Sea turtles<br>– Floating vegetation<br>• During large-caliber gun firing observe for:<br>– Marine mammals<br>– Sea turtles | • 30 minutes |

## Table 4.6-1: Activity-Based Mitigations for Acoustic, Explosive, and Non-Explosive Ordnance Stressors (continued)

| Mitigation Category | Mitigation Zones | Mitigation Requirements | Mitigation Requirement Timing | Wait Period |
|---|---|---|---|---|
| **Explosive Stressors** | | | | |
| **Explosive Bombs** | | | | |
| • Any NEW | • 2,500 yd. from the intended target (cease fire) | • One Lookout in an aircraft | • Immediately prior to the initial start of bomb delivery (e.g., when arriving on- station), observe for:<br>– Marine mammals<br>– Sea turtles<br>– Floating vegetation<br>• During bomb delivery, observe for:<br>– Marine mammals<br>– Sea turtles<br>• After the event, when practical, observe the detonation vicinity for dead or injured:<br>– Marine mammals<br>– Sea turtles<br>• If a marine mammal is visibly injured or killed as a result of detonation, explosives use in the event would be suspended immediately and established incident reporting procedures would be followed | • 10 minutes |
| **Explosive Gunnery** | | | | |
| • Air-to-surface medium-caliber ordnance | • 200 yd., from the intended impact location (cease fire) | • One Lookout on a vessel or in an aircraft | • Immediately prior to the initial start of gun firing (e.g., while maneuvering on station), observe for:<br>– Marine Mammals<br>– Sea turtles<br>– Floating vegetation<br>• During gunnery firing, observe for:<br>– Marine mammals<br>– Sea turtles<br>• After the event, when practical, observe the detonation vicinity for dead or injured:<br>– Marine mammals<br>– Sea turtles<br>• If a marine mammal is visibly injured or killed as a result of detonation, explosives use in the event would be suspended immediately, and established incident reporting procedures would be followed. | • 10 or 30 minutes (depending on fuel constraints of the platform) |
| • Surface-to-surface medium-caliber ordnance | • 600 yd. from the intended impact location (cease fire) | | | |
| • Surface-to-surface large-caliber ordnance | • 1,000 yd. from the intended impact location (cease fire) | | | |
| **Explosive Mine Countermeasure and Neutralization (No Divers)** | | | | |
| • 0.1-5 lb. NEW | • 600 yd. from the detonation site (cease fire) | • One Lookout on a vessel or in an aircraft | • Immediately prior to the initial start of detonations (e.g., while maneuvering on station; typically, 10 or 30 minutes depending on fuel constraints) observe for: | • 10 or 30 minutes (depending on |

## Table 4.6-1: Activity-Based Mitigations for Acoustic, Explosive, and Non-Explosive Ordnance Stressors (continued)

| Mitigation Category | Mitigation Zones | Mitigation Requirements | Mitigation Requirement Timing | Wait Period |
|---|---|---|---|---|
| • >5 lb. NEW | • 2,100 yd. from the detonation site (cease fire) | • Two Lookouts: one in a small boat and one in an aircraft | – Marine mammals<br>– Sea turtles<br>– Floating vegetation<br>• During detonations or fuse initiation, observe for:<br>– Marine mammals<br>– Sea turtles<br>• After the event, observe the detonation vicinity for 10 or 30 minutes (depending on fuel constraints), observe for dead or injured:<br>– Marine mammals<br>– Sea turtles<br>• If a marine mammal is visibly injured or killed as a result of detonation, explosives use in the event would be suspended immediately and established incident reporting procedures would be followed. | fuel constraints of the platform) |
| **Explosive Mine Neutralization (With Divers)** | | | | |
| • Activities under positive control | • 500 yd. from the detonation site (cease fire) | • Two Lookouts in two small boats (one Lookout per boat), or one small boat and one rotary-wing aircraft (with one Lookout each), and one Lookout on shore for shallow-water events | • Time-delay devices will be set not to exceed 10 minutes<br>• Immediately prior to the initial start of detonations or fuse initiation for positive control events (e.g., while maneuvering on station) for 30 minutes prior for time-delay events, observe for:<br>– Marine mammals<br>– Sea turtles<br>– Floating vegetation<br>– Manta rays<br>– Hammerhead sharks<br>• During detonations or fuse initiation, observe for:<br>– Marine mammals<br>– Sea turtles<br>– Hammerhead sharks and manta rays within the Mariana Islands Range Complex: Divers will notify the support boat or Range Safety Officer of sightings (of any hammerhead sharks or manta rays, due to difficulty in differentiating species). Detonations will cease if divers' sight a hammerhead when setting charges and will recommence when it is no longer observed.<br>• When practical based on mission, safety, and environmental conditions:<br>– Boats will observe from the mitigation zone radius mid-point<br>– When two are used, boats will observe from opposite sides of the mine location<br>– Platforms will travel a circular pattern around the mine location<br>– Boats will have one Lookout observe inward toward the mine location and one observe outward toward the mitigation zone perimeter<br>– Divers will be part of the Lookout Team | • 10 or 30 minutes (depending on fuel constraints or the platform) |
| • Activities using time-delay fuses | • 1,000 yd. from the detonation site (cease fire) | • Four Lookouts in two small boats (two Lookouts per boat), and one additional Lookout in an aircraft if used in the event | | |

## Table 4.6-1: Activity-Based Mitigations for Acoustic, Explosive, and Non-Explosive Ordnance Stressors (continued)

| Mitigation Category | Mitigation Zones | Mitigation Requirements | Mitigation Requirement Timing | Wait Period |
|---|---|---|---|---|
| | | | • After the event, observe the detonation vicinity for 30 minutes for dead or injured:<br>– Marine mammals<br>– Sea turtles<br>– Manta rays<br>– Hammerhead sharks<br>• If a marine mammal is visibly injured or killed as a result of detonation, explosives use in the event would be suspended immediately and established incident reporting procedures would be followed. | |
| **Explosive Missiles and Rockets** | | | | |
| • 0.6–20 lb. NEW (air-to-surface) | • 900 yd. from the intended impact location (cease fire) | • One Lookout in an aircraft | • Immediately prior to the initial start of missile or rocket delivery (e.g., during a fly-over of the mitigation zone), observe for:<br>– Marine mammals<br>– Sea turtles<br>– Floating vegetation<br>• During missile or rocket delivery, observe for:<br>– Marine mammals<br>– Sea turtles<br>• After the event, when practical, observe the detonation vicinity for dead or injured:<br>– Marine mammals<br>– Sea turtles<br>• If a marine mammal is visibly injured or killed as a result of detonation, explosives use in the event would be suspended immediately and established incident reporting procedures would be followed | • 10 or 30 minutes (depending on fuel constraints of the platform) |
| • >20–500 lb. NEW (air-to-surface) | • 2,000 yd. from the intended impact location (cease fire) | | | |
| **Research-Based Sub-Surface Explosives** | | | | |
| • 0.1–5 lb. NEW for other types of sub-surface explosives used in research applications | • 600 yd. from the device detonation site (cease fire) | • One Lookout on a small boat or in an aircraft<br>• Conduct passive acoustic monitoring for marine mammals; use information from detections to assist visual observations. | • Immediately prior to the initial start of detonations, observe for:<br>– Marine mammas<br>– Sea turtles<br>– Floating vegetation<br>• During detonations, observe for:<br>– Marine mammals<br>– Sea turtles<br>• After the event, when practical, observe the detonation vicinity for dead or injured:<br>– Marine mammals<br>– Sea turtles<br>• If a marine mammal is visibly injured or killed as a result of detonation, explosives use in the event would be suspended | • 10 or 30 minutes (depending on fuel constraints of the platform) |

## Table 4.6-1: Activity-Based Mitigations for Acoustic, Explosive, and Non-Explosive Ordnance Stressors (continued)

| Mitigation Category | Mitigation Zones | Mitigation Requirements | Mitigation Requirement Timing | Wait Period |
|---|---|---|---|---|
| | | | immediately, and established incident reporting procedures would be followed | |
| **Explosive Torpedoes** | | | | |
| • Any NEW | • 2,100 yd. from the intended impact location (cease fire) | • One Lookout in an aircraft<br>• Conduct passive acoustic monitoring for marine mammals; use information from detections to assist visual observations. | • Immediately prior to the initial start of detonations (e.g., during target deployment), observe for:<br>– Marine mammals<br>– Sea turtles<br>– Floating vegetation<br>– Jellyfish aggregations<br>• During torpedo launches, observe for:<br>– Marine mammals<br>– Sea turtles<br>– Jellyfish aggregations<br>• After the event, when practical, observe the detonation vicinity for dead or injured:<br>– Marine mammals<br>– Sea turtles<br>• If a marine mammal is visibly injured or killed as a result of detonation, explosives use in the event would be suspended immediately, and established incident reporting procedures would be followed | • 10 or 30 minutes (depending on fuel constraints of the platform) |
| **Sinking Exercise (SINKEX)** | | | | |
| • Any NEW | • 2.5 NM from the target ship hull (cease fire) | • Two Lookouts; one on a vessel and one in an aircraft<br>• Conduct passive acoustic monitoring for marine mammals; use information from detections to assist visual observations | • During aerial observations for 90 minutes prior to the initial start of weapon firing, observe for:<br>– Marine mammals<br>– Sea turtles<br>– Floating vegetation<br>– Jellyfish aggregations<br>• From the vessel during weapon firing, and from the aircraft and vessel immediately after planned or unplanned breaks in weapon firing or more than 2 hours, observe for:<br>– Marine mammals<br>– Sea turtles<br>• Observe the detonation vicinity for 2 hours after sinking the vessel or until sunset, whichever comes first, for dead or injured:<br>– Marine mammals<br>– Sea turtles<br>• If a marine mammal is visibly injured or killed as a result of detonation, explosives use in the event would be suspended immediately, and established incident reporting procedures would be followed | • 30 minutes |

## Table 4.6-1: Activity-Based Mitigations for Acoustic, Explosive, and Non-Explosive Ordnance Stressors (continued)

| Mitigation Category | Mitigation Zones | Mitigation Requirements | Mitigation Requirement Timing | Wait Period |
|---|---|---|---|---|
| **Non-Explosive Ordnance Stressors** | | | | |
| **Non-Explosive Aerial-Deployed Mines and Bombs** | | | | |
| • Non-explosive aerial-deployed mines<br>• Non-explosive bombs | • 1,000 yd. from the intended target (cease fire) | • One Lookout in an aircraft | • Immediately prior to the initial start of mine or bomb delivery (e.g., when arriving on station), observe for:<br>– Marine mammals<br>– Sea turtles<br>– Floating vegetation<br>• During mine or bomb delivery, observe for:<br>– Marine mammals<br>• Sea turtles | • 10 minutes |
| **Non-Explosive Gunnery** | | | | |
| • Non-explosive surface-to-surface large-caliber ordnance<br>• Non-explosive surface-to-surface and air-to-surface medium-caliber ordnance<br>• Non-explosive surface-to-surface and air-to-surface small-caliber ordnance | • 200 yd. from the intended impact location (cease fire) | • One Lookout on a vessel or in an aircraft | • Immediately prior to the initial start of gun firing (e.g., while maneuvering on station), observe for:<br>– Marine mammals<br>– Sea turtles<br>– Floating vegetation<br>• During gunnery firing, observe for:<br>– Marine mammals<br>• Sea turtles | • 10 or 30 minutes (depending on fuel constraints of the platform) |
| **Non-Explosive Missiles and Rockets** | | | | |
| • Non-explosives (air-to-surface) | • 900 yd. from the intended impact location (cease fire) | • One Lookout in an aircraft | • Immediately prior to the start of missile or rocket delivery (e.g., during a fly-over of the mitigation zone), observe for:<br>– Marine mammals<br>– Sea turtles<br>– Floating vegetation<br>• During missile or rocket delivery, observe for:<br>– Marine mammals<br>• Sea turtles | • 10 or 30 minutes (depending on fuel constraints of the platform) |

### 4.6.2 Mitigation Specific to Vessels, Vehicles, and Towed In-Water Devices

Additional details on the activity-based mitigation requirements for vessels, unmanned vehicles, and towed in-water devices are described in Table 4.6-2. For ship classes required to maintain more than one Lookout, the specific requirement is subject to change over time in accordance with the applicable navigation instruction, such as the Surface Ship Navigation Department Organization and Regulations Manual (U.S. Department of the Navy, 2021). The Action Proponents will notify NMFS should their Lookout policies change, including in the Surface Ship Navigation Department Organization and Regulations Manual. Mitigation will be implemented to the maximum extent practical based on the prevailing circumstances, including consideration of safety of vessels, unmanned vehicles, towing platforms, and crews, as well as maneuverability restrictions. Mitigation will not be implemented (1) by submerged submarines, (2) by unmanned vehicles except when escort vessels are already participating in the event and have positive control over the unmanned vehicle movements, (3) when marine mammals (e.g., dolphins) are determined to be intentionally swimming at the bow, alongside the vessel or vehicle, or directly behind the vessel or vehicle (e.g., to bow-ride or wake-ride), and (4) when impractical based on mission requirements (e.g., during certain aspects of amphibious exercises).

**Table 4.6-2: Activity-Based Mitigations for Vessels, Vehicles, and Towed In-Water Devices**

| Mitigation Category | Mitigation Requirements | Mitigation Zones and Requirements |
|---|---|---|
| **Manned Surface Vessels** | | |
| • Manned surface vessels, including surfaced submarines | • One or more Lookouts on manned underway surface vessels in accordance with the most recent navigation safety instruction | • Immediately prior to manned surface vessels getting underway and while underway, the Lookout(s) will observe for the following:<br>– Marine mammals<br>– Sea turtles<br>• Underway manned surface vessels will maneuver themselves (which may include reducing speed) to maintain the following distances as mission and circumstances allow:<br>– 500 yd. from whales<br>– 200 yd. from other marine mammals<br>– Vicinity of sea turtles |
| **Unmanned Vehicles** | | |
| • Unmanned Surface Vehicles and Unmanned Underwater Vehicles already being escorted (and operated under positive control) by a manned surface support vessel | • One Lookout on a surface support vessel that is already participating in the event, and has positive control over the unmanned vehicle | • Immediately prior to unmanned vehicles getting underway and while underway, the Lookout will observe for the following:<br>– Marine mammals<br>– Sea turtles<br>• A surface support vessel that is already participating in the event, and has positive control over the unmanned vehicle, will maneuver the unmanned vehicle (which may include reducing its speed) to ensure it maintains the following distances as mission and circumstance allow:<br>– 500 yd. from whales<br>– 200 yd. from other marine mammals<br>– Vicinity of sea turtles |
| **Towed In-Water Devices** | | |
| • In-water devices towed by an aircraft, a manned surface support vessel, or an Unmanned Surface Vehicle or Unmanned Underwater Vehicle already being escorted (and operated under positive control) by a manned surface vessel | • One Lookout on the manned towing vessel or aircraft, or on a surface support vessel that is already participating in the event and has positive control over an unmanned vehicle that is towing an in-water device. | • Immediately prior to and while in-water devices are being towed, the Lookout will observe for the following:<br>– Marine mammals<br>– Sea turtles<br>• Manned towing platforms, or surface support vessels already participating in the event that have positive control over an unmanned vehicle that is towing an in-water device, will maneuver itself or the unmanned vehicle (which may include reducing speed) to ensure towed in-water devices maintain the following distances as mission and circumstances allow:<br>– 250 yd. from marine mammals<br>– Vicinity of sea turtles |

### 4.6.3 Visual Observation Effectiveness

Oedekoven and Thomas (2022) evaluated the effectiveness of Navy Lookout Teams at detecting marine mammals before they entered a defined set of mitigation zones (i.e., 200, 500, and 1,000 yd.). The study analyzed sighting data collected by the Navy over 27 embarks from 2010 to 2019. Results indicated that the effectiveness of Navy Lookout Teams was generally less than that of trained biologist observer teams, and varied by sighted species, group size, and distance. The Navy reviewed the same dataset used by Oedekoven and Thomas (2022), plus sonar use data, and found that sonar status (i.e., on versus off) was an important factor in evaluating how species availability may influence the prevalence of marine mammal sightings for Navy Lookouts and biologists alike. Sighting rates near vessels using hull-mounted active sonar were lower when sonar was on versus off, suggesting that a portion of marine mammals were not available to be sighted when the sonar was on (due to changed surfacing behavior or avoiding close exposures to sonar) (Navy, 2023). Table 4.6-3 provides a summary of the factors that could potentially influence the real-time effectiveness of the Action Proponents' visual observations (Barlow, 2015; Jefferson et al., 2015; Navy, 2023; Oedekoven & Thomas, 2022). As described in the Acoustic and Explosive and Acoustic Effects Report, the quantitative analysis for this SEIS/OEIS does not reduce model-estimated impacts to account for activity-based mitigation.

**Table 4.6-3: Potential Factors Influencing Visual Observation Effectiveness**

| Factor | Description of Influence on Sightability |
|---|---|
| Species dive behavior | Long-duration and deep-diving species are not at the surface often or for long period of time, which limits the amount of time they are available to be seen by Lookouts. Groups size also influences sightability. Species that travel in groups or large pods (e.g., delphinids, sperm whales, fin whales) are generally easier to detect than solitary individuals or pairs. Information on dive behaviors and group sizes for species that occur in the Study Area is provided in the technical reports titled *Dive Distribution for Marine Species Occurring in the U.S. Navy's* and the *U.S. Navy Marine Species Density Database Phase IV for the Mariana Islands Training and Testing Study Area*. |
| Species group size | |
| Species physical traits and surface behaviors | Larger-bodied species (e.g., baleen and sperm whales) or species with tall dorsal fins (e.g., killer whales) would generally be easier to detect relative to small-bodied species and species without dorsal fins (e.g., sea turtles). Similarly, species with highly conspicuous surface-active behaviors (e.g., breaching, leaping, bow-riding) are generally easier to detect than cryptic species. For example, whales that fluke regularly (e.g., humpback) or variably (e.g., blue and fin whales) before they dive may be easier to detect than those that fluke rarely (e.g., sei, common minke, and Bryde's whales). Similarly, species that are active at the surface (e.g., bottlenose and spinner dolphins) or remain at the surface for extended periods of time as they forage or socialize (e.g., sperm whales) would be easier to detect than cryptic species that surface inconspicuously (e.g., beaked whales, dwarf and pygmy sperm whales, sea turtles). Prominent blows, such as those exhibited by many species of baleen whales (e.g., humpback whales) are easier to detect than small or less visible blows (e.g., Bryde's and common minke whales). Some species do not exhibit a blow when they surface to breathe (e.g., sea turtles). |
| Observation conditions | Weather conditions, such a clear daytime skies, low sea states, low winds (i.e., low prevalence of white caps), and low glare are optimal for marine species observations. Animal sightability generally declines as viewing conditions decline. |
| Observation area and platform | Marine mammal and sea turtle sightability may be influenced by the mitigation zone size, observation platform, ad distance between the two. Aircraft (when no operating at high altitudes) generally have the best vantage point for observing throughout an entire mitigation zone due to their height and speed over the water, and ability to conduct close-approach flyovers (depending on the event). Aircraft Lookouts are typically existing crewmembers responsible for other essential tasks (e.g., navigation), and some types of aircraft may have windows that are small or positioned in a way that partially obstruct views of the sea space directly beneath the aircraft. Due to their low vantage point on the water, Lookouts in small boats may be more likely to detect animals in close proximity to the boat or that display conspicuous visual cues (e.g., blows, splashes, flukes, travel in groups) than animals at further distances (e.g., near a mitigation zone perimeter) or that display inconspicuous visual cues (e.g., solitary sea turtles surfacing without a splash). The bridges of surface ships offer a higher vantage point relative to small boats. For certain events, such as hull-mounted active sonar, the mitigation zone is located directly around the hull of the ship on which the Lookout is positioned. Species sightability would generally decrease with distance, particularly for mitigation zones located far from the observation platform (e.g., a gunnery mitigation zone several NM down range). The use of hand-held or big-eye binoculars can help compensate for the difficulty of sighting animals at distance (depending on the event). |

## 4.7 Geographic Mitigation

Designated portions of the Study Area where the Action Proponents will implement geographic mitigation for physical habitats, marine species habitats, or cultural resources are referred to as "mitigation areas" (Figure 4.7-1). The remainder of this section provides the geographic mitigation requirements and a qualitative discussion of their environmental benefits. Mitigation areas apply year-round unless specified otherwise, and do not apply to *de minimis* sources. Detailed descriptions of important seafloor habitats (e.g., for corals), marine mammal habitats, and cultural resources (e.g., shipwrecks), as well as maps depicting how these features overlap the mitigation areas, are provided in this chapter.

Should national security require the Action Proponents to exceed the limit of a mitigation area (e.g., sonar hours), personnel conducting the activity would be required to obtain approval through the chain of command prior to commencing the applicable event. The Action Proponents would provide NMFS with advance notification and include relevant information about the event (e.g., sonar hours, use of explosives) in their annual training and testing activity reports.

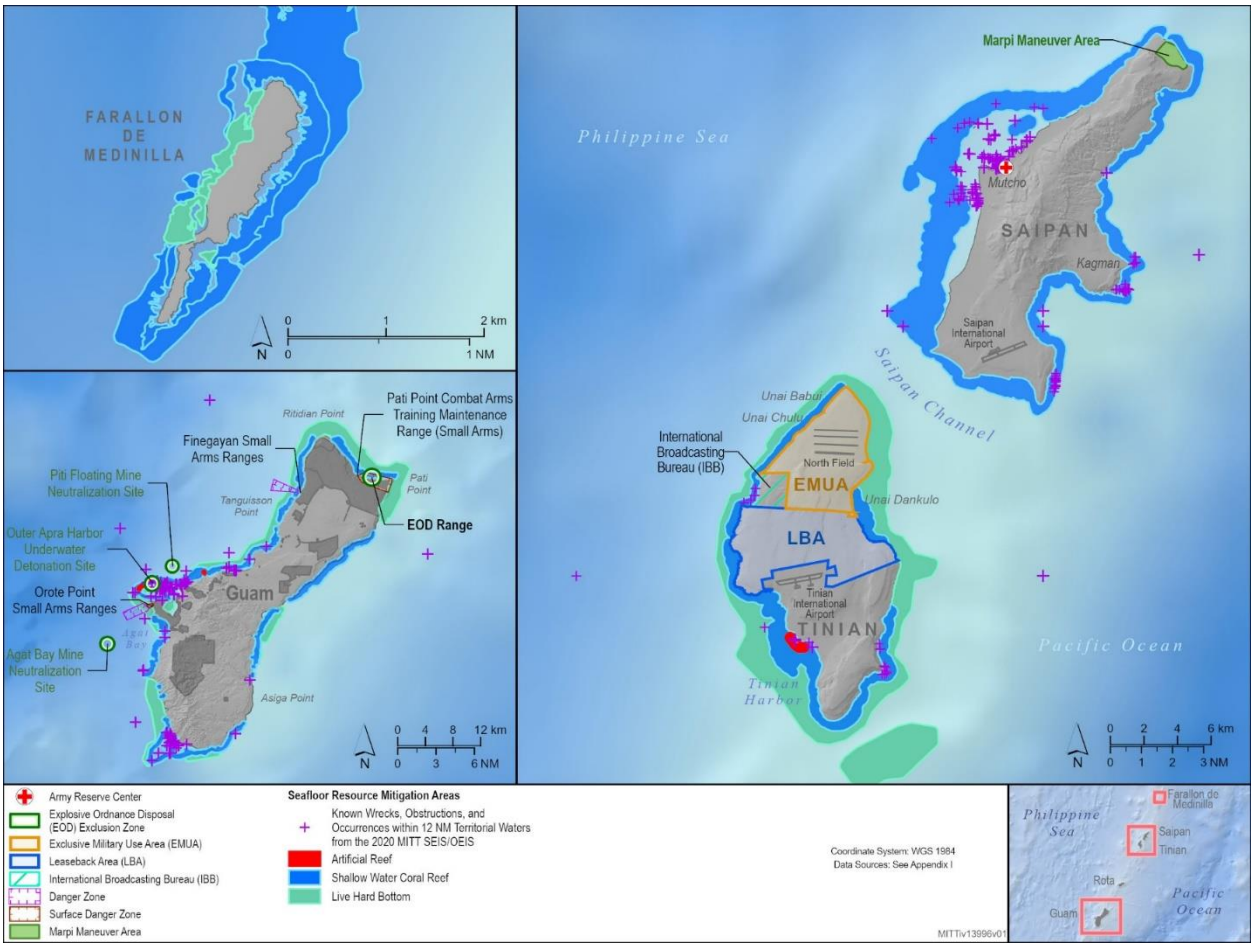


**Figure 4.7-1: Guam and CNMI Mitigation Areas**

### 4.7.1 Seafloor Resource Mitigation Areas

The Action Proponents implement geographic mitigation to protect sensitive seafloor habitats – including shallow-water coral reefs, artificial reefs, shipwrecks, and hard bottom substrates – from the impacts of explosives and physical strike stressors (as indicated in Table 4.7-1). These measures are designed to safeguard not only the physical structures themselves but also the vital ecosystem services they provide for fish, sea turtles, and invertebrates that rely on them for feeding and shelter. The effectiveness of these protections is largely dependent on high-quality mapping data from the Phase IV Mariana Islands Training and Testing SEIS/OEIS: Marine Benthic Habitat Database Technical Report (U.S. Department of the Navy, 2024d), which allows for the precise placement of training activities to avoid these ecologically and socioeconomically valuable areas.

**Table 4.7-1: Seafloor Resource Mitigation Area Requirements**

| Category | Mitigation Requirements | Mitigation Benefits |
|---|---|---|
| **Shallow Water Coral Reef** | | |
| Explosives | • The Action Proponents will not detonate any in-water explosives (including underwater explosives and explosives deployed against surface targets) within a horizontal distance of 350 yd. from shallow-water coral reefs (except at designated nearshore training areas around Guam and Apra Harbor, such as Piti Floating Mine Neutralization Site, Outer Apra Harbor Underwater Detonation Site, and Agat Bay Mine Neutralization Site, where these resources will be avoided to the maximum extent practicable). | • The 350-yd. mitigation area radius for in-water explosives was conservatively designed to be several times larger than the impact footprint (e.g., crater and expelled material radius) of the largest bottom-laid explosive used in the Study Area. The military expended material with the largest footprint used in other Navy study areas is a 650-lb. net explosive weight (NEW) mine with an estimated impact footprint radius of 22.7 yd. (20.8 m). The 350-yd. mitigation area radius is 11 times larger than this footprint radius and is even more conservatively sized when compared to the impact footprints of smaller explosives, including the largest explosive applicable to the MITT Study Area, which has a charge size of 20 lb. NEW and a footprint radius of just 2.2 yd. (2 m). Therefore, the mitigation will prevent direct effects (and some level of indirect effects) from explosives on shallow-water coral reefs in the Study Area. |
| Physical disturbance and strike | • The Action Proponents will not set vessel anchors within the anchor swing circle radius from shallow-water coral reefs (except in designated anchorages).<br>• The Action Proponents will not place non-explosive seafloor devices or deploy non-explosive ordnance against surface targets (including aerial-deployed mine shapes) within a horizontal distance of 350 yd. from shallow-water coral reefs (except at designated anchorages and nearshore training areas around Guam and within Apra Harbor, where these resources will be avoided to the maximum extent practicable). | • The anchor swing circle mitigation will ensure that vessel anchors do not come into contact with shallow-water coral reefs and precious coral beds when factoring in environmental conditions that could affect anchoring positions, such as winds, currents, and water depth.<br>• For ease of implementation, the 350-yd. mitigation area radius for explosives was also adopted for seafloor devices and non-explosive ordnance deployed against surface targets. This mitigation area radius is even more conservative when compared to the small impact footprints of these non-explosive stressors. Therefore, the mitigation will prevent direct effects (and some level of indirect effects) from seafloor devices and non-explosive ordnance deployed against surface targets on shallow-water coral reefs and precious coral beds. |
| **Artificial Reef, Hard Bottom Substrate, and Shipwreck** | | |
| Explosives | • The Action Proponents will not detonate explosives on or near the seafloor (e.g., explosive bottom-laid or moored mines) within a horizontal distance of 350 yd. from artificial reefs, hard bottom substrate, and shipwrecks (except in designated locations, where these resources will be avoided to the maximum extent practicable). | • The 350-yd. mitigation area radius will prevent direct effects (and some level of indirect effects) from explosives on artificial reefs, hard bottom substrate, and shipwrecks for the reasons described in Section 4.7.1. |
| Physical disturbance and strike | • The Action Proponents will not set vessel anchors within the anchor swing circle radius from artificial reefs, hard bottom substrate, and shipwrecks (except at designated anchorages and nearshore training areas around Guam and within Apra Harbor, where these | • Mitigation ensures that vessel anchors do not come into contact with artificial reefs, hard bottom substrate, and shipwrecks, when factoring in environmental conditions that could affect anchoring position, such as winds, current, and water depth.<br>• For ease of implementation, the 350-yd. mitigation area radius for explosives was also adopted for seafloor devices (that are |

| Category | Mitigation Requirements | Mitigation Benefits |
|---|---|---|
| | resources will be avoided to the maximum extent practicable).<br>• The Action Proponents will not place non-explosive seafloor devices (that are not precisely placed) within a horizontal distance of 350 yd. from artificial reefs, hard bottom substrate, and shipwrecks except at designated nearshore training areas, where these resources will be avoided to the maximum extent practicable).<br>• The Action Proponents will not position precisely placed non-explosive seafloor devices directly on artificial reefs, hard bottom substrate, or shipwrecks.<br>• The Action Proponents will avoid positioning precisely placed non-explosive seafloor devices near these resources by the largest distance that is practical to implement based on mission requirements. | not precisely placed) and is even more conservative when compared to the small impact footprints of non-explosive seafloor devices.<br>• Mitigation specific to precisely placed seafloor devices was first developed and coordinated with NMFS for live hard bottom habitats during the 2022 HSTT Study Area's Essential Fish Habitat Assessment consultation (U.S. Department of the Navy, 2022). That mitigation is being included in this document and applied to the whole mitigation area category of hard bottom substrate as well as artificial reefs and shipwrecks, for consistency and practicality of implementation. Because precisely placed seafloor devices are deployed with a high degree of placement accuracy, the original intent of the mitigation (i.e., preventing direct physical strike and disturbance) will continue to be achieved. Therefore, the mitigation for seafloor devices that are either precisely placed or not precisely placed will collectively prevent direct effects (and some level of indirect effects) from seafloor devices on artificial reefs, hard bottom substrate, and shipwrecks. |

### 4.7.2 Marine Mammal and Sea Turtle Mitigation Areas

Table 4.7-2 details geographic marine mammal and sea turtle mitigation related to the use of active sonar and explosives off Marpi Reef, north of Saipan, Chalan Kanoa Reef, west of Saipan, and Agat Bay, Guam. The mitigation is a continuation from the 2020 SEIS/OEIS.

**Table 4.7-2: Mitigation Area Requirements for Marpi Reef, Chalan Kanoa Reef, and Agat Bay Nearshore**

| Category | Mitigation Requirements | Mitigation Benefits |
|---|---|---|
| **Marpi Reef** | | |
| Acoustic | • From December 1 – April 30, the Action Proponents will not use more than 20 combined hours of MF1 and MF1C surface ship hull-mounted mid-frequency active sonar during training and testing within the Marpi Reef and Chalan Kanoa Reef mitigation areas.<br>• The Navy will report the total hours of active sonar (all bins, by bin) used in the Marpi Reef Mitigation Area and Chalan Kanoa Reef Mitigation Area from December 1 to April 30 in its annual training and testing activity reports submitted to NMFS. | • Mitigation is designed to reduce exposure of humpback whales in important seasonal reproductive habitat to levels of sound that have the potential to cause injurious or behavioral effects. |
| Explosives | • The Action Proponents will not detonate in-water explosives (including underwater explosives and explosives deployed against surface targets) within the mitigation area (year-round). | • Mitigation is designed to prevent exposure of humpback whales in important seasonal reproductive habitat to explosives that have the potential to cause injury, mortality, or behavioral disturbance. |
| Acoustic, Explosives, Physical disturbance and strike | • The Navy will issue an annual seasonal awareness notification message to alert ships and aircraft operating in the Marpi Reef Mitigation Area and Chalan Kanoa Reef Mitigation Area to the possible presence of increased concentrations of humpback whales from December 1 through April 30. To maintain safety of navigation and to avoid interactions with large whales during transits, the Navy will instruct vessels to remain vigilant to the presence of humpback whales that, when concentrated seasonally, may become vulnerable to vessel strikes.<br>• Platforms will use the information from the awareness notification messages to assist their visual observation of applicable mitigation zones during training and testing activities and to aid in the implementation of activity-based mitigation. | • Mitigation is designed to minimize potential humpback whale vessel interactions and exposure to acoustic, explosive, and physical disturbance and strike stressors that have the potential to cause mortality, injury, or behavioral disturbance during the reproductive season. |
| **Chalan Kanoa Reef** | | |
| Acoustic | • From December 1 to April 30, the Action Proponents will not use more than 20 combined hours of MF1 and MF1C surface ship hull- | • Mitigation is designed to avoid or reduce exposure of humpback whales in important |

| Category | Mitigation Requirements | Mitigation Benefits |
|---|---|---|
| | mounted mid-frequency active sonar during training and testing within the Marpi Reef and Chalan Kanoa Reef mitigation areas.<br>• The Navy will report the total hours of active sonar (all bins, by bin) used in the Marpi Reef Mitigation Area and Chalan Kanoa Reef Mitigation Area from December 1 to April 30 in its annual training and testing activity reports submitted to NMFS. | seasonal reproductive habitat and sea turtles foraging at or near the reef to levels of sound that have the potential to cause injurious or behavioral effects. |
| Explosives | • The Action Proponents will not detonate in-water explosives (including underwater explosives and explosives deployed against surface targets) within the mitigation area (year-round). | • Mitigation is designed to prevent exposure of humpback whales in important seasonal reproductive habitat and sea turtles foraging at or near the reef to explosives that have the potential to cause injury, mortality, or behavioral disturbance. |
| Acoustic, Explosives, Physical disturbance and strike | • The Navy will issue an annual seasonal awareness notification message to alert ships and aircraft operating in the Marpi Reef Mitigation Area and Chalan Kanoa Reef Mitigation Area to the possible presence of increased concentrations of humpback whales from December 1 through April 30. To maintain safety of navigation and to avoid interactions with large whales during transits, the Navy will instruct vessels to remain vigilant to the presence of humpback whales that, when concentrated seasonally, may become vulnerable to vessel strikes.<br>• Platforms will use the information from the awareness notification messages to assist their visual observation of applicable mitigation zones during training and testing activities and to aid in the implementation of activity-based mitigation. | • Mitigation is designed to minimize potential humpback whale vessel interactions and exposure to acoustic, explosive, and physical disturbance and strike stressors that have the potential to cause mortality, injury, or behavioral disturbance during the reproductive season. |
| **Agat Bay Nearshore** | | |
| Acoustic | • The Action Proponents will not use MF1 or MF1C surface ship hull-mounted mid-frequency active sonar during training and testing annually within the mitigation area (year-round). | • Mitigation is designed to avoid or reduce exposure of spinner dolphins in seasonally important resting habitat and sea turtles in foraging habitat to levels of sound that have the potential to cause injurious or behavioral effects. |
| Explosives | • The Action Proponents will not detonate in-water explosives (including underwater explosives and explosives deployed against surface targets) within the mitigation area (year-round). | • Mitigation is designed to prevent exposure of spinner dolphins in seasonally important resting habitat and sea turtles in foraging habitat to explosives that have the potential to cause injury, mortality, or behavioral disturbance. |

## 4.8 Terrestrial Mitigation

The Action Proponents implement terrestrial mitigation on FDM, which serves as the only land-based area for activities like air-to-ground bombing and naval surface fire support. Recognized as an important habitat, FDM supports several endangered and protected species, including the Micronesian megapode, Mariana fruit bat, and various migratory seabirds. Because the island's unique environment allows for training under realistic combat conditions, the Action Proponents have developed a baseline of protection designed to minimize the physical and biological impact on these sensitive resident populations.

To protect these species, the Action Proponents enforce strict restrictions on the locations and types of ordnance used, particularly in the northern SUA where megapodes and fruit bats are most likely to forage and roost. Furthermore, ship-based bombardment is strategically limited to firing from the west to prevent disturbances to major seabird rookeries located on the island's eastern cliffs. These measures represent the highest level of mitigation that remains operationally practical, ensuring that essential military readiness tasks can coexist with the preservation of FDM's diverse avian and bat populations.

Table 4.8-1 details terrestrial mitigation measures related to physical disturbance, strikes, and explosives on FDM. The mitigation is a continuation from the 2020 SEIS/OEIS.

**Table 4.8-1: Farallon de Medinilla Mitigation Requirements**

| Category | Mitigation Requirements | Mitigation Benefits |
|---|---|---|
| Physical Disturbance and Strikes | • The Navy will not use explosive cluster weapons, scatterable munitions, fuel air explosives, incendiary munitions, depleted uranium rounds, and bombs greater than 2,000 lb. within the mitigation area (year-round).<br>• The Navy will not target the northern Special Use Area and the narrow land bridge with explosive or non-explosive ordnance (year-round).<br>• The Navy will not use explosive ordnance in Impact Area 1 (year-round)<br>• The Navy will only target Impact Areas 1, 2, and 3 during air-to-ground bombing, missile, and gunnery exercises.<br>• The Navy will only fire from the west during ship-based bombardment.<br>• Navy personnel will not be authorized on FDM without approval from Joint Region Marianas Operations.<br>• During training activities involving aircraft dropping explosive or non-explosive ordnance on a surface target, mitigation will include visual observation immediately before and during the exercise. Firing will cease if a sea turtle is observed (on shore) in the vicinity of the intended impact location. Firing will recommence if the sea turtle is observed exiting the vicinity of the intended impact location, or if the intended impact location has been repositioned to a new location (i.e., to where the sea turtle is no longer within the vicinity of the intended impact location). | • Mitigation is designed to avoid or reduce exposure of birds, bats, and sea turtles that occur on land to physical disturbance and strikes that have the potential to cause injury, mortality, or behavioral disturbance.<br>• Certain mitigations provide further benefit by reducing the potential for physical damage to the island. |
| Explosives | | • Mitigation is designed to prevent exposure of birds, bats, and sea turtles that occur on land to explosives that have the potential to cause injury, mortality, or behavioral disturbance. |

## 4.9 Summary of New or Modified Mitigation Requirements

Table 4.8-2 summarizes new mitigation measures and substantive modifications to existing measures.

**Table 4.9-1: Summary of New or Modified Mitigation Requirements**

| Category | Changes in Mitigation Requirements for this SEIS/OEIS |
|---|---|
| **Activity-based Mitigation** | |
| **Lookout Teams** | This SEIS/OEIS includes a requirement for additional personnel on the platform conducting the event, or on additional participating platforms, to serve as part of the Lookout Team for all acoustic, explosive, and physical disturbances and strike stressor mitigation categories. In the 2020 SEIS/OEIS, additional personnel were required to assist Lookouts for explosive events only. The Action Proponents have also been, in practice, implementing this for active sonar and non-explosive events, and are now formalizing their current practice as a requirement. Additionally, the *U.S. Navy Lookout Training Handbook* was updated in 2022 to include a more robust chapter on environmental compliance, mitigation, and marine species observation tools and techniques (NAVEDTRA 12968-E). These changes are collectively designed to improve the effectiveness of activity-based mitigation. |
| **Broadband and Other Active Acoustic Sources** | For this SEIS/OEIS, a 200-yd. shut down mitigation zone would apply broadband and other active acoustic sources less than 200 dB, while the tiered 1,000-yd. power down/500-yd. power down/200-yd. shut down mitigation zones would apply to those sources greater than or equal to 200 dB. This requirement is meant to encompass new acoustic sources (e.g., sources used for oceanographic and acoustic research) that use a range of frequencies. Broadband source mitigation zones were not specified in the 2020 SEIS/OEIS. |
| **High-Altitude Aircraft** | This SEIS/OEIS clarifies that aircraft operating at high altitudes (e.g., Maritime Patrol Aircraft) are exempt from requirements to conduct activity-based mitigation. When operating at high altitudes, observations for marine mammals or sea turtles would not be effective. |
| **Vessel Movements** | This SEIS/OEIS clarifies that one or more Lookouts will be posted in accordance with the most recent navigation guidance, which is subject to change over time. The 2020 SEIS/OEIS required one Lookout on underway vessels. |
| **Unmanned Vehicles** | This SEIS/OEIS includes new activity-based mitigation requirements for applicable events that involve Unmanned Surface Vehicles and Unmanned Underwater Vehicles (and the sources they use, tow, or deploy) that are already being escorted and operated under positive control by a manned surface vessel. In the 2020 SEIS/OEIS, activity-based mitigations were not required for unmanned vehicles or sources they used, towed, or deployed. |
| **Research-Based Sub-Surface Explosives** | This SEIS/OEIS includes requirements for "research-based sub-surface explosives" to account for new explosive events with research applications (e.g., oceanographic and acoustic research) that would use 0.1 to 5-lb. NEW. |
| **Geographic Mitigation** | |
| **Artificial Reef, Hard Bottom Substrate, and Shipwreck Mitigation Areas** | This SEIS/OEIS includes new mitigation for precisely placed seafloor devices developed for hard bottom substrate during the 2022 Hawaii-Southern California Training and Testing Study Area's Essential Fish Habitat consultation reinitiation (U.S. Department of the Navy, 2022). For this SEIS/OEIS, that mitigation is being applied to the whole mitigation area category of hard bottom substrate as well as artificial reefs and shipwrecks for consistency and practicality of implementation. |

## 4.10 Mitigation Considered but Eliminated

Mitigation measures that were considered but eliminated for not meeting the appropriate balance between being environmentally beneficial and practical to implement are described in Table 4.10-1.

**Table 4.10-1: Mitigation Considered but Eliminated**

| Mitigation Considered | Not Sufficiently Beneficial | Impractical | | | Assessment Summary |
|---|---|---|---|---|---|
| | | Criterion 1: Safety | Criterion 2: Sustainability | Criterion 3: Mission | |
| 1. Mitigation for navigation sonar | | X | | | Shutting down or powering down active sonar used for safety of navigation would present unacceptable safety risks to personnel and equipment |
| 2. Activity-based Mitigations for long-duration acoustic sources | | | X | | Long-duration active sonar sources, such as the low-level sources used by the Office of Naval Research for acoustic and oceanographic research, are deployed in remote locations for long time spans (e.g., 1 year). Adding visual observers would require substantial additional resources (i.e., personnel and equipment) in excess of what is available, and associated increases in operation costs. |
| 3. Activity-based Mitigations for acoustic sources not under positive control | | | | X | Activity-based mitigations for active sonar sources not under positive control would not be effective because these types of sources could not be powered down or shut down in response to a sighting after they are deployed. Maintaining positive control throughout the duration of the training or testing activity could result in degraded realism or a reduced ability to meet pre-deployment certification requirements. |
| 4. Activity-based Mitigations for high-altitude aircraft | | | X | X | Visual observations by Lookouts positioned in aircraft operating at high altitudes would not be effective due to the vertical distance between mitigation zone and observation platform. Additional maneuvering to lower altitudes where visual observations are effective would degrade training or testing realism and result in increased operational cost associated with higher fuel consumption. |
| 5. Activity-based Mitigations for manned escort vessels for all use of unmanned platforms | | | X | | Unmanned platforms are remotely controlled or designed to operate independently, oftentimes in remote locations or for long time spans. Adding escort vessels (when they are not already participating in an event) for the purpose of activity-based mitigation would require substantial additional resources (i.e., personnel and equipment) in excess of what is available, and an associated increase in operational costs. |

## Table 4.10-1: Mitigation Considered but Eliminated (continued)

| Mitigation Considered | Not Sufficiently Beneficial | Impractical | | | Assessment Summary |
|---|---|---|---|---|---|
| | | Criterion 1: Safety | Criterion 2: Sustainability | Criterion 3: Mission | |
| 6. Adding third-party marine species observers to conduct visual observations that inform mitigations for additional even types | | X | X | X | Adding third-party visual observers to observe additional event types would require additional resources in excess of what is available (i.e., berthing and space availability), and an associated increase in operational costs. The use of third-party observers presents security clearance issues, as well as national security concerns due to the requirement to provide advance notification of specific times and locations of platform movements and activities (e.g., vessels using active sonar). Events may occur simultaneously and in various locations throughout the Study Area, and some may last for a long period of time (e.g., weeks). Event timetables may be based on free-flow development of tactical situations and cannot be precisely fixed to accommodate arrival of third-party aircraft or vessels. Pre-event surveys to clear areas prior to an event begins would be ineffective for the purpose of real-time mitigation (e.g., the location of a moving animal in proximity to the mitigation zone would change, animals could move in or out of the event area after surveys have been completed). For offshore events, the length of time observers would spend on station would be limited due to aircraft fuel restrictions. Increased safety risks would be associated with offshore surveys and the presence of civilian aircraft or vessels in the vicinity of events (e.g., sea space conflicts, airspace conflicts, proximity to explosives). |
| 7. Requiring active sonar mitigation for marine mammals swimming at the bow, alongside the vessel, or directly behind the vessel | X | | | X | Marine mammals (e.g., dolphins) intentionally bow-riding, swimming alongside to wake-ride, or pursuing underway vessels would be out of the main active sonar transmission axis. Furthermore, implementing mitigation for animals persistently located within an active sonar mitigation zone (due to their intentional pursuit of underway vessels) would have the same types of effects on mission requirements as increasing the mitigation zone size, which is described in row 15 of this table. |
| 8. Adding additional Lookouts or observation platforms | | X | X | X | The number of required Lookouts and observation platforms is based on resource availability (i.e., crews, platforms, and equipment) safety considerations (i.e., space restrictions, sea space or airspace conflicts), and duty assignments (e.g., requiring additional personnel or reassigning duties). Adding vessels or aircraft to observe a mitigation zone would result in sea space or airspace conflicts with the event participants. For explosives, weapon firing, or ordnance deployment, this would increase safety risks due to the presence of additional vessels or aircraft within the vicinity of explosives, intended impact locations, or projectile paths. Sea space and airspace conflicts would either require participating platforms to modify their flight plans or vessel movement tracks (which would reduce event realism) or force the added observation platforms to position themselves a safe distance away from the activity area (which would not be effective). However, additional personnel on platforms conducting the events, or on additional participating platforms, will serve as part of the Lookout Team for all acoustic, explosive, and physical disturbance and strike stressor mitigation categories as described in Section 4.6. |
| 9. Developing additional weapon firing mitigation zones | X | | | | Weapon firing noise from weapon systems other than large caliber guns (which are deck-mounted on surface ships with a muzzle that extends over the water) would not expose marine mammals or sea turtles to potentially injurious levels of underwater sound. |
| 10. Developing a mitigation zone for non-explosive vessel-deployed mines | X | | | | Mitigation zones for non-explosive vessel-deployed mines is not warranted because of the extremely low potential for physical strike of a marine mammal or sea turtle from a mine deployed so close to the water surface (by vessels that are implementing vessel movement mitigation for marine mammals and sea turtles), or below the surface for submarine-deployed mines. |

## Table 4.10-1: Mitigation Considered but Eliminated (continued)

| Mitigation Considered | Not Sufficiently Beneficial | Impractical | | | Assessment Summary |
|---|---|---|---|---|---|
| | | Criterion 1: Safety | Criterion 2: Sustainability | Criterion 3: Mission | |
| 11. Developing mitigation zones around aerial targets | X | | | | Mitigation zones for explosive and non-explosive weapon firing is not warranted for ordnance fired against air targets because there is no potential for direct effect because the detonations occur in air, and the potential for projectile fragments to co-occur in space and time with a marine mammal or sea turtle at or near the surface is extremely low. |
| 12. Developing mitigation zones for surface-to-surface and shore-to-surface missiles and rockets | X | | X | X | Mitigation zones apply to missiles and rockets deployed from aircraft because aircraft can fly over the intended impact area prior to commencing firing. Mitigation would not be effective for vessel- or shore-deployed missiles and rockets (without requiring additional observation platforms) because of the distance between the firing platform and target location. It would not be possible for vessels to conduct close-range observations due to the length of time (and associated operational costs and event delays) it would take to complete observations and then transit back to the firing position (typically around 15 or 75 NM each way, depending on the event). |
| 13. Establishing a minimum pre-event or post-event observation duration for additional events | | | X | X | Some events have established minimum time requirements for observations prior to the initial start of an event or after completion of an event, while the time requirements for other events must remain more general to accommodate dynamic event schedules or other operational factors. Requiring minimum pre-event or post-event observation durations would have the same types of effects on mission requirements as increasing the mitigation zone size as described in row 15 of this table. |
| 14. Using developmental mitigation technologies for mitigation | X | | | | As described in Section 4.5, the Action Proponents plan to continue investing in research on and development of mitigation technologies, such as infrared, thermal detection, unmanned aerial vehicles, passive acoustic range instrumentation, and automated detection software or sensors. The development of any associated mitigation measures will be undertaken in coordination with NMFS through the adaptive management process. |
| 15. Increasing mitigation zone sizes, or extending the post-sighting wait periods beyond 10 or 30 minutes | | X | X | X | Increasing mitigation zone sizes or post-sighting wait periods would potentially increase the number of instances and the total length of time activities would be ceased or delayed. This would significantly diminish realism in a way that would prevent activities from meeting intended objectives and decrease the ability to complete events as required and on time. This would have implications for fuel restrictions (e.g., need for aircraft to go off station to refuel), personnel fatigue, range scheduling (e.g., sea space and air space conflicts), and operational costs. Multiple refueling events could double (or more) event length, which would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the event area. For events with multiple participants, degrading the training or testing value of one event element degrades the value of all other elements. For active sonar events, requiring additional or lengthier power downs or shutdowns would create fundamental differences in how active sonar would be used in training versus real-world missions. For example, additional power downs or shutdowns would prevent sonar operators from developing and maintaining awareness of the tactical picture. Without realistic training in conditions analogous to real-world missions, sonar operators cannot become proficient in effectively operating active sonar. Sonar operators, vessel crews, and aircrews would be expected to operate sonar during real-world missions in a manner inconsistent with how they were trained. Diminishing proficiency or eroding capabilities presents significant risk to personnel safety during real-world missions and impacts affects the ability to deploy with required levels of readiness necessary to accomplish tasking by Combatant Commanders or other national security tasking. |

## Table 4.10-1: Mitigation Considered but Eliminated (continued)

| Mitigation Considered | Not Sufficiently Beneficial | Impractical | | | Assessment Summary |
|---|---|---|---|---|---|
| | | Criterion 1: Safety | Criterion 2: Sustainability | Criterion 3: Mission | |
| | | | | | For events involving explosives, weapon firing, or ordnance deployment, requiring additional or lengthier delays or shut downs would cause a significant loss of training or testing time, reduce the number of opportunities crews have to fire or deploy ordnance on a target, decrease realism, impede the ability for crews to train and become proficient in using weapons or systems, prevent development of the ability to react to changes in the tactical situation or respond to incoming threats, cause significant delays to training or testing schedules, prevent units from meeting individual training and certification requirements, prevent units from deploying with the level of readiness necessary to accomplish their missions, and impede the ability of program managers and weapons system acquisition programs to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. For SINKEX, explosive torpedo events, and medium- or large caliber gunnery events, visual observations within the margin of increased mitigation zone size would be unsafe and ineffective unless additional observation platforms were allocated. Mission-essential safety protocols require all event participants (including Lookouts) to maintain focus on the activity area for safety of the public, personnel, and equipment. Mitigation zone sizes are correlated with the activity area; therefore, an increase in mitigation zone size would not meet the safety criteria. For example, when air-to-surface medium-caliber gunnery events involve fighter aircraft descending on a target, or rotary-wing aircraft flying a racetrack pattern and descending on a target using a forward-tilted firing angle, maintaining focused attention on the activity area is paramount to aircraft safety. Vessel movement mitigation for marine mammals is based on guidance from NMFS and the USFWS. A mitigation zone size is not specified for sea turtles to allow flexibility based on vessel type and mission requirements (e.g., small boats operating in a narrow harbor). For towed in-water devices, mission and safety requirements determine the operational parameters (e.g., course) for towing platforms. Because these devices are towed and not self-propelled, they generally have limited maneuverability and are unable to make immediate course corrections. For example, a high degree of pilot skill is required when rotary-wing aircraft are deploying in-water devices, safely towing them at relatively low speeds and altitudes, and recovering them. The aircraft can safely alter course to shift the route of the towed device in response to a sighted marine mammal or sea turtle up to a certain extent |
| | | | | | (i.e., up to the size of the mitigation zone) while still maintaining the parameters needed for stable towing. However, the aircraft would be unable to further alter its course to more drastically course-correct the towed device without decreasing towing stability, which would have implications for safety of personnel and equipment. |
| 16. Implementing mandatory vessel speed restrictions | | X | X | X | As described in Section 4.6.2, vessel movement mitigation involves maneuvering to maintain a specified distance from marine mammals and sea turtles, which may include reducing speed. As described in Section 2.3.3 of the 2020 SEIS/OEIS, vessels used under the Proposed Action are required to operate in accordance with applicable navigation rules. In addition, vessels transit at speeds that are optimal for fuel conservation, to maintain schedules, and to meet mission requirements. Vessel captains use the totality of the circumstances to ensure the vessel is traveling at appropriate speeds in accordance with navigation rules. Depending on the circumstances, this may involve adjusting speeds during periods of reduced visibility or in certain locations (e.g., locations with other vessel traffic).<br>For training, mandatory vessel speed restrictions would be impractical to implement because vessel operators need to train to operate vessels safely and proficiently as they realistically would during real-world missions, including being able to react to changing tactical situations and evaluate system capabilities. For example, during training activities involving flight operations from an aircraft carrier, the vessel must maintain a certain wind speed over the deck to launch or recover aircraft. Depending on wind conditions, the aircraft carrier itself must travel at a certain speed to generate the wind required to launch or recover aircraft. Additionally, operating vessels at speeds that are not optimal for fuel conservation or mission |

## Table 4.10-1: Mitigation Considered but Eliminated (continued)

| Mitigation Considered | Not Sufficiently Beneficial | Impractical | | | Assessment Summary |
|---|---|---|---|---|---|
| | | Criterion 1: Safety | Criterion 2: Sustainability | Criterion 3: Mission | |
| | | | | | requirements would be unsustainable due to increased time on station and operational costs. Seasonal vessel speed restrictions would result in vessels being unable to meet all of their requirements during their limited time available to be underway based on the complex logistical considerations involved with maintaining individual vessel and deployment schedules. For testing and research, the Action Proponents need to test the full range of their vessels and vessel-deployed system capabilities to ensure safety and functionality in conditions analogous to real-world missions, and before full-scale production or delivery to the fleet. For example, the Action Proponents conduct propulsion testing specifically to test the functionality of vessel propulsion systems, including maneuvering, full-power runs, and endurance runs. During this event, vessels must operate across the full spectrum of capable speeds to accomplish the primary testing objectives. |
| 17. Additional geographic mitigation for active sonar in areas with certain bathymetric features | | | | X | The Action Proponents select locations for certain active acoustic activities based on water depths that are ideal for acoustic propagation research, seafloor types, or bathymetric phenomena (e.g., seamounts) that are of particular interest for ocean acoustic research and realism of military readiness activities. Shifting events to alternative or sub-ideal locations to avoid certain bathymetric features (e.g., shelf breaks, underwater canyons) would preclude ready access to the environmental and oceanographic conditions needed to meet mission objectives. |
| 18. Restrictions on the location or timing of major training exercises | | X | | X | Major training exercises may require large areas of the littorals, open ocean, and nearshore areas for realistic and safe anti-submarine warfare training. Exercise locations may have to change during an exercise or during exercise planning based on assessments of unit performance or other conditions, such as weather and mechanical issues, which precludes the ability to develop restrictions on event location or timing within the Study Area. |
| 19. Restricting training activities to certain established locations | | X | | X | Modern sensing technologies make training on a large scale without observation more difficult. A foreign military's continual observation of U.S. military training in predictable geographic areas and timeframes would enable foreign nations to gather intelligence and subsequently develop techniques, tactics, and procedures to potentially and effectively counter U.S. military operations. Other activities may be conducted on a smaller and more localized scale, with training or testing at discrete locations that are critical to certain aspects of readiness. Threats to national security are constantly evolving, and the Action Proponents require the ability to adapt training to meet these emerging threats. Restricting access to broad-scale areas of water would impact the ability for training to evolve as threats evolve. Eliminating opportunities to train in myriad at-sea conditions would put U.S. forces at a tactical disadvantage during real-world missions. This would also present a risk to national security if potential adversaries were to be alerted to the environmental conditions within which training has been prohibited. |
| 20. Restrictions on explosives and non-explosive stressor use near additional types of seafloor resources | | | | X | Implementing additional mitigation for other activities or types of seafloor resources would not allow the Action Proponents to continue meeting their mission requirements to successfully accomplish readiness objectives due to restrictions on ready access to a significant portion of the Study Area. |
| 21. Prohibiting activities in areas with low historic | | | | X | The frequency at which an area is used for training or testing does not necessarily equate to its level of importance for meeting an activity objective or collectively contributing to meeting mission requirements. Some infrequently used areas are critical for a particular event. |

## Table 4.10-1: Mitigation Considered but Eliminated (continued)

| Mitigation Considered | Not Sufficiently Beneficial | Impractical | | | Assessment Summary |
|---|---|---|---|---|---|
| | | Criterion 1: Safety | Criterion 2: Sustainability | Criterion 3: Mission | |
| use for training and testing | | | | | |
| 22. Additional seasonal restrictions for training and testing based on species occurrence or density | | X | X | X | Training and testing schedules are based on national tasking, the Optimized Fleet Response Plan and other training plans, Department of Homeland Security strategic goals, evolving geopolitical world events, forecasting of future testing requirements, deployment schedules, maintenance schedules, acquisition schedules, and emerging requirements. The Action Proponents require flexibility in the timing of their use of active sonar and explosives in order to meet mission and deployment schedules. Vessels, aviation squadrons, and testing programs have a limited amount of time available for training and testing. Variables such as maintenance and weather must be accounted for when scheduling event locations and timing. Event locations may have to change during an event or during pre-event planning based on assessments of unit performance or other conditions, such as inclement weather (e.g., hurricanes) and mechanical issues. This precludes the ability to completely prohibit events from occurring seasonally within areas delineated by marine species occurrence or seasonal densities. |
| 23. Restricting active sonar based on time of day or visibility (e.g., weather conditions) | | | | X | Although the majority of active sonar use occurs during the day, the Action Proponents may have a nighttime training requirement for some systems. Training in both good visibility (e.g., daylight, favorable weather conditions) and low visibility (e.g., nighttime, inclement weather conditions) is vital because environmental differences between day and night and varying weather conditions affect sound propagation and the detection capabilities of sonar. Temperature layers that move up and down in the water column and ambient noise levels can vary significantly between night and day. This affects sound propagation and could affect how sonar systems function and are operated. |
| 24. Blanket geographic restrictions within certain regions or areas (e.g., distances from shore) | | X | X | X | Blanket expansions on the scope or size of mitigation areas would encroach upon the primary water space where military readiness activities are scheduled to occur. The Action Proponents select locations for their events based on proximity to training ranges, available airspace, unobstructed sea space, aircraft emergency landing fields, target storage and deployment locations, systems command support facilities, and areas of historical use that provide critical known bathymetric features and consistency for comparative data collection. Requiring the Action Proponents to shift activities to alternative locations or farther offshore would have significant effects on safety, sustainability, and the ability to meet mission requirements within limited available timeframes. For example, certain surface-to-surface and air-to-surface small, medium, and large caliber gunnery activities and missile and rocket activities, must be conducted in proximity to the target storage depots because the associated targets (e.g., remotely controlled jet ski targets) are limited by how far offshore they can safely be employed and controlled based on distance, weather, and sea state. Certain training activities, such as deployment certification exercises that involve integration with multiple warfare components, require large areas of the littorals and open ocean for realistic and safe training. Similarly, the testing community is required to install and test systems on platforms at the locations where those platforms are stationed. Logistical support of range testing can only efficiently and effectively occur when the support is co-located with the testing activities. Some types of pierside and at-sea testing must occur in proximity to naval shipyards or contractor shipyards.<br>Nearshore areas also serve as critical training and testing locations for certain explosive activities. For example, the explosive ordnance disposal training location at the Silver Strand Training Complex is vital due to its existing target setup, ideal bottom structure, and good bottom depth to safely train divers with explosives. Explosive ordnance disposal teams can be required to deploy with a 3-week notice, which presents a need to constantly train to maintain readiness for real-world missions. |

## Table 4.10-1: Mitigation Considered but Eliminated (continued)

| Mitigation Considered | Not Sufficiently Beneficial | Impractical | | | Assessment Summary |
|---|---|---|---|---|---|
| | | Criterion 1: Safety | Criterion 2: Sustainability | Criterion 3: Mission | |
| | | | | | Relocating this activity to a location without these features would increase safety risks and diminish the effectiveness of training events. |
| 25. Implementing active sonar ramp-up | X | | | X | Implementing active sonar ramp-up procedures during training or testing under the Proposed Action would not be representative of real-world missions and would significantly affect realism. For example, during an anti-submarine warfare exercise using active sonar, ramp-ups would alert opponents (e.g., target submarines) to the transmitting vessel's presence. This would defeat the purpose of the training by allowing the target submarine to detect the searching unit and take evasive measures, thereby denying the sonar operator the opportunity to learn how to locate the submarine. Additionally, based on the source levels, vessel speeds, and sonar transmission intervals that will be used during typical active sonar activities under the Proposed Action, ramp-up would likely be an ineffective mitigation measure for the active sonar activities conducted under the Proposed Action. |
| 26. Reducing annual active sonar hours, replacing active sonar with passive sonar, or modifying active sonar sources for training | | | | X | Passive sonar and other available sensors are used in concert with active sonar to the maximum extent practical. Training with active sonar is essential to national security. Active sonar is the only reliable technology for detecting and tracking potential enemy diesel-electric submarines. Equipment power levels are set consistent with mission requirements. Active sonar signals are designed explicitly to provide optimum performance at detecting underwater objects (e.g., submarines) in a variety of acoustic environments. The ability to effectively operate active sonar is a highly perishable skill that must be repeatedly practiced during realistic training. The Action Proponents must train in the same mode and manner in which they conduct real-world missions. Anti-submarine warfare training typically involves the periodic use of active sonar to develop the "tactical picture," or an understanding of the battle space (e.g., area searched or unsearched, identifying false contacts, and understanding the water conditions). This can take from several hours to multiple days and typically occurs over vast areas with varying physical and oceanographic conditions (e.g., bathymetry, topography, surface fronts, and variations in sea surface temperature). Sonar operators train to avoid interference and sound-reducing clutter from varying ocean floor topographies and environmental conditions, practice coordinating their efforts with other sonar operators in a strike group, develop skill proficiency in detecting and tracking submarines and other threats, and practice the focused endurance vital to effectively working as a team in shifts around the clock until the conclusion of the event. The Action Proponents use active sonar only when it is essential to the mission. For example, for this EIS/OEIS, the Action Proponents are using a representative level of activity (rather than a maximum tempo of training activity in every year), which has reduced the amount of mid-frequency active sonar hours estimated to be necessary to meet training requirements relative to the 2020 SEIS/OEIS. |
| 27. Replacing active sonar training with synthetic activities (e.g., computer simulated training) | | | | X | The Action Proponents currently use, and will continue to use, computer simulation to augment training whenever possible. Simulators and synthetic training are critical elements that provide early skill repetition and enhance teamwork; however, they cannot replicate the complexity and stresses faced during real-world missions to which the Action Proponents train under the Proposed Action (e.g., anti-submarine warfare training using surface ship hull-mounted mid-frequency active sonar). Just as a pilot would not be ready to fly solo after simulator training, operational Commanders cannot allow personnel to engage in real-world missions based solely on simulator training. |
| 28. Restricting active sonar training during surface ducting conditions | | | | X | Surface ducting occurs when water conditions, such as temperature layers and lack of wave action, result in little sound energy penetrating beyond a narrow layer near the surface of the water. Submarines have long been known to take advantage of the phenomena associated with surface ducting to avoid being detected by active sonar. Training with active sonar in these conditions is a critical component of readiness because sonar operators need to learn how sonar transmissions |

## Table 4.10-1: Mitigation Considered but Eliminated (continued)

| Mitigation Considered | Not Sufficiently Beneficial | Impractical | | | Assessment Summary |
|---|---|---|---|---|---|
| | | Criterion 1: Safety | Criterion 2: Sustainability | Criterion 3: Mission | |
| | | | | | are altered due to surface ducting, how submarines may take advantage of them, and how to operate sonar effectively under these conditions. Avoiding military readiness activities during surface ducting conditions, reducing power, shutting down active sonar based on environmental conditions, or implementing other sonar modification techniques (e.g., sound shielding) for the purpose of mitigation would affect a Commander's ability to develop the tactical picture. It would also prevent sonar operators from training in conditions analogous to those faced during real-world missions, which is described in row 15 of this table. The ocean conditions contributing to surface ducting change frequently, and surface ducts lack uniformity, may or may not extend over a large geographic area and can be of varying duration, making it difficult to determine where to reduce power and for how long. As noted by the U.S. Supreme Court in Winter v. Natural Resources Defense Council Inc., 555 U.S. 7 (2008), because surface ducting conditions occur relatively rarely and are unpredictable, it is especially important for the Action Proponents to be able to train under these conditions when they occur. |
| 29. Requiring use of active acoustic monitoring devices | | X | X | X | During Surveillance Towed Array Sensor System low-frequency active sonar (which is not part of the Proposed Action), the Navy uses a specially designed adjunct high-frequency marine mammal monitoring active sonar, or "HF/M3." HF/M3 can only be towed at slow speeds and operates like fish finders used by fishermen. Installing the HF/M3 adjunct system on the tactical sonar ships used under the Proposed Action would have implications for safety and mission requirements due to effects on speed and maneuverability, as well as excessive additional operating costs. |
| 30. Requiring mitigation based on passive acoustic detections of marine mammals | | | X | X | When platforms with passive acoustic monitoring capabilities are already participating in an event, sonar technicians will alert Lookouts to passive acoustic detections of marine mammals as described in Section 4.6. Significant logistical constraints (e.g., personnel and equipment availability, operational costs) would make diverting equipped platforms or constructing and maintaining new passive acoustic monitoring systems impractical. The fluidity and nature of military readiness activities (e.g., fast-paced and mobile readiness evolutions) make it impractical for passive acoustic devices to be used as precise real-time indicators of marine mammal location for the purposes of implementing mitigation (e.g., active sonar power downs or shutdowns, ceasing use of explosives) without an accompanying visual sighting. Implementing mitigation for animals located outside of the mitigation zone (which could occur due to imprecise localizations or relative movements of animals and the mitigation zone) would have the same types of effects on mission requirements as increasing the mitigation zone size, which is described in row 15 of this table. |
| 31. Reducing explosive counts or NEW, or substituting with non-explosives | | | | X | Activities that involve explosives are inherently different from those that involve non-explosive ordnance. For example, critical components of an explosive Bombing Exercise Air-to-Surface include the assembly, loading, delivery, and assessment of the explosive bomb. Explosive bombing training exercises start with ground personnel, who must practice the building and loading of explosive munitions. Training includes the safe handling of explosive material, configuring munitions to precise specifications, and the loading of munitions onto aircraft. Aircrew must then identify a target and safely deliver fused munitions, discern if the bomb was assembled correctly, and determine bomb damage assessments based on how and where the explosive detonated. An air-to-surface bombing exercise using non-explosive ordnance can train aircrews on valuable skills to locate and accurately deliver munitions on a target; however, it cannot effectively replicate the critical components of an explosive activity in terms of assembly, loading, delivery, and assessment of an explosive bomb. Reducing the counts or sizes of explosives would impede the ability for the Action Proponents to train and become proficient in using explosive weapon systems (which would result in a significant risk to personnel safety during real-world missions), and would ultimately prevent units from meeting individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish missions) and impede the ability to certify forces to |

## Table 4.10-1: Mitigation Considered but Eliminated (continued)

| Mitigation Considered | Not Sufficiently Beneficial | Impractical | | | Assessment Summary |
|---|---|---|---|---|---|
| | | Criterion 1: Safety | Criterion 2: Sustainability | Criterion 3: Mission | |
| | | | | | deploy to meet national security tasking. For testing, the Action Proponents need to test the full range of their platforms, weapon systems, and components to ensure safety and functionality in conditions analogous to real-world missions, and before full-scale production or delivery to the fleet. |
| 32. Adopting mitigation implemented by foreign military units | | | | X | Mitigation is carefully developed for and assessed by each individual unit based on their own assessment of mitigation benefits and practicality of implementation. Readiness considerations differ based on each nation's strategic reach, global mission, country-specific legal requirements, and geographic considerations. The Action Proponents will implement mitigation that has been determined to be effective at avoiding effects from the Proposed Action and practical to implement. Many of these measures are the same as, or comparable to, those implemented by foreign navies. For example, most navies implement some form of mitigation to cease certain activities if a marine mammal is visually observed in a mitigation zone (Dolman et al., 2009). Some navies also implement geographic mitigation. The Action Proponents will implement several mitigation measures and environmental compliance initiatives that are not implemented by foreign navies, such as providing extensive support for scientific monitoring and research and complying with stringent reporting requirements. |
| 33. Additional reporting requirements | | X | X | X | The Action Proponents developed their reporting requirements in conjunction with NMFS to be consistent with mission requirements and balance the usefulness of the information to be collected with the practicality of collecting it. The Action Proponents' activity reports and incident reports are designed to verify implementation of mitigation; comply with current permits, authorizations, and consultation requirements; and improve future environmental analyses. Additional reporting would be ineffective as mitigation because it would not result in modifications to training activities or further avoidance or reductions of potential effects. Lookouts are not trained to make species-specific identification and would not be able to provide detailed scientific data if more detailed marine species observation reports were to be required. Furthermore, the Action Proponents do not currently maintain a record management system to collect, archive, analyze, and report every marine species observation or all vessel speed data for every event and all vessel movements. For example, the speed of Action Proponent vessels can fluctuate an unlimited number of times during training or testing events. Developing and implementing a record management system of this magnitude would be unduly cost prohibitive and place a significant administrative burden on vessel operators and activity participants. Burdening operational Commanders, vessel operators, and event participants with requirements to complete additional administrative reporting would distract them from focusing on mission-essential tasks. Additional reporting requirements would draw event participants' attention away from the complex tactical tasks they are primarily obligated to perform, such as driving a warship or engaging in a gunnery event, which would adversely affect personnel safety, public health and safety, and the ability to meet mission objectives. |
| 34. Developing mitigation outside the Action Proponent's legal authority | | | | X | The Action Proponents did not develop mitigation outside their legal authority to implement. For example, the Action Proponents do not have legal authority to develop Marine Protected Areas to restrict commercial or recreational fishing, which is a recommendation received through public comments on previous EIS/OEISs. |
| 35. Vessel movement mitigation for cable laying vessels performing Modernization & | | X | | X | The Action Proponents determined it would be impractical based on safety and mission requirements to implement mitigation for manned surface vessels and towed in-water devices actively conducting cable laying during Modernization & Sustainment of Ranges activities. The vessels performing these activities move very slowly through the water column (e.g., 2-3 kts) to facilitate a gradual, controlled rate of descent to minimize risk of damage to the cable. Additionally, vessels are required to follow a prescribed route based on ROV surveys to ensure the cable is laid on its intended route, predominantly |

## Table 4.10-1: Mitigation Considered but Eliminated (continued)

| Mitigation Considered | Not Sufficiently Beneficial | Impractical | | | Assessment Summary |
|---|---|---|---|---|---|
| | | Criterion 1: Safety | Criterion 2: Sustainability | Criterion 3: Mission | |
| Sustainment of Ranges activity | | | | | sandy bottom habitat avoiding rocky areas, to minimize damage to the cable. Deviating from this route or slowing to a near stop once cable laying has commenced would present risk of damage to cable laying equipment and personnel operating it. |
| 36. Requiring NMFS Protected Species Observer (PSO) certification for Navy Lookouts | X | | X | X | Requiring NMFS PSO certification for Navy Lookouts is impractical and provides insufficient benefit.<br>NOAA's PSO certification requires educational, experiential, and training qualifications, including a background in biological sciences, which are incompatible with the duties and training of a Navy Lookout. Lookouts perform numerous duties beyond observation, including maintaining proficiency in general seamanship and rate-specific skills. Mandating a biological sciences background would drastically reduce the pool of eligible personnel.<br>Furthermore, PSO certification for all Lookouts would create a substantial administrative burden and severely challenge Lookout manning requirements. The Navy operates numerous large vessels (e.g., destroyers, aircraft carriers) and smaller support craft within the action area, each with rotating Lookout crews to manage watch rotations, mitigate fatigue, and ensure vigilance. This rotation, coupled with frequent personnel transfers, would necessitate certifying a large number of Lookouts, significantly complicating manning efforts. Additionally, relying on the NMFS PSO application process could create certification delays incompatible with Navy manning and readiness needs.<br>Existing PSO training curricula vary considerably in frequency, cost, length, activity focus, and geographic scope, and are typically conducted by third-party providers. Establishing a separate Navy PSO training program for Lookouts would be unsustainable within the demanding Optimized Fleet Response Plan and negatively affect Navy readiness.<br>Moreover, Navy Lookouts already must complete Lookout Training, which includes marine resource sighting cues and observation techniques, as well as the roles and responsibilities of Lookouts and the official in charge of an activity. In addition to this training, Lookouts complete NMFS-approved Marine Species Awareness Training. Furthermore, the Lookout Training Handbook was updated in 2022 with a thorough Marine Resources chapter covering topics from identifying indicator species to determining direction of travel.<br>The goal of PSO certification is to ensure that PSOs have the appropriate training to safely and effectively perform their required duties to meet the needs of a particular project. The Navy's Lookout training and qualification program already achieves that goal for Navy's at-sea activities. Therefore, the Navy has determined that PSO certification and/or PSO-specific training would not provide sufficient benefit to outweigh the risk to Navy readiness |

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# Appendix A Military Readiness Activities Descriptions

# Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Mariana Islands Training and Testing

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# APPENDIX A MILITARY READINESS ACTIVITIES DESCRIPTIONS

## A.1 Why the Action Proponents Train

The Action Proponents are statutorily mandated to protect U.S. national security by being ready to effectively prosecute war and defend the nation by conducting operations at sea. Naval operations at sea are essential to protecting U.S. national interests, considering that 70 percent of the earth is covered in water, 80 percent of the planet's population lives within proximity to coastal areas, and 90 percent of global commerce is conducted by sea.

Through its continuous presence on the world's oceans, the Navy can respond to a wide range of situations because, on any given day, over one-third of its ships, submarines, and aircraft are deployed to overseas locations. Before deploying, Sailors and Marines train to develop a broad range of capabilities to respond to threats, from full-scale armed conflict in a variety of different geographic areas and environmental conditions to humanitarian assistance and disaster relief efforts. Training prepares Navy and Marine Corps personnel to be proficient in operating and maintaining the equipment, weapons, and systems they will use to conduct their assigned missions. Refer to Section 1.4.1 in the 2020 SEIS/OEIS for additional information on the Action Proponents' Training.

The USCG has broad, multifaceted, jurisdictional authority for management of activities over all waters subject to jurisdiction of the U.S. The USCG's law enforcement and national defense mission authority is based on 14 U.S.C. section 102, requiring the USCG to "maintain a state of readiness to assist in the defense of the United States, including when functioning as a specialized service in the Navy pursuant to section 103." The USCG has national defense and statutory missions. The four major national defense missions are maritime intercept operations, deployed port operations/security and defense, peacetime engagement, and environmental defense operations. These missions are essential military tasks assigned to the USCG as a component of joint and combined forces in peacetime, crisis, and war. For specific information on the USCG, please refer to Appendix A.1 of this SEIS/OEIS.

The USAF and Army are increasingly required to operate in a marine environment with naval forces and therefore have a requirement to train in this environment.

## A.2 Why the Navy Tests

The Navy's research and acquisition community, including research-funding organizations, laboratory facilities, and SYSCOMs, has a mission to provide weapons, systems, and platforms for the Navy to support its missions and ensure a technological edge over the U.S.'s potential adversaries. This community is at the forefront of researching, developing, testing, evaluating, acquiring, and delivering modern platforms, systems, and related equipment to meet Fleet capability and readiness requirements. The Navy's research-funding organizations and laboratories concentrate primarily on the development of new science and technology, and the initial testing of concepts that are relevant to the Navy in the future. SYSCOMs develop ship, aircraft, and weapons systems that support all Navy platforms throughout their lifecycles from systems acquisition through sustainment to end of life.

Testing of weapons, systems, and platforms must be conducted at sea to ensure these technologies perform as designed and expected in the environment where they will be relied upon by the services.

## A.3 Training Activities

The proposed training activities would be conducted by the U.S. Navy (Navy), U.S. Marine Corps (USMC), U.S. Air Force (USAF), U.S. Army (Army), and U.S. Coast Guard (USCG). The Navy as the lead agency, jointly with the USAF, Army, and USCG, are action proponents for the training activities described in this appendix. The training activities are organized generally into eight primary mission areas and a miscellaneous category (Other Training) that includes those activities that do not fall within a primary mission area but are an essential part of military training.

Descriptions of military readiness activities are included in Data Sheets. Location information provided on the Data Sheets indicate where activities would occur within the broad MITT Study Area. Specific locations which are typically scheduled for the activity are included and are not intended to restrict activity to only those locations.

The tempo of activities (i.e., the number of events per year) are found in Chapter 2, Table 2-4. The number of events per year by Action Proponent (Services) are found at the end of this Appendix. Newly proposed activities in this Draft SEIS/OEIS are designated as a "New Activity." All acronyms included in the Data Sheets are defined in the Acronyms and Abbreviations list within the MITT SEIS/OEIS. All in-water explosive bin descriptions are found in Section 3.0.

In addition, because the military conducts a number of activities within larger training exercises, descriptions of those larger exercises are also included here. It is important to note that these larger exercises are comprised entirely of individual activities described in the primary mission areas. These exercises frequently include multiple services (Navy, USMC, USCG, Army, USAF) and could include foreign participants. Foreign participation is episodic to location and time (by year). Data collected to make assumptions about events has factored a certain number of participants which could include foreign participants.

New technologies and tactics require forces to be distributed over increasingly larger areas to conduct realistic training and testing.

### A.3.1 Major Anti-Submarine Warfare Training Exercises

A major training exercise is comprised of multiple "unit level" activities conducted by several units operating together while commanded and controlled by a single commander. The Anti-Submarine Warfare (ASW) exercises typically employ an exercise scenario developed to train and evaluate the larger integrated force in naval tactical tasks. In a major training exercise, most of the operations and activities being directed and coordinated by the strike group commander are identical in nature to the operations conducted during individual, crew, and smaller-unit training events. In a major training exercise, however, these disparate training tasks are conducted in concert, rather than by an individual smaller unit. Table A-1 describes the differences between major training exercises and smaller integrated/coordinated anti-submarine warfare exercises based on scale, duration, and sonar hours.

**Table A-1: Major Anti-Submarine Warfare Training Exercises and Integrated/Coordinated Anti-Submarine Warfare Training**

| | Exercise Group | Description | Scale | Duration | Location | Exercise Examples | Modeled Hull-mounted Sonar per Exercise |
|---|---|---|---|---|---|---|---|
| **Major Training Exercises** | Large Integrated ASW | Larger-scale, longer duration integrated ASW exercises | Up to three Carrier Strike Groups in coordination with other Services, 2 or more submarines, multiple ASW aircraft | Typically, a 10-day exercise | Study Area | Joint Multi-Strike Group Exercise (e.g., Valiant Shield) | >500 hours |
| ***Integrated/Coordinated Training*** | Small Integrated ASW | Small-scale, short duration integrated ASW exercises | Approximately 3–6 surface ASW units, at least 1 submarine, 2–6 ASW aircraft | Generally, <5 days | Study Area; Apra Harbor | SWATT, NUWTAC | 50–100 hours |
| | Medium Coordinated ASW | Medium-scale, short duration, coordinated ASW exercises | Approximately 2–4 surface ASW units, possibly a submarine, 2–5 ASW aircraft | Generally 3–10 days | Study Area | GuamEx | <100 hours |
| | Small Coordinated ASW | Small-scale, short duration, coordinated ASW exercises | Approximately 2–4 surface ASW units, possibly a submarine, 1–2 ASW aircraft | Generally 2–4 days | Study Area | Group Sail | <50 hours |

Notes: ASW = Anti-Submarine Warfare, SWATT = Surface Warfare Advanced Tactical Training, GuamEx = Guam Exercise, NUWTAC = Naval Undersea Warfare Training Assessment Course

Major ASW training exercises are listed below.

### A.3.1.1 Joint Multi-Strike Group Exercise

| Major Training Exercise - Large Integrated ASW | | |
|---|---|---|
| **Joint Multi-Strike Group Exercise** | | |
| **Short Description** | Typically, a 10-day Joint exercise, in which up to three carrier strike groups would conduct training exercises simultaneously. | |
| **Long Description** | The Joint Multi-Strike Group Exercise, or Fleet Exercise, demonstrates the Navy's ability to operate a large naval force of up to three Carrier Strike Groups in coordination with other Services. In addition to this joint warfare demonstration, it also fulfills the Navy's requirement to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. The exercise would involve Joint assets engaging in a "free play" battle scenario, with U.S. forces pitted against a replicated opposition force. The exercise provides realistic in-theater training.<br><br>Coast Guard cutters and aircraft may participate in this activity.<br><br>Anti-Submarine Warfare exercises could occur concurrent with amphibious activities, which bring forces ashore such as an Amphibious Assault. The MITT action will include anti-submarine warfare exercises and amphibious activities in the water. Land-based amphibious activities on Tinian will be included in CJMT. | |
| **Typical Components** | **Platforms:** Aircraft Carrier, Fixed Wing – Patrol Aircraft, Rotary-Wing Aircraft, Submarine, Surface Combatant, Unmanned Aerial Vehicle – Fixed Wing, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets:** Sub-surface Targets – Maneuvering<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted, Countermeasures, Sonar Systems - Towed, Sonar Systems - Dipping, Sonobuoys<br>**Munitions:** See notes in parameters for analysis | |
| **Active Sonar** | LFH, MFM, MFH, MF1, MF1C, HFH, Broadband (LF to HF), Broadband (MF to HF) | |
| **In-Water Explosives** | See notes in parameters for analysis | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels<br>Towed in-water devices<br>Unmanned vehicles | |
| **Parameters for Analysis** | Only the anti-submarine warfare activities were analyzed as a Joint Multi-Strike Group Exercise. Other warfare area training conducted during the Joint Multi-Strike Group Exercise is analyzed elsewhere as unit-level training (e.g., gunnery exercise, missile exercise). This activity occurs > 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Islands Range Complex | MITT Study Area |
| | MITT Study Area | Mariana Islands Range Complex |

### A.3.2 Integrated/Coordinated Training Anti-Submarine Warfare

Integrated or coordinated anti-submarine warfare training exercises are similar to major training exercises in that they are comprised of several basic, unit-level exercises, with training conducted by an individual unit, but are generally on a smaller scale, are of shorter duration, and use fewer hours of active sonar than a major training exercise.

### A.3.2.1 Surface Warfare Advanced Tactical Training

| Small Integrated Anti-Submarine Warfare Training | | |
|---|---|---|
| **Surface Warfare Advanced Tactical Training** | | |
| **Short Description** | Multiple ships and aircraft coordinate the use of sensors, including sonobuoys, to search, detect, and track a threat submarine. Surface Warfare Advanced Tactical Training (SWATT) exercises are not dedicated anti-submarine warfare exercises and involve multiple warfare areas. | |
| **Long Description** | SWATT is an intermediate training exercise designed primarily to increase operator proficiency and exercise combined force responses to surface warfare, anti-submarine warfare, air warfare and electromagnetic spectrum operations.<br><br>Within the MITT Study Area, SWATT occurs annually and consists of multiple surface warfare, anti-submarine and air warfare live fire events. Multiple ships and aircraft search for, locate, and track one submarine. Occurs once per carrier strike group training cycle.<br><br>Use of other munitions and explosives in SWATT are included in unit-level events.<br><br>Anti-Submarine Warfare exercises could occur with amphibious activities, which bring forces ashore such as Amphibious Assault. | |
| **Typical Components** | **Platforms:** Amphibious Warfare Vessels, Fixed Wing – Patrol Aircraft, Rotary-Wing Aircraft, Submarine, Surface Combatant, Unmanned Aerial Vehicle – Rotary Wing, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted, Countermeasures, Sonar Systems - Towed, Sonar Systems - Dipping, Sonobuoys<br>**Munitions:** See notes in parameters for analysis | |
| **Active Sonar** | LFH, MFM, MFH, MF1, MF1C, Broadband (MF to HF) | |
| **In-Water Explosives** | See notes in parameters for analysis | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels<br>Towed in-water devices<br>Unmanned vehicles | |
| **Parameters for Analysis** | Only the anti-submarine warfare activities were analyzed as a SWATT. Other warfare area training conducted during SWATT was analyzed as unit-level training (e.g., gunnery exercises, missile exercises).<br>This activity occurs > 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.2.2 Small Integrated Anti-Submarine Warfare – NUWTAC/Multi-Sail

| Small Integrated Anti-Submarine Warfare Training | |
|---|---|
| **NUWTAC/Multi-Sail** | |
| **Short Description** | Multiple ships, aircraft, and submarines integrate the use of their sensors, including sonobuoys, to search for, detect, classify, localize, and track a threat submarine. |
| **Long Description** | Small Integrated ASW operations include the Navy Undersea Warfare Training and Assessment Course and Small Joint Coordinated ASW Exercises like Multi-Sail/GUAMEX.<br><br>The Navy Undersea Warfare Training and Assessment Course (NUWTAC) is a tailored course of instruction designed to improve Sea Combat Commander and strike group integrated anti-submarine warfare warfighting skill sets. The submarine may practice simulated attacks against the ships while being tracked. Hull-mounted, towed array, and dipping sonar is employed by ships and helicopters. The submarine also periodically operates its sonar.<br><br>Multi-Sail/GUAMEX is an Anti-Submarine Warfare (ASW) exercise conducted by the forward deployed Navy Strike Groups to sustain and assess their ASW proficiency while located in the Seventh Fleet area of operations, and includes such recent exercises as Sea Dragon, Pacific Griffin, Pacific Vanguard. The exercise is designed to assess the Strike Groups' ability to conduct ASW in the most realistic environment, against the level of threat expected, in order to effect changes to both training and capabilities (e.g., equipment, tactics, and changes to size and composition) of U.S. Navy Strike Groups. The Strike Group receives significant sustainment training value in ASW and other warfare areas, as training is inherent in all at-sea exercises. Additional unit-level activities, such as MISSILEX, may be conducted during these events.<br><br>Anti-Submarine Warfare exercises could occur concurrent with amphibious activities, which bring forces ashore such as Amphibious Assault. |
| **Typical Components** | **Platforms:** Fixed Wing – Patrol Aircraft, Rotary-Wing Aircraft, Submarine, Surface Combatant, Unmanned Aerial Vehicle – Rotary Wing, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br><br>**Targets:** Sub-surface Targets – Maneuvering<br><br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted, Countermeasures, Sonar Systems - Towed, Sonar Systems - Dipping, Sonobuoys<br><br>**Munitions:** See notes in parameters for analysis |
| **Active Sonar** | LFH, MFM, MFH, MF1, MF1C, Broadband (MF to HF) |
| **In-Water Explosives** | See notes in parameters for analysis |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br><br>Active acoustic sources<br>Manned surface vessels<br>Towed in-water devices<br>Unmanned vehicles |

| Small Integrated Anti-Submarine Warfare Training | | |
|---|---|---|
| **NUWTAC/Multi-Sail** | | |
| **Parameters for Analysis** | Only the anti-submarine warfare activities were analyzed as a Small Integrated ASW – NUWTAC/Multi-Sail. All other warfare area training conducted during Small Integrated ASW – NUWTAC/Multi-Sail was analyzed as unit-level training (e.g., gunnery, missile exercise).<br>ASW activity occurs > 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.2.3 Medium Coordinated Anti-Submarine Warfare

| Medium Coordinated Anti-Submarine Warfare Training | | |
|---|---|---|
| **Medium Coordinated Anti-Submarine Warfare** | | |
| **Short Description** | Typically, a 3–10-day exercise with multiple ships, aircraft, and submarines integrating the use of their sensors, including sonobuoys, to search, detect, and track threat submarines. | |
| **Long Description** | Medium coordinated ASW exercises are tailored events designed to train submarines and surface combatants and develop warfighting tactics, techniques, and procedures, and may include torpedo firing. These exercises generally consist of a coordinated training scenario that typically involves two to four surface ships, embarked helicopters, two to three submarines, unmanned vehicles, and maritime patrol aircraft.<br><br>Medium Coordinated Anti-Submarine Warfare exercises include stand-alone ASW events, such as an Anti-Submarine Warfare Tactical Development Exercise (TACDEVEX) or a Group Sail event, generally lasting 3-10 days.<br><br>Anti-Submarine Warfare exercises could occur concurrent with amphibious activities, which bring forces ashore such as Amphibious Assault. | |
| **Typical Components** | **Platforms:** Fixed Wing – Patrol Aircraft, Rotary-Wing Aircraft, Submarine, Surface Combatant, Unmanned Aerial Vehicle – Fixed Wing, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets:** Sub-surface Targets - Maneuvering, Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted, Countermeasures, Sonar Systems - Towed, Safety and Navigation, Sonar Systems - Dipping, Pinger, Sonobuoys<br>**Munitions:** Torpedoes - Exercise, see notes in parameters for analysis | |
| **Active Sonar** | MFM, MFH, MF1, MF1C, HFH, Broadband (LF to HF), Broadband (MF to HF) | |
| **In-Water Explosives** | See notes in parameters for analysis | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels<br>Towed in-water devices<br>Unmanned Vehicles | |
| **Parameters for Analysis** | Only the anti-submarine warfare activities were analyzed as a medium coordinated ASW exercise. All other warfare area training conducted during a medium coordinated ASW exercise was analyzed as unit-level training (e.g., bombing exercises, gunnery exercises, missile exercises). ASW activity occurs > 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.2.4 Independent Deployer Certification Exercise/Tailored Surface Warfare Training

| Small Coordinated Anti-Submarine Warfare Training | | |
|---|---|---|
| **Independent Deployer Certification Exercise/Tailored Surface Warfare Training** | | |
| **Short Description** | Multiple ships, aircraft, and submarines conduct integrated multi-warfare training with a surface warfare. Serves as a ready-to-deploy certification for individual surface ships tasked with surface warfare missions. | |
| **Long Description** | This event stresses planning, coordination, and communications during multiple warfare training scenarios. Multiple ships and multiple helicopters searching for, locating, and attacking a submarine. Typically, one group is actively prosecuting while another group is repositioning. Simultaneously, the submarine may practice simulated attacks against the ships. Example exercises include Pacific Griffin and Pacific Vanguard. Multiple acoustic sources may be active at one time.<br><br>Anti-Submarine Warfare exercises could occur concurrent with amphibious activities, which bring forces ashore such as Amphibious Assault. | |
| **Typical Components** | **Platforms:** Rotary-Wing Aircraft, Submarine, Surface Combatant, Unmanned Aerial Vehicle - Fixed Wing, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Anti-Submarine Warfare systems<br>**Munitions:** See notes in parameters for analysis | |
| **Active Sonar** | See notes in parameters for analysis | |
| **In-Water Explosives** | See notes in parameters for analysis | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels<br>Towed in-water devices<br>Unmanned vehicles | |
| **Parameters for Analysis** | All ASW acoustic sources which may be used during Independent Deployer Certification Exercise/Tailored Surface Warfare Training have been accounted for in the modeling and analysis of ASW Unit Level Training events presented in this Draft SEIS/OEIS. All other warfare area training conducted during Independent Deployer Certification Exercise/Tailored Surface Warfare Training ASW exercise was analyzed as unit-level training (e.g., bombing exercises, gunnery exercises, missile exercises).<br><br>ASW activity occurs > 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area; Mariana Islands Range Complex | MITT Study Area; Mariana Islands Range Complex |

### A.3.3 Air Warfare Training

The mission of air warfare is to destroy or reduce enemy air and missile threats (including unmanned airborne threats) and serves two purposes: to protect U.S. forces from attacks from the air and to gain air superiority. Air warfare provides U.S. forces with adequate attack warnings, while denying hostile forces the ability to gather intelligence about U.S. forces.

Aircraft conduct air warfare through radar search, detection, identification, and engagement of airborne threats. Surface ships conduct air warfare through an array of modern anti-aircraft weapon systems such as aircraft detecting radar, naval guns linked to radar-directed fire-control systems, surface-to-air missile systems, and radar-controlled guns for close-in point defense.

#### A.3.3.1 Air Combat Maneuvers

| **Air Warfare** | | |
|---|---|---|
| **Air Combat Maneuvers** | | |
| **Short Description** | Fixed-wing aircrews aggressively maneuver against threat aircraft to gain tactical advantage. | |
| **Long Description** | Basic flight maneuvers in which fixed-wing aircrew engage in offensive and defensive maneuvering against each other. No ordnance is expended during this training, however countermeasures such as chaff and flares may be used. These maneuvers typically involve two aircraft; however, based upon the training requirement, air combat maneuvers may involve over a dozen aircraft. Includes Air Intercept Control activities from Ph III. | |
| **Typical Components** | **Platforms:** Fixed Wing – Strike Aircraft<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | None | |
| **Parameters for Analysis** | No munitions are fired. Flares and chaff may be used. All flares and chaff are accounted for in flare exercise and chaff exercise.<br><br>This activity occurs greater than 12 NM from land (FDM excepted). | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.3.2 Air Defense Exercise

| Air Warfare | | |
|---|---|---|
| **Air Defense Exercise** | | |
| **Short Description** | Aircrew and ship crews conduct defensive measures against threat aircraft or simulated missiles. | |
| **Long Description** | Fixed-wing aircrew and ship personnel perform measures designed to defend against attacking threat aircraft or missiles or reduce the effectiveness of such attack. This exercise involves full detection through engagement sequence. Aircraft operate at varying altitudes and speeds. This exercise includes air intercept control exercises where aircraft controllers on ships, in fixed-wing aircraft, or at land-based locations, use search radars to track and direct friendly aircraft to intercept the threat aircraft. This exercise also includes detect to engage exercises, where personnel on ships use search radars to detect, classify, and track enemy aircraft or missiles up to the point of engagement. No ordnance is fired during this exercise, however countermeasures, such as chaff and flares, may be used. Coast Guard aircraft may participate in this activity. | |
| **Typical Components** | **Platforms:** Aircraft Carrier, Fixed Wing – Adversary Aircraft, Fixed Wing - Command and Control Aircraft, Fixed Wing – Strike Aircraft, Surface Combatant, Unmanned Aerial Vehicle – Fixed Wing<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | No munitions are fired. Flares and chaff may be used. All flares and chaff are accounted for in flare exercise and chaff exercise.<br><br>This activity occurs > 12 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.3.3 Gunnery Exercise Air-to-Air – Medium Caliber

| Air Warfare | | |
|---|---|---|
| **Gunnery Exercise Air-to-Air - Medium-Caliber** | | |
| **Short Description** | Fixed-wing aircrews fire medium-caliber guns at air targets. | |
| **Long Description** | Fixed-wing aircrews maneuver aircraft in a gunnery pattern to achieve a weapons firing solution with integrated medium-caliber guns. Typically involves two or more fixed-wing aircraft and a target banner towed by a contract aircraft (e.g., Lear jet). The target banner is recovered after the exercise. | |
| **Typical Components** | **Platforms:** Fixed Wing – Strike Aircraft<br>**Targets:** Air Targets - Other<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile - Medium Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | None | |
| **Parameters for Analysis** | This activity is conducted at an altitude of 15,000 ft. and above, during the daytime, and beyond 12 NM from shore (FDM excepted). A towed air target is a banner target and will be recovered. Only non-explosive munitions used. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.3.4 Gunnery Exercise Surface-to-Air – Large Caliber

| **Air Warfare** | | |
|---|---|---|
| **Gunnery Exercise Surface-to-Air - Large-Caliber** | | |
| **Short Description** | Surface ship crews fire large-caliber guns at air targets. | |
| **Long Description** | Surface ship crews defend against threat aircraft or missiles with large-caliber guns to disable or destroy the threat. An exercise involves one ship and a simulated threat aircraft or missile that is detected by the ship's radar. Large-caliber guns fire non-explosive projectiles at the threat before it reaches the ship. The target is towed by a contract air services jet or is an expendable unmanned aerial vehicle. | |
| **Typical Components** | **Platforms:** Surface Combatant<br>**Targets:** Air Targets - Other<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile - Large Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Weapon firing noise | |
| **Parameters for Analysis** | The target is a fiberglass finned target that is towed approximately 3 NM behind the towing aircraft.<br>For Navy exercises all projectiles are assumed to be non-explosive.<br><br>This activity would occur greater than 12 NM from land (FDM excepted). | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.3.5 Gunnery Exercise Surface-to-Air – Medium Caliber

| Air Warfare | | |
|---|---|---|
| **Gunnery Exercise Surface-to-Air - Medium-Caliber** | | |
| **Short Description** | Surface ship crews fire medium-caliber guns at air targets. | |
| **Long Description** | Surface ship crews defend against threat aircraft or missiles with medium-caliber guns to disable or destroy the threat. An exercise involves one ship and a simulated threat aircraft or anti-ship missile that is detected by the ship's radar. Medium-caliber guns fire non-explosive projectiles to disable or destroy the threat before it reaches the ship. The target is towed by a contract air services jet or is an expendable unmanned aerial vehicle. | |
| **Typical Components** | **Platforms**: Surface Combatant<br>**Targets**: Air Targets - Other<br>**Systems being Trained/Tested**: None<br>**Munitions**: Projectile - Medium Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | The target is a fiberglass finned target that is towed approximately 3 nautical miles behind the towing aircraft. The target is typically recovered but may be damaged, resulting in target fragments or loss of target.<br><br>This activity would occur greater than 12 NM from land (FDM excepted). | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.3.6 Missile Exercise Air-to-Air

| Air Warfare | | |
|---|---|---|
| **Missile Exercise Air-to-Air** | | |
| **Short Description** | Fixed-wing aircrews fire air-to-air missiles at air targets. | |
| **Long Description** | An exercise involves two or more fixed-wing aircraft and a target. Missiles are either explosive warheads or non-explosive practice munitions. The target is an unmanned aerial target drone, a tactical air-launched decoy, or a parachute suspended illumination flare. Target drones deploy parachutes and are recovered by small boat or rotary-wing aircraft; tactical air-launched decoys and illumination flares are expended and not recovered. These exercises typically occur at high altitudes. | |
| **Typical Components** | **Platforms:** Fixed Wing – Strike Aircraft<br>**Targets:** Air Targets - Drone, Air Targets - Flare<br>**Systems being Trained/Tested:** None<br>**Munitions:** Air-to-Air Missiles | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | None | |
| **Parameters for Analysis** | Assumes that all missiles are explosive (missiles explode at medium altitudes), although non-explosive practice munitions may be used. All propellant and explosives are consumed. Tactical air-launched decoys and illumination flares are expended and not recovered.<br><br>This activity would occur greater than 12 NM from land (FDM excepted). | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.3.7 Missile Exercise Surface-to-Air

| Air Warfare | | |
|---|---|---|
| **Missile Exercise Surface-to-Air** | | |
| **Short Description** | Surface ship crews defend against threat missiles and aircraft with missiles. | |
| **Long Description** | Surface ship crews defend against threat missiles and aircraft with ship-launched surface-to-air missiles. The exercise involves an aerial target that simulates a threat aircraft, anti-ship missile, or land attack missile, which is detected by the ship's radar. Ship-launched surface-to-air missiles are fired to disable or destroy the threat. The target typically is either a sub-sonic remote-controlled drone or a supersonic target. Target drones deploy parachutes and are recovered by small boat or rotary-wing aircraft; when used, tactical air-launched decoys are not recovered. Supersonic targets are not recovered. | |
| **Typical Components** | **Platforms:** Surface Combatant<br>**Targets:** Air Targets - Drone<br>**Systems being Trained/Tested:** None<br>**Munitions:** Surface-to-Air Missiles | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | Assumes that all surface-to-air missiles are high explosive. Missile explodes well above surface (at medium altitudes). All explosive and propellant are consumed. Targets typically not destroyed; unmanned drones are recovered when possible.<br><br>This activity would occur greater than 12 NM from land (FDM excepted). | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.4 Amphibious Warfare Training

The mission of amphibious warfare is to project military power from the sea to the shore (i.e., attack a threat on land by a military force embarked on ships) through the use of naval firepower and expeditionary landing forces. Amphibious warfare operations include small unit reconnaissance or raid missions to large-scale amphibious exercises involving multiple ships and aircraft combined into a strike group.

Amphibious warfare training ranges from individual, crew, and small unit events to large task force exercises. Individual and crew training include amphibious vehicles and naval gunfire support training. Such training includes shore assaults, boat raids, airfield or port seizures, and reconnaissance. Large scale amphibious exercises involve ship-to-shore maneuver, naval fire support, such as shore bombardment, and air strike and attacks on targets that are in close proximity to friendly forces. Amphibious Warfare training also includes training in the rapid movement of supplies and capabilities ashore, provide relief and logistics in times of disaster and crisis.

The descriptions and parameters for the analyses provided in the amphibious warfare data sheets only capture the at-sea (in-water vessels and air assets moving from ship-to-shore) and do not include landing or land-based activities. Land-based activities, and their associated land impacts, are evaluated in other environmental documents.

### A.3.4.1 Amphibious Assault

| Amphibious Warfare | | |
|---|---|---|
| **Amphibious Assault** | | |
| **Short Description** | Large unit forces move ashore from amphibious ships at sea for the immediate execution of inland objectives. | |
| **Long Description** | Large unit forces move ashore from amphibious ships at sea for the immediate execution of inland objectives by maneuvering amphibious vessels to position, launching, and recovering landing craft and aircraft, and forming landing waves. Amphibious assault is conducted for the purposes of prosecuting further combat operations, obtaining a site for an advanced naval or airbase, or denying the enemy use of an area.<br><br>Unit-level training exercises involve one or more amphibious ships, and their associated watercraft and aircraft, to move personnel and equipment from ship to shore without the command and control and supporting elements involved in a full-scale exercise. The goal is to practice loading, unloading, and movement and to develop the timing required for a full-scale exercise.<br><br>This activity could be conducted in support of bringing forces ashore in support of land-based USMC activities, such as a Marine Air Ground Task Force Exercise, which are analyzed in separate NEPA documents. | |
| **Typical Components** | **Platforms:** Amphibious Vehicles, Amphibious Warfare Vessels, Fixed Wing – Strike Aircraft, Fleet Support Vessel, Rotary-Wing Aircraft, Tiltrotor Aircraft<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | Typical exercise: 1-3 amphibious ships (e.g., LHA or LHD, LPD, LSD); 2-8 landing craft (landing craft, air cushion; landing craft, utility); 4-14 amphibious assault vehicles; up to 22 aircraft (e.g., MH-53, H-46/MV-22, AH-1, UH-1, AV-8); a Marine Expeditionary Unit (2,200 Marines). This analysis only captures the at-sea (in-water | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Islands Range Complex | CNMI Nearshore |
| | Tinian | Guam Nearshore |
| | Guam | |

### A.3.4.2 Amphibious Raid

| Amphibious Warfare | | |
|---|---|---|
| **Amphibious Raid** | | |
| **Short Description** | Small unit forces move swiftly from ships at sea for a specific short-term mission. These are quick operations with as few personnel as possible. | |
| **Long Description** | Small unit forces swiftly move from amphibious vessels at sea into hostile territory for a specific mission, including a planned withdrawal. Raids are conducted to inflict loss or damage, secure information, create a diversion, confuse the enemy, or capture or evacuate individuals or material. Amphibious raid forces are kept as small as possible to maximize stealth and speed of the operation.<br><br>An event may employ assault amphibian vehicle units, small boats, small unit live-fire and non-live-fire operations. Surveillance or reconnaissance unmanned surface and aerial vehicles may be used during this exercise. Coast Guard units may also participate.<br><br>This activity could be conducted in support of bringing forces ashore in support of land-based USMC activities such as a Marine Air Ground Task Force Exercise, which are analyzed in separate NEPA documents. | |
| **Typical Components** | **Platforms:** Amphibious Vehicles, Amphibious Warfare Vessels, Rotary-Wing Aircraft, Small Boat, Tiltrotor Aircraft, Unmanned Aerial Vehicle - Rotary Wing, Unmanned Surface Vehicles<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Unmanned vehicles | |
| **Parameters for Analysis** | Weapons firing (if conducted) during this event is discussed in appropriate activity descriptions (e.g., surface-to-surface and air-to-surface small-caliber gunnery exercises). During the conduct of amphibious raids personnel may exit the watercraft in the surf zone and divers and combat swimmers will stand in the surf zone and walk onto the beach. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Islands Range Complex | CNMI Nearshore |
| | Tinian | Guam Nearshore |
| | Guam | |
| | Rota | |

### A.3.4.3 Amphibious Vehicle Maneuvers/Rehearsals

| Amphibious Warfare | | |
|---|---|---|
| **Amphibious Vehicle Maneuvers/Rehearsals** | | |
| **Short Description** | Amphibious vehicles conduct in water training, maintenance and repairs including rehearsal of amphibious landings. | |
| **Long Description** | Amphibious vehicles maintained and operated in Inner Apra Harbor will conduct in-water training, in water repairs and in water maintenance. Splash down points will be designated concrete ramps.<br><br>Ship borne amphibious vessels maneuver to position, flood well decks, and launch and recover landing craft including hovercraft, combat rubber raiding craft, armored amphibious craft, landing craft ship, and task force aircraft in assault landing rehearsals. Assault craft form landing waves and approach shore without landing.<br><br>This activity could be conducted in support of bringing forces ashore in support of land-based USMC activities such as a Marine Air Ground Task Force Exercise, which are analyzed in separate NEPA documents. | |
| **Typical Components** | **Platforms:** Amphibious Vehicles, Amphibious Warfare Vessels, Fleet Support Vessel, Small Boat<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | Apra Harbor activities will range from 12 to 14 events per year.<br><br>Mechanized amphibious vehicles will utilize concrete ramps of the Amphibious Vehicle Laydown Area in Apra Harbor to support vehicle training and maintenance..<br><br>During Rehearsals, amphibious vehicles train to launch from, and return to, amphibious ships. Amphibious vehicles approach surf zone but turn away before entering surf zone or landing zone. Typical participants: amphibious vessels (e.g., LHA or LHD, LPD, LSD), Landing Craft Air Cushion (LCAC), the Landing Craft Utility (LCU), the Amphibious Combat Vehicle (ACV), the Amphibious Assault Recovery Vehicle (AAV-R), and the Lighter Amphibious Resupply Cargo (LARC) vehicle. Small boats include the use of the Landing Craft Personnel Light (LCPL), the Improved Navy Lighterage System (INLS), the Rigid Hull Inflatable Boats (RHIBs), and the Combat Rubber Raiding Craft (CRRCs). | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area and Nearshore | MITT Study Area; Mariana Islands Range Complex; Apra Harbor |

### A.3.4.4 Naval Surface Fire Support Exercise – Land-Based Targets

| Amphibious Warfare | | |
|---|---|---|
| **Naval Surface Fire Support Exercise - Land-Based Target** | | |
| **Short Description** | Surface ship crews fire large-caliber guns at land-based targets in support of forces ashore. | |
| **Long Description** | Surface ship crews use large-caliber guns to support forces ashore.<br><br>One or more ships position themselves from three to six NM from the target area and a land-based spotter relays type and exact location of the target. After observing the fall of the shot, the spotter relays any adjustments needed to reach the target. Once the rounds are on target, the spotter requests a sufficient number to effectively destroy the target.<br><br>This exercise occurs on land ranges where explosive and non-explosive practice munitions are authorized. | |
| **Typical Components** | **Platforms:** Surface Combatant<br>**Targets:** Land Targets<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile - Large Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Weapons firing noise | |
| **Parameters for Analysis** | Projectile impact is on land; however, potential nearshore in-water impacts are considered. Observed ricochets and misses that land in waters surrounding FDM occupied by corals are reported. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | FDM | FDM; R7201; R7201A |

### A.3.4.5 Non-Combat Amphibious Operation

| Amphibious Warfare | | |
|---|---|---|
| **Non-Combat Amphibious Operation** | | |
| **Short Description** | Military units evacuate noncombatants from hostile or unsafe areas or provide Humanitarian Assistance in times of disaster. | |
| **Long Description** | Navy, Marine Corps, and Coast Guard forces train to move personnel and equipment from ship-to-shore and from shore-to-ship to facilitate non-combat military operations. These training events include Non-Combatant Evacuation Operation, Humanitarian Assistance Operations, and Disaster Relief Operations. Noncombatants are evacuated when their lives are endangered by war, civil unrest, or natural disaster. Helicopters, landing crafts, amphibious ships, and other forces could be expected to participate in this operation during day or night. | |
| **Typical Components** | **Platforms:** Amphibious Vehicles, Amphibious Warfare Vessels, Rotary-Wing Aircraft, Small Boat, Tiltrotor Aircraft, Unmanned Aerial Vehicle – Rotary Wing<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | Sea-, land-, and air-based activity. Includes previous operations identified as Humanitarian Assistance Operations | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Islands Range Complex | CNMI Nearshore |
| | Guam | Guam Nearshore |
| | Tinian | |
| | Rota | |

### A.3.4.6 Unmanned Aerial Vehicle – Intelligence, Surveillance, and Reconnaissance

| Amphibious Warfare | | |
|---|---|---|
| **Unmanned Aerial Vehicle - Intelligence, Surveillance, and Reconnaissance** | | |
| **Short Description** | Military and Coast Guard units employ unmanned aerial vehicles to launch, operate, and gather intelligence for specified amphibious missions. | |
| **Long Description** | Unmanned aerial vehicles may be launched from ships, boats, submarines, or ground and are used to gather tactical or theater-level intelligence. | |
| **Typical Components** | **Platforms:** Unmanned Aerial Vehicle - Fixed Wing, Unmanned Aerial Vehicle - Rotary Wing<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | None | |
| **Parameters for Analysis** | Sea-, land-, and air-based activity. Unmanned Aerial vehicles are typically recovered; however, units may be damaged and lost. Small expendable units may also be used. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Islands Range Complex | MITT Study Area; Mariana Islands Range Complex |

### A.3.5 Anti-Submarine Warfare

Anti-submarine warfare involves helicopter and maritime patrol aircraft, ships, and submarines. These units operate alone or in combination to locate, track, and neutralize submarines. Controlling the undersea battlespace is a unique naval capability and a vital aspect of sea control. Undersea battlespace dominance requires proficiency in anti-submarine warfare. Every deploying strike group and individual surface combatant must possess this capability.

Various types of active and passive sonar are used by the Navy to determine water depth, and identify, track, and target submarines. Passive sonar "listens" for sound waves by using underwater microphones, called hydrophones, which receive, amplify, and process underwater sounds. No sound is introduced into the water when using passive sonar. Passive sonar can indicate the presence, character, and movement of submarines. However, passive sonar provides only a bearing (direction) to a sound-emitting source; it does not provide an accurate range (distance) to the source. Active sonar is needed to locate objects because active sonar provides both bearing ad range to the detected contact (such as an enemy submarine).

The Navy's anti-submarine warfare training plan, including the use of active sonar in at-sea training scenarios, includes multiple levels of training. Individual-level anti-submarine warfare training addresses basic skills such as detection and classification of contacts, distinguishing discrete acoustic signatures including those of ships, submarines, and marine life, and identifying the characteristics, functions, and effects of controlled jamming and evasion devices.

More advanced, integrated anti-submarine warfare training exercises involving active sonar are conducted in coordinated, at-sea operations during training events involving submarines, ships, aircraft, and helicopters. This training integrates the full anti-submarine warfare continuum form detecting and tracking a submarine to attacking a target using either exercise torpedoes or simulated weapons. Training events include detection and tracking exercises against "enemy" submarine contacts; torpedo employment exercises against the target; and exercising command and control tasks in a multi-dimensional battlespace.

### A.3.5.1 Anti-Submarine Warfare Torpedo Exercise – Helicopter

| Anti-Submarine Warfare | | |
|---|---|---|
| **Anti-Submarine Warfare Torpedo Exercise - Helicopter** | | |
| **Short Description** | Helicopter crews search for, track, and detect submarines. Recoverable air launched torpedoes are employed against submarine targets. | |
| **Long Description** | Helicopters using sonobuoys and dipping sonar search for, detect, classify, localize, and track a sub-surface target simulating a threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and with the intent to destroy the target. Sonobuoys (both passive and active) and dipping sonar (both passive and active) are typically employed during the exercise. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target (EMATT), a MK-30 target, or a live submarine. This exercise may involve a single aircraft or occur during a coordinated larger exercise involving multiple aircraft and ships, including a major range event. Unmanned aerial systems may also be used. The exercise torpedo is recovered by a special recovery helicopter or small craft assets. Temporary range instrumentation (hydrophones) may be deployed in support of this activity. See Figure A-1. | |
| **Typical Components** | **Platforms:** Rotary-Wing Aircraft, Unmanned Surface Vehicle, Unmanned Aerial Vehicle – Rotary Wing, Unmanned Underwater Vehicle<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonar Systems - Dipping, Sonobuoys<br>**Munitions:** Torpedoes - Exercise | |
| **Active Sonar** | MFM, MFH, HFH | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels<br>Unmanned vehicles | |
| **Parameters for Analysis** | This activity occurs greater than 3 NM from land.<br>Submarine may provide service as the target. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.5.2 Anti-Submarine Warfare Torpedo Exercise – Maritime Patrol Aircraft

| Anti-Submarine Warfare | | |
|---|---|---|
| **Anti-Submarine Warfare Torpedo Exercise - Maritime Patrol Aircraft** | | |
| **Short Description** | Maritime patrol aircraft crews search for, track, and detect submarines. Recoverable air launched torpedoes are employed against submarine targets. | |
| **Long Description** | Fixed-wing maritime patrol aircraft employ sonobuoys to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine.<br><br>Sonobuoys (both passive and active) are typically employed by a maritime patrol aircraft operating at altitudes below 3,000 ft. Both sonobuoys and torpedoes (using the High-Altitude Anti-Submarine Warfare Weapon Capability kit) may be delivered at high altitudes to remain clear of high threat areas The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and vessels, including a major range event. The exercise torpedo is recovered by helicopter or small boat. Temporary range instrumentation (hydrophones) may be deployed in support of this activity. See Figure A-1. | |
| **Typical Components** | **Platforms:** Fixed Wing – Patrol Aircraft<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonobuoys<br>**Munitions:** Torpedoes - Exercise | |
| **Active Sonar** | MFM, HFH | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources | |
| **Parameters for Analysis** | Submarine may provide service as the target.<br>If target is air-dropped, one parachute per target.<br><br>This activity occurs greater than 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–234** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.5.3 Anti-Submarine Warfare Torpedo Exercise – Ship

| Anti-Submarine Warfare | | |
|---|---|---|
| **Anti-Submarine Warfare Torpedo Exercise - Ship** | | |
| **Short Description** | Surface ship crews search for, track, and detect submarines. Exercise torpedoes are used during this exercise. | |
| **Long Description** | Surface ships search for, detect, and track threat submarines to determine a firing position to launch a torpedo and attack the submarine. A surface ship operates at slow speeds while employing hull-mounted or towed array sonar. Passive or active sonar is employed depending on the type of threat submarine, the tactical situation, and environmental conditions. The anti-submarine warfare target used for this exercise is a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, MK-30 Target, or live submarine. This exercise may involve a single ship or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event.<br><br>The exercise torpedo is recovered by helicopter or small craft. Temporary range instrumentation (hydrophones) may be deployed in support of this activity. See Figure A-1. | |
| **Typical Components** | **Platforms:** Surface Combatant, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted, Countermeasures<br>**Munitions:** Torpedoes – Exercise | |
| **Active Sonar** | MF1, MF1C, HFH, Broadband (MF to HF) | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels<br>Towed in-water devices | |
| **Parameters for Analysis** | Submarines may provide service as the target. Torpedoes are recovered.<br>This activity occurs greater than 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.5.4 Anti-Submarine Warfare Torpedo Exercise – Submarine

| Anti-Submarine Warfare | | |
|---|---|---|
| **Anti-Submarine Warfare Torpedo Exercise - Submarine** | | |
| **Short Description** | Submarine crews search for, track, and detect submarines. Exercise torpedoes are used during this exercise. | |
| **Long Description** | Submarine crews search for, detect, and track a threat submarine to develop firing position to launch a torpedo. A single submerged submarine operates at slow speeds and various depths while using its hull mounted or towed array sonar to track a threat submarine. Passive sonar is used almost exclusively. Non-explosive exercise torpedoes can be launched and active sonar can be used during this training exercise.<br><br>This exercise may involve a single submarine or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other range complexes depending on training requirements and available assets. Temporary range instrumentation (hydrophones) may be deployed in support of this activity. See Figure A-1. | |
| **Typical Components** | **Platforms:** Submarine<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted, Countermeasures<br>**Munitions:** Torpedoes – Exercise | |
| **Active Sonar** | MFH, HFH, Broadband (LF to HF) | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels<br>Towed in-water devices | |
| **Parameters for Analysis** | Guidance wire has a low tensile strength and breaks easily. Weights and flex tubing sink rapidly.<br>This activity occurs greater than 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.5.5 Anti-Submarine Warfare Tracking Exercise – Helicopter

| Anti-Submarine Warfare | | |
|---|---|---|
| **Anti-Submarine Warfare Tracking Exercise - Helicopter** | | |
| **Short Description** | Helicopter crews search for, track, and detect submarines. | |
| **Long Description** | Helicopters using sonobuoys and dipping sonar search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine.<br><br>The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft or occur during a coordinated larger exercise involving multiple aircraft and ships, including a major range event. Unmanned aerial systems, may also be used. Temporary range instrumentation (hydrophones) may be deployed in support of this activity. See Figure A-1. | |
| **Typical Components** | **Platforms:** Rotary-Wing Aircraft, Unmanned Aerial Vehicle – Rotary Wing, Unmanned Underwater Vehicle, Surface Combatant<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonar Systems - Dipping, Sonobuoys<br>**Munitions:** None | |
| **Active Sonar** | MFM, MFH, | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Unmanned vehicles<br>Manned surface vessels | |
| **Parameters for Analysis** | Submarines may provide service as the target.<br>This activity occurs greater than 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area<br>Transit Corridor | MITT Study Area; Mariana Islands Range Complex<br>MITT Transit Lane |

### A.3.5.6 Anti-Submarine Warfare Tracking Exercise – Maritime Patrol Aircraft

| Anti-Submarine Warfare | | |
|---|---|---|
| **Anti-Submarine Warfare Tracking Exercise - Maritime Patrol Aircraft** | | |
| **Short Description** | Maritime patrol aircraft crews search for, track, and detect submarines. | |
| **Long Description** | Fixed-wing maritime patrol aircraft employ sonobuoys to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine.<br><br>Sonobuoys may be released at high altitudes. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and vessels, including a major range event. Temporary range instrumentation (hydrophones) may be deployed in support of this activity. | |
| **Typical Components** | **Platforms:** Fixed Wing – Patrol Aircraft, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonobuoys<br>**Munitions:** None | |
| **Active Sonar** | MFM | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Unmanned vehicles | |
| **Parameters for Analysis** | Submarine may provide service as the target.<br>If target is air-dropped, one parachute per target.<br>This activity occurs greater than 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.5.7 Anti-Submarine Warfare Tracking Exercise – Ship

| Anti-Submarine Warfare | | |
|---|---|---|
| **Anti-Submarine Warfare Tracking Exercise - Ship** | | |
| **Short Description** | Surface ship crews search for, track, and detect submarines. Exercise torpedoes may be used during this event. | |
| **Long Description** | Surface ships search for, detect, and track threat submarines to determine a firing position to launch a torpedo and attack the submarine.<br><br>A surface ship operates at slow speeds while employing sonobuoys, hull-mounted sonars, or towed array sonar. Passive or active sonar is employed depending on the type of threat submarine, the tactical situation, and environmental conditions. The target for this exercise is either a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, MK-30 Recoverable Training Target, or live submarine.<br><br>This exercise may involve a single ship or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. Temporary range instrumentation (hydrophones) may be deployed in support of this activity. | |
| **Typical Components** | **Platforms:** Surface Combatant<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted, Countermeasures<br>**Munitions:** None | |
| **Active Sonar** | MF1, MF1C, Broadband (MF to HF) | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels | |
| **Parameters for Analysis** | A submarine may provide service as the target.<br>This activity occurs greater than 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.5.8 Anti-Submarine Warfare Tracking Exercise – Submarine

| Anti-Submarine Warfare | | |
|---|---|---|
| **Anti-Submarine Warfare Tracking Exercise - Submarine** | | |
| **Short Description** | Submarine crews search for, track, and detect submarines. | |
| **Long Description** | Submarine crews search for, detect, and track a threat submarine to develop firing position to launch a torpedo.<br><br>A single submerged submarine operates at slow speeds and various depths while using its hull mounted sonar to track a threat submarine. Passive sonar is used almost exclusively. The target for this exercise is either an MK 39 Expendable Mobile Anti-Submarine Warfare Training Target, MK 30 recoverable training target, or live submarine.<br><br>This exercise may involve a single submarine or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. Temporary range instrumentation (hydrophones) may be deployed in support of this activity. | |
| **Typical Components** | **Platforms:** Submarine<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted, Navigation Systems<br>**Munitions:** None | |
| **Active Sonar** | MFH, HFH, Broadband (LF to HF) | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels | |
| **Parameters for Analysis** | This activity occurs greater than 3 NM from land. For biological resource analysis, vessel noise and vessel strike are only analyzed for the periods while the submarines are surfaced, typically brief in nature. Applicable Activity-based Mitigations for Marine Species related to vessel movement are only considered during the period of surfacing as well. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area<br>Transit Corridor | MITT Study Area; Mariana Islands Range Complex MITT Transit Lane |

## A.3.6 Electronic Warfare

The mission of electronic warfare is to degrade the enemy's ability to use electronic systems, such as communication systems and radar, and to confuse or deny them the ability to defend their forces and assets. Electronic warfare is also used to detect enemy threats and counter their attempts to degrade the electronic capabilities of the Navy.

Typical electronic warfare activities include threat avoidance training, signals analysis for intelligence purposes, and use of airborne and surface electronic jamming devices (that block or interfere with other devices) to defeat tracking, navigation, and communications systems.

### A.3.6.1 Counter Targeting Chaff Exercise – Aircraft

| **Electronic Warfare** | | |
|---|---|---|
| **Counter Targeting Chaff Exercise - Aircraft** | | |
| **Short Description** | Fixed-winged aircraft and helicopter aircrews deploy chaff to disrupt threat targeting and missile guidance radars. | |
| **Long Description** | Fixed-winged aircraft and helicopter aircrews deploy chaff to disrupt threat targeting and missile guidance radars.<br><br>Fixed-winged aircraft and helicopter aircrews detect electronic targeting signals from threat radars or missiles, dispense chaff, and immediately maneuver to defeat the threat. The chaff cloud deceives the inbound missile and the aircraft clears away from the threat.<br><br>Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths to elicit frequency responses, which deceive enemy radars. Chaff is employed to create a target that will lure enemy radar and weapons system away from the actual friendly platform. | |
| **Typical Components** | **Platforms:** Fixed Wing – Strike Aircraft, Rotary-Wing Aircraft<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | None | |
| **Parameters for Analysis** | Chaff is usually expended while conducting other training activities, such as air combat maneuvering. Potential effects are analyzed under this activity.<br><br>This activity occurs >12 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.6.2 Counter Targeting Chaff Exercise – Ship

| Electronic Warfare | | |
|---|---|---|
| **Counter Targeting Chaff Exercise - Ship** | | |
| **Short Description** | Surface ship crews deploy chaff to disrupt threat targeting and missile guidance radars. | |
| **Long Description** | Surface ship and Coast Guard cutter crews deploy chaff to disrupt threat targeting and missile guidance radars to defend against an attack.<br><br>Surface ship crews detect electronic targeting signals from threat radars or missiles, dispense chaff, and immediately maneuver to defeat the threat. The chaff cloud deceives the inbound missile and the vessel clears away from the threat. The typical exercise duration is approximately 1.5 hours.<br><br>Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths to elicit frequency responses, which deceive enemy radars. Chaff is employed create a target that will lure enemy radar and weapons system away from the actual friendly platform.<br><br>Ships may also train with advanced countermeasure systems, such as the MK 53 Decoy Launching System (Nulka). | |
| **Typical Components** | **Platforms:** Surface Combatant<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** MK 53 Nulka | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | Stressors to human resources were not analyzed for this activity since it occurs greater than 12 NM from shore.<br>This training activity is conducted by Navy and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.6.3 Counter Targeting Flare Exercise

| Electronic Warfare | | |
|---|---|---|
| **Counter Targeting Flare Exercise** | | |
| **Short Description** | Fixed-winged aircraft and helicopter aircrews deploy flares to disrupt threat infrared missile guidance systems. | |
| **Long Description** | Fixed-winged aircraft and helicopter aircrews deploy flares to disrupt threat infrared missile guidance systems.<br><br>Aircraft detect electronic targeting signals from threat radars or missiles or a threat missile plume when launched and dispense flares and immediately maneuver to defeat the threat. This exercise trains aircraft personnel in the use of defensive flares designed to confuse infrared sensors or infrared homing missiles, thereby causing the sensor or missile to lock onto the flares instead of the real aircraft. Typically, an aircraft will expend five flares in an exercise while operating above 3,000 ft. Flare exercises are often conducted with chaff exercises, rather than as a stand-alone exercise. | |
| **Typical Components** | **Platforms:** Fixed Wing – Strike Aircraft, Rotary Wing Aircraft<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | None | |
| **Parameters for Analysis** | Approximately five flares per aircraft are expended per exercise.<br>All combustible material in flares is assumed to be consumed before contact of the casing with the water.<br>This activity typically occurs greater than 12 NM from land. However, rotary-wing events may occur closer to land (up to 3 NM when crew-served EW threat emitters [MANPADS] are employed). | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.6.4 Electronic Warfare Operations

| Electronic Warfare | | |
|---|---|---|
| **Electronic Warfare Operations** | | |
| **Short Description** | Aircraft and surface ship crews control portions of the electromagnetic spectrum used by enemy systems to degrade or deny the enemy's ability to take defensive actions. | |
| **Long Description** | Aircraft and surface ship crews control the electromagnetic spectrum used by enemy systems to degrade or deny the enemy's ability to take defensive actions. Electronic Warfare Operations can be active or passive, offensive, or defensive. Fixed-wing aircraft employ active jamming and deception against enemy search radars to mask the friendly inbound strike aircraft mission. Surface ships detect and evaluate enemy electronic signals from enemy aircraft or missile radars, evaluate courses of action concerning the use of passive or active countermeasures, then use ship maneuvers and either chaff, flares, active electronic countermeasures, or a combination of them to defeat the threat. | |
| **Typical Components** | **Platforms:** Fixed Wing – Adversary Aircraft, Rotary-Wing Aircraft, Surface Combatant<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | All chaff and flares involved in this exercise are covered under chaff exercises and flare exercises, respectively. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

## A.3.7 Expeditionary Warfare

The mission of expeditionary warfare is to provide security and surveillance in the littoral (at the shoreline), riparian (along a river), or coastal environments. Expeditionary warfare is wide ranging and includes defense of harbors, operation of remotely operated vehicles, defense against swimmers, and boarding/seizure operations.

Expeditionary warfare training activities include underwater construction team training, dive and salvage operations, and insertion/extraction via air, surface, and subsurface platforms.

### A.3.7.1 Dive and Salvage Operations

| **Expeditionary Warfare** | | |
|---|---|---|
| **Dive and Salvage Operations (New Activity)** | | |
| **Short Description** | Navy divers perform dive operations and salvage training. | |
| **Long Description** | Navy and USCG divers will conduct a variety of salvage training to include de-beaching operations, underwater repairs to ships, underwater survey operations, and other underwater training as required. | |
| **Typical Components** | **Platforms:** Support Craft<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | Tools utilized to support this activity, and the in-water sound from their use, is de minimis for this activity. The practice salvage platform, utilized during de-beaching operations, can be sunk and then refloated and removed from the training area. This activity could include opportunistic training as requested by CNMI or Guam governments. Additional analysis may be conducted when specific details are known. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | CNMI Nearshore |
| | | Guam Nearshore |
| | | Mariana Islands Range Complex |

### A.3.7.2 Personnel Insertion/Extraction – Air

| Expeditionary Warfare | | |
|---|---|---|
| **Personnel Insertion/Extraction - Air** | | |
| **Short Description** | Personnel are inserted into and extracted from an objective area by fixed-wing aircraft or helicopters. | |
| **Long Description** | Personnel are inserted into a water objective via fixed-wing aircraft using parachutes or by helicopters via ropes or jumping into the water. They will conduct an infiltration to an objective (e.g., harbor, beach, moored vessel) and conduct a variety of tasks. The insertion/extraction activities are confined to in-water training. Upon completion of training objectives, personnel are extracted by helicopters or small boats. | |
| **Typical Components** | **Platforms:** Fixed Wing – Adversary Aircraft, Fixed Wing - Cargo and Transport Aircraft, Rotary-Wing Aircraft,<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | This activity analysis captures only the overwater portion and does not include any portion of the activity conducted on land, as the activity may be analyzed in other environmental planning. Activities are typically conducted in nearshore water. USCG may also conduct this training. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Islands Range Complex | MITT Study Area; Mariana Islands Range Complex |
| | Guam | |
| | Rota | |
| | Saipan | |

### A.3.7.3 Personnel Insertion/Extraction – Surface and Subsurface

| Expeditionary Warfare | | |
|---|---|---|
| **Personnel Insertion/Extraction – Surface and Subsurface** | | |
| **Short Description** | Personnel are inserted into and extracted from an objective area by small boats or subsurface platforms. | |
| **Long Description** | Utilizing both small surface and subsurface platforms, personnel are inserted in the water. They will conduct an infiltration to an objective (e.g., harbor, beach, moored vessel) and conduct a variety of tasks. The insertion/extraction activities are confined to in-water training. | |
| **Typical Components** | **Platforms:** Small Boat, Submersible vessel<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | Exercises are typically conducted in waters near land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Islands Range Complex | MITT Study Area; Mariana Islands Range Complex |
| | Guam | |
| | Rota | |
| | Saipan | |

### A.3.7.4 Personnel Insertion/Extraction – Swimmer/Diver

| Expeditionary Warfare | | |
|---|---|---|
| **Personnel Insertion/Extraction - Swimmer/Diver** | | |
| **Short Description** | Divers and swimmer infiltrate harbors, beaches, or moored vessels and conduct a variety of tasks. | |
| **Long Description** | Divers and swimmer infiltrate harbors, beaches, or moored vessels and conduct a variety of tasks. Activity may include Navy personnel learning advanced self-contained underwater breathing apparatus (SCUBA) diving to include tactics, techniques, and procedures and emergency procedures. Small boats are used for safety. | |
| **Typical Components** | **Platforms:** Small Boat<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | None | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Islands Range Complex; Guam; Tinian; Rota; Saipan | MITT Study Area; Mariana Islands Range Complex |
| | Guam | |
| | Tinian | |
| | Rota | |
| | Saipan | |

### A.3.7.5 Underwater Construction Team Training

| Expeditionary Warfare | | |
|---|---|---|
| **Underwater Construction Team Training - New Activity** | | |
| **Short Description** | Navy and Coast Guard divers conduct underwater repair and construction. | |
| **Long Description** | Navy and Coast Guard divers will perform cutting, welding, assembly, and installation of deep-water structures, mooring systems, underwater instrumentation, clearing of hazards, and other training as needed. | |
| **Typical Components** | **Platforms:** Small Boat, Unmanned Bottom Crawler<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Unmanned vehicles | |
| **Parameters for Analysis** | This activity is conducted by the Navy and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | CNMI Nearshore |
| | | Guam Nearshore |
| | | Mariana Islands Range Complex |

### A.3.7.6 Port Damage Repair (No Dredging/No Pile Driving)

| Expeditionary Warfare | | |
|---|---|---|
| **Port Damage Repair (No Dredging/No Pile Driving) - New Activity** | | |
| **Short Description** | Navy Expeditionary forces train to repair critical port facilities. | |
| **Long Description** | Navy Expeditionary forces support Fleet mission through expedient repair of critical port facilities. Training includes diving operations, salvage operations, and repairs to piers, quay walls, and other waterfront infrastructure. Training activity normally lasts five days. | |
| **Typical Components** | **Platforms:** Small Boat, Support Craft, Fixed Structure, Unmanned Bottom Crawler<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Unmanned vehicles | |
| **Parameters for Analysis** | Tools utilized during this activity, and the potential noise derived from their in-water use, are categorized as de minimis. This activity could include opportunistic training as requested by CNMI or Guam governments. Additional analysis may be conducted when specific details are known. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2030** |
| | | Guam Nearshore |
| | | CNMI Nearshore |

## A.3.8 Mine Warfare

The mission of mine warfare is to detect, classify, and avoid or neutralize (disable) mines to protect Navy ships and submarines and to maintain fee access to ports and shipping lanes. Mine warfare also includes offensive mine laying to gain control of or deny the enemy access to sea space. Naval mines can be laid by ships, submarines, or aircraft.

Mine warfare neutralization training includes activities in which ships, aircraft, submarines, underwater vehicles, unmanned vehicles, or marine mammal detection systems search for mine shapes. Personnel train to destroy or disable mines by attacking underwater explosives to or near the mine or using remotely operating vehicles to destroy the mine.

### A.3.8.1 Mine Countermeasures – Mine Detection

| **Mine Warfare** | | |
|---|---|---|
| **Mine Countermeasures – Mine Detection** | | |
| **Short Description** | Helicopter aircrews and Unmanned Surface Vehicles (USVs) detect mines using towed or laser mine detection systems. | |
| **Long Description** | Helicopter aircrews use an airborne devices to detect, locate, and classify potential mines. Towed devices, operated by USVs, employ active acoustic sources, such as high-frequency and side scanning sonar. These devices are similar in function to systems used to map the seafloor or locate submerged structures/items. Airborne devices utilize laser systems to locate mines located below the surface. | |
| **Typical Components** | **Platforms:** Rotary-Wing Aircraft, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets:** Mine Targets<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Unmanned vehicles | |
| **Parameters for Analysis** | Sonar mine detection systems towed from surface vessels.<br>Airborne laser systems used to detect mine shapes.<br>Laser systems are similar to commercial Light Detection and Ranging (LIDAR) systems.<br>The in-air energy stressor was used in analysis of potential impacts on human resources.<br>Mine shapes may be deployed via ship and will be recovered. | |
| **Location** | **Phase II Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Littorals | MITT Study Area; Mariana Islands Rane Complex |
| | Mariana Island Range Complex | Guam Nearshore |
| | Inner and Outer Apra Harbor | CNMI Nearshore |

### A.3.8.2 Mine Countermeasures – Towed Mine Neutralization

| Mine Warfare | | |
|---|---|---|
| **Mine Countermeasures – Towed Mine Neutralization** | | |
| **Short Description** | USVs and Unmanned Underwater Vehicles tow systems through the water that are designed to disable or trigger mines. | |
| **Long Description** | USVs and Unmanned Underwater Vehicles use towed devices to trigger mines that are designed to detonate when they detect ships/submarines by engine/propeller sounds or magnetic (steel construction) signature. Towed devices can also employ cable cutters to detach floating moored mines. Training may be conducted with non-explosive training mine shapes. | |
| **Typical Components** | **Platforms:** Rotary-Wing Aircraft, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets:** Mine Targets<br><br>**Systems being Trained/Tested:** Towed Mine Neutralization Systems<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Towed in-water devices<br>Unmanned vehicles | |
| **Parameters for Analysis** | Mechanical sweeping (cable cutting), acoustic and magnetic influence sweeping devices are towed from helicopters and surface vessels.<br>Cable cutters utilize an insignificant charge (similar to a shotgun shell).<br>Acoustic sweeps generate ship-type noise via a mechanical system.<br>Towing systems though minefields (or without mines, to train to deploy, tow, and recover) may involve instrumented mines.<br>Mine shapes are recovered. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |
| | | Guam Nearshore |
| | | CNMI Nearshore |
| | | Apra Harbor |

### A.3.8.3 Airborne Mine Laying

| Mine Warfare | | |
|---|---|---|
| **Airborne Mine Laying** | | |
| **Short Description** | Fixed-wing aircraft drop non-explosive mine shapes. | |
| **Long Description** | Fixed-winged aircraft lay offensive or defensive mines for a tactical advantage for friendly forces. Fixed-winged aircraft lay a precise minefield pattern for specific tactical situations. The aircrew typically makes multiple passes in the same flight pattern and drop one or more training shapes per pass. Training shapes are non-explosive. | |
| **Typical Components** | **Platforms:** Fixed Wing Aircraft<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** Mines | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Non-explosive aerial deployed mines | |
| **Parameters for Analysis** | Mine laying is similar to non-explosive bombing activities.<br>Mine laying will typically take place in waters less than 100 ft. in depth.<br>Events may employ guided mine shapes released from high altitudes and distance.<br>Assume 12 mine shapes are used per activity.<br><br>Nearshore/shallow water events will be planned to minimize/avoid coral impacts and ensure public safety. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Islands Range Complex Warning Areas | MITT Study Area; Mariana Islands Range Complex |

### A.3.8.4 Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises

| Mine Warfare | | |
|---|---|---|
| **Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises** | | |
| **Short Description** | Maritime security personnel train to protect civilian ports and harbors against enemy efforts to interfere with access to those ports. | |
| **Long Description** | Naval forces (including USCG) provide mine warfare capabilities to support Department of Homeland Security sponsored exercises. The three pillars of mine warfare, airborne (helicopter), surface (surface ships), and undersea (divers, marine mammals, and unmanned vehicles) mine countermeasures will be brought to bear in order to ensure strategic U.S. ports remain free of mine threats. Various mine warfare sensors, which utilize active acoustics, will be employed in the detection, classification, and neutralization of mines. Along with traditional mine warfare techniques, such as helicopter towed mine countermeasures, new technologies (unmanned vehicles) will be utilized. Marine mammal systems may be used during this exercise.<br><br>Exercise locations and scenarios will vary according to Department of Homeland Security strategic goals and evolving world events. Coast Guard cutters, small boats, and aircraft may participate in this activity. | |
| **Typical Components** | **Platforms:** Rotary-Wing Aircraft, Small Boat, Support Craft, Unmanned Underwater Vehicle<br>**Targets:** Mine Targets<br>**Systems being Trained/Tested:** Acoustic Communications, Electromagnetic Systems, Sonar Systems – Mine Warfare, Unmanned Vehicle Systems<br>**Munitions:** Explosive mine neutralizers | |
| **Active Sonar** | HFH, HFM, MFH | |
| **In-Water Explosives*** | E4 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br><br>Active acoustic sources<br>Manned surface vessels<br>Towed in-water devices<br>Unmanned vehicles<br>Explosive mine neutralization (with divers)<br>Explosive mine countermeasures and neutralization (no divers) | |
| **Parameters for Analysis** | Non-permanent mine shapes will be laid in various places on the bottom and will be retrieved.<br>Shapes are varied, from about 1 m circular to about 2.5 m long by 1 m wide. They will be recovered using normal assets, with diver involvement.<br>Explosives may be used if required for scheduled mine neutralization activities.<br>Explosives will only be used in designated Mine Training areas.<br>This training activity is conducted by the Navy and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana littorals | Inner Apra Harbor |

| | | |
|---|---|---|
| **Mine Warfare** | | |
| **Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises** | | |
| | Mariana Islands Range Complex | MITT Study Area; Mariana Islands Range Complex |
| | Inner and Outer Apra Harbor | Outer Apra Harbor |
| | | Guam Nearshore |
| | | CNMI Nearshore |

### A.3.8.5 Limpet Mine Neutralization System

| Mine Warfare | | |
|---|---|---|
| **Limpet Mine Neutralization System** | | |
| **Short Description** | Navy Explosive Ordnance Disposal divers place a small charge on a simulated underwater mine. | |
| **Long Description** | A metal sheet containing a non-explosive limpet mine is lowered into the water, sometimes from the side of a small vessel, such as an LCM-8 craft. Navy Explosive Ordnance Divers place a single shock wave generator of Limpet Mine Neutralizing Systems on the mine that is located mid-water column, within water depths of 10 to 20 feet. A bag is placed over the mine to catch falling debris. | |
| **Typical Components** | **Platforms:** Small Boat, Unmanned Underwater Vehicle<br>**Targets:** Metal Plates<br>**Systems being Trained/Tested:** Demolition Devices<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Unmanned vehicles | |
| **Parameters for Analysis** | *De minimis* small explosive charges would be used during this activity and not quantitatively analyzed and therefore are not included under munitions. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana littorals | Agat Bay Mine Neutralization Site |
| | Inner and Outer Apra Harbor | Inner Apra Harbor |

### A.3.8.6 Mine Neutralization – Explosive Ordnance Disposal

| Mine Warfare | | |
|---|---|---|
| **Mine Neutralization Explosive Ordnance Disposal** | | |
| **Short Description** | Personnel disable threat mines using explosive charges. | |
| **Long Description** | Navy divers, typically explosive ordnance disposal personnel, disable threat mines with explosive charges to create a safe channel for friendly vessels to transit or placing or detonating limpet mines on steel structures.<br><br>Personnel detect, identify, evaluate, and neutralize mines in the water with an explosive device and may involve detonation of one or more explosive charges ranging up to 10 or 20 pounds of TNT equivalent, depending on location. These operations are normally conducted during daylight hours for safety reasons.<br><br>Time-delay fuses may be used for these activities. Personnel also identify and place limpet mine charges on a steel structure in the water and detonate an explosive charge. These operations are normally conducted during daylight hours for safety reasons. | |
| **Typical Components** | **Platforms:** Small Boat, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets:** Mine Targets<br>**Systems being Trained/Tested:** Nones<br>**Munitions:** Demolition Devices | |
| **Active Sonar** | No | |
| **In-Water Explosives** | E5, E6 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Unmanned vehicles<br>Explosive mine neutralization (with divers) | |
| **Parameters for Analysis** | Time-delayed fuses may be used (up to 10 minutes) for charges up to 20 lb. net explosive weight (NEW) in some locations. Charges are placed anywhere in water column, including bottom.<br><br>Agat Bay underwater detonation site has a maximum charge size of 20 lb. net explosive weight (NEW). Piti and Outer Apra Harbor underwater detonation sites have a maximum charge size of 10 lb. NEW. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Agat Bay Mine Neutralization Site | Agat Bay Mine Neutralization Site |
| | Outer Apra Harbor UNDET Site | Outer Apra Harbor UNDET Site |
| | Piti Floating Mine Neutralization Site | Piti Floating Mine Neutralization Site |

### A.3.8.7 Surface Ship Object Detection

| Mine Warfare | | |
|---|---|---|
| **Surface Ship Object Detection** | | |
| **Short Description** | Ship crews detect and avoid mines while navigating restricted areas or channels using active sonar. | |
| **Long Description** | Surface ship crews detect and avoid mines or other underwater hazardous objects while navigating restricted areas or channels using active sonar. Activities could be embedded within major training exercises. | |
| **Typical Components** | **Platforms:** Surface Combatant<br>**Targets:** None<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted<br>**Munitions:** None | |
| **Active Sonar** | MF1K | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels | |
| **Parameters for Analysis** | Existing placed mine shapes/targets of opportunity to be used. There is the potential for temporary placement of mine shapes. Potential locations for this activity include Mariana Nearshore locations and Apra Harbor. | |
| **Location** | **Phase III Requirement 202-2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.8.8 Underwater Demolition Qualification and Certification

| Mine Warfare | | |
|---|---|---|
| **Underwater Demolition Qualification and Certification** | | |
| **Short Description** | Navy divers conduct various levels of training and certification in placing underwater demolition charges. | |
| **Long Description** | Demolition requalification and training provides teams with experience in underwater detonations by conducting detonations on metal plates near the shoreline | |
| **Typical Components** | **Platforms:** Small Boat, Unmanned Underwater Vehicle<br>**Targets:** Metal Plates<br>**Systems being Trained/Tested:** None<br>**Munitions:** Demolition Devices | |
| **Active Sonar** | No | |
| **In-Water Explosives** | E5, E6 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Unmanned vehicles<br>Explosive mine neutralization (with divers) | |
| **Parameters for Analysis** | Agat Bay underwater detonation site has a maximum charge size of 20 lb. net explosive weight (NEW). Piti and Outer Apra Harbor underwater detonation sites have a maximum charge size of 10 lb. NEW. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Agat Bay Mine Neutralization Site | Agat Bay Mine Neutralization Site |
| | Outer Apra Harbor UNDET Site | Outer Apra Harbor UNDET Site |
| | Piti Underwater Detonation Site | Piti Underwater Detonation Site |

### A.3.8.9 Underwater Mine Countermeasure Raise, Tow, Beach, and Exploitation

| Mine Warfare | | |
|---|---|---|
| **Underwater Mine Countermeasure Raise, Tow, and Beach, and Exploitation** | | |
| **Short Description** | Personnel locate mines, perform mine neutralization, raise, and tow mines to the beach, and conduct exploitation operations for intelligence gathering. | |
| **Long Description** | Navy divers, typically explosive ordnance disposal personnel, locate mines using unmanned underwater vehicle, marine mammals, or other diver search techniques. Mines are then neutralized or prevented from working as they are intended. Explosive ordnance disposal personnel ensure the neutralization measures are effective, and the shapes are safe to bring to the beach. A lift balloon is attached to the line to raise the shape to the surface, and then a small boat slowly tows the shape to the beach. The final step, exploitation, is intelligence gathering, identifying the mine and how it works, and then disassembling it or disposing of it. | |
| **Typical Components** | **Platforms:** Rotary-Wing Aircraft, Small Boat, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets:** Mine Targets<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Unmanned vehicles | |
| **Parameters for Analysis** | Mine shapes are recovered and brought ashore on Reserve Craft Beach, as part of the activity. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | Inner Apra Harbor |
| | | Outer Apra Harbor |

## A.3.9 Strike Warfare

The mission of strike warfare is to conduct offensive attacks on land-based targets, such as refineries, power plants, bridges, major roadways, and ground forces to reduce the enemy's ability to wage war. Strike warfare employs weapons by manned and unmanned air, surface, submarine, and Navy special warfare assets in support of extending dominance over enemy territory (power projection). Strike warfare includes training fixed-wing attack aircraft pilots and aircrews in the delivery of precision-guided munitions, non-guided munitions, rockets, and other ordnance against land-based targets.

### A.3.9.1 Bombing Exercise Air-to-Ground

| **Strike Warfare** | | |
|---|---|---|
| **Bombing Exercise Air-to-Ground** | | |
| **Short Description** | Bombing exercise involves training of strike fighter aircraft delivery of ordnance against land targets in day or night conditions. | |
| **Long Description** | Bombing exercise involves training of strike fighter aircraft delivery of ordnance against land targets in day or night conditions. The bombing exercise may involve simulated close air support training in direct support of and near forces on the ground, such as Navy or Marine forces engaged in training activities on land and may include the use of targeting laser. | |
| **Typical Components** | **Platforms:** Fixed Wing – Strike Aircraft<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** Bombs | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>None | |
| **Parameters for Analysis** | Bombs are released in accordance with range standard operating procedures. Land targets only.<br>Observed ricochets and misses that land in waters surrounding FDM occupied by corals are reported. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | FDM | FDM; R7201; R7201A |

### A.3.9.2 Gunnery Exercise Air-to-Ground

| Strike Warfare | | |
|---|---|---|
| **Gunnery Exercise Air-to-Ground** | | |
| **Short Description** | Fixed wing aircraft and helicopter crews use guns to attack ground targets, day or night, with the goal of destroying or disabling enemy vehicles, structures, or personnel. | |
| **Long Description** | Fixed-wing aircraft and helicopter crews use guns to attack ground targets, day or night, with the goal of destroying or disabling enemy vehicles, structures, or personnel. This activity could be conducted by strike fighters firing medium caliber projectiles, aerial gunships firing medium and large caliber projectiles, or helicopters firing medium and small caliber projectiles.<br>This activity may include the use of targeting laser. | |
| **Typical Components** | **Platforms:** Fixed Wing – Other Aircraft, Fixed Wing – Strike Aircraft, Rotary-Wing Aircraft<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile - Small Caliber, Projectile - Medium Caliber, Projectile - Large Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>None | |
| **Parameters for Analysis** | Land based targets only. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | FDM | FDM; R7201; R7201A |

### A.3.9.3 Missile Exercise Air-to-Ground

| Strike Warfare | | |
|---|---|---|
| **Missile Exercise Air-to-Ground** | | |
| **Short Description** | Missiles or rockets are launched against a land target. | |
| **Long Description** | Fixed-wing aircraft, helicopter, ship or submarine crews use missiles to attack ground targets, day or night, with the goal of destroying or disabling enemy vehicles, structures, or personnel. | |
| **Typical Components** | **Platforms:** Fixed Wing – Strike Aircraft, Rotary-Wing Aircraft, Unmanned Aerial Vehicle - Fixed Wing<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** Air-to-Surface Missiles, Rockets | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>None | |
| **Parameters for Analysis** | Land based targets only. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | FDM | FDM; R7201; R2701A |

### A.3.10 Surface Warfare

Surface warfare is a type of naval warfare in which aircraft, surface ships, and submarines employ weapons and sensors in operations directed against enemy surface ships or small boats. Aircraft-to-surface Surface Warfare is conducted by long-range attacks using air-launched cruise missiles, precision guided munitions, or aircraft guns. Surface warfare also is conducted by warships employing torpedoes, naval guns, and surface-to-surface missiles. Submarines attack surface ships using torpedoes or submarine-launched, anti-ship cruise missiles. Training in surface warfare includes surface-to-surface gunnery and missile exercises, air-to-surface gunnery and missile exercises, and submarine missile or torpedo launch events. Gunnery and missile training generally involves expenditure of ordnance against a towed target. A sinking exercise is a specialized training event that provides an opportunity for ship, submarine, and aircraft crews to use multiple weapons systems to deliver high-explosive ordnance on a deactivated vessel, which is deliberately sunk.

Surface warfare also encompasses maritime security, that is, the interception of a suspect surface ship by a Navy ship for the purpose of boarding-party inspection or the seizure of the suspect ship. Training in these tasks is conducted in visit, board, search and seizure activities.

### A.3.10.1 Bombing Exercise

| Surface Warfare | | |
|---|---|---|
| **Bombing Exercise** | | |
| **Short Description** | Fixed-wing aircrews deliver bombs against surface targets. | |
| **Long Description** | Fixed-wing aircraft conduct bombing exercises against stationary floating targets (e.g., MK-58 smoke buoy), towed targets, or maneuvering targets. An aircraft clears the area, deploys a smoke buoy, and then delivers high-explosive or non-explosive practice bombs on the target.<br><br>Activities for strike fighters typically involve a flight of two aircraft delivering unguided or guided munitions that may be either high-explosive or non-explosive. The following munitions may be employed by strike fighter aircraft in the course of a bombing exercise: Unguided munitions including non-explosive subscale bombs (MK-76 and BDU-45), and explosive and non-explosive general-purpose bombs (MK-80 series). Precision-guided munitions include laser-guided bombs (explosive, non-explosive), laser-guided training rounds (non-explosive), Joint Direct Attack Munitions (explosive, non-explosive). | |
| **Typical Components** | **Platforms:** Fixed Wing – Strike Aircraft<br>**Targets:** Surface Targets - Floating, Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** None<br>**Munitions:** Bombs | |
| **Active Sonar** | No | |
| **In-Water Explosives** | E9, E10, E12 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Aerial-deployed mines and non-explosive bombs<br>Explosive bombs | |
| **Parameters for Analysis** | Explosive bombs are assumed to explode just below the surface.<br>This activity would occur at least 50 NM from land (FDM excepted).<br>Approximately 90 percent of non-explosive bombs are the sub-scale bombs such as the MK-76 and BDU-48. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.10.2 Fast Attack Craft and Fast Inshore Attack Craft

| Surface Warfare | | |
|---|---|---|
| **Fast Attack Craft and Fast Inshore Attack Craft** | | |
| **Short Description** | Navy ships and helicopters defend against small boat attacks. | |
| **Long Description** | Navy ships and helicopters detect, coordinate, and defend against multiple high speed small boats employing swarm tactics. Ships must coordinate defenses to achieve proper targeting of attack craft. Activities conducted in the open ocean are called Fast Attack Craft, while those in littoral waters are called Fast Inshore Attack Craft. | |
| **Typical Components** | **Platforms:** Amphibious Warfare Vessels, Surface Combatant, Rotary-wing Aircraft, Unmanned Aerial Vehicles, Unmanned Surface Vehicles<br>**Targets:** Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile - Small Caliber, Projectile - Medium Caliber, Projectile - Large Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | E5 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Unmanned vehicles<br>Explosive gunnery<br>Non-explosive gunnery<br>Weapon firing noise | |
| **Parameters for Analysis** | This activity occurs > 3 NM from land.<br>Large caliber gunnery event will occur beyond 12 NM | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | MITT Study Area; Mariana Islands Range Complex |

### A.3.10.3 Gunnery Exercise Air-to-Surface – Medium Caliber

| Surface Warfare | | |
|---|---|---|
| **Gunnery Exercise Air-to-Surface Medium-Caliber** | | |
| **Short Description** | Fixed-wing and helicopter aircrews fire medium-caliber guns at surface targets. | |
| **Long Description** | Fixed-wing and helicopter aircrews engage surface targets with medium-caliber guns. Targets simulate enemy ships, boats, swimmers, and floating/near- surface mines. Fighter aircraft descend on a target firing high-explosive or non-explosive practice munitions medium-caliber projectiles. Helicopters will fly a racetrack pattern around an at-sea target. Aircrew will engage the target with medium-caliber weapons. Targets range from a smoke float, or an empty steel drum, to high-speed remote-controlled boats and jet-skis. | |
| **Typical Components** | **Platforms:** Fixed Wing – Strike Aircraft, Rotary-Wing Aircraft<br>**Targets:** Surface Targets - Floating, Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile - Medium Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Non-explosive gunnery<br>Towed in-water devices | |
| **Parameters for Analysis** | Most medium-caliber air-to-surface gunnery exercises will be with non-explosive training projectiles. High-explosive rounds will supplement when non-explosive training projectiles are not available. Fixed-wing projectile casings remain with aircraft and rotary-wing projectile casings are expended into the water.<br><br>High-explosive projectiles used during this activity would be *de minimis*.<br><br>This activity occurs > 12 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area SUA > 12 NM from land | MITT Study Area; Mariana Islands Range Complex |
| | Transit Corridor | |

### A.3.10.4 Gunnery Exercise Air-to-Surface – Small Caliber

| Surface Warfare | | |
|---|---|---|
| **Gunnery Exercise Air-to-Surface Small-Caliber** | | |
| **Short Description** | Helicopter and tiltrotor aircrews, use small-caliber guns to engage surface targets. | |
| **Long Description** | Navy, Marine Corps, and Coast Guard helicopters and tiltrotor aircraft, fly a racetrack pattern around an at-sea target. Targets simulate enemy ships, boats, and floating/near-surface mines. Each gunner will engage the target with small-caliber weapons. Targets range from a smoke float, an empty steel drum, to high-speed remote-controlled boats and jet-skis. | |
| **Typical Components** | **Platforms:** Rotary-Wing Aircraft<br>**Targets:** Surface Targets - Floating, Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile - Small Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Non-explosive gunnery | |
| **Parameters for Analysis** | This activity occurs > 12 NM from land | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area SUA > 12 NM from land | MITT Study Area; Mariana Islands Range Complex |

### A.3.10.5 Gunnery Exercise Surface-to-Surface Boat – Medium Caliber

| Surface Warfare | | |
|---|---|---|
| **Gunnery Exercise Surface-to-Surface Boat Medium-Caliber** | | |
| **Short Description** | Small boat crews fire medium-caliber guns at surface targets. | |
| **Long Description** | Navy and Coast Guard small boat crews fire medium-caliber guns at surface targets. Boat crews may use high or low speeds to approach and engage targets simulating other boats, floating mines, or nearshore land targets with medium-caliber (up to and including 40 mm) weapons. A commonly used target is an empty steel drum.<br><br>A number of different types of boats are used depending on the unit using the boat and their mission. Boats are most used to protect ships in harbors and high value units, such as aircraft carriers, nuclear submarines, and liquid natural gas tankers, while entering and leaving ports, as well as to conduct riverine operations and various naval special warfare operations. The boats used by these units include small unit river craft, combat rubber raiding craft, rigid-hull inflatable boats, patrol craft, and many other versions of these types of boats. These boats use inboard or outboard diesel or gasoline engines with either propeller or water jet propulsion. | |
| **Typical Components** | **Platforms:** Small Boat<br>**Targets:** Surface Targets - Floating<br>**Systems being Trained/Tested:** None<br>**Munitions:** Grenades | |
| **Active Sonar** | No | |
| **In-Water Explosives** | E1 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Explosive gunnery<br>Non-explosive gunnery<br>Towed in-water devices | |
| **Parameters for Analysis** | One target used per activity, typically a stationary target such as a 50–liter steel drum. Explosive rounds would be fired greater than 12 NM from land. Non-explosive rounds would be fired greater than 3 NM from land.<br>This training activity is conducted by Navy and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area > 12 NM from land (explosive) | MITT Study Area; Mariana Islands Range Complex |
| | MITT Study Area > 3 NM from land (non-explosive) | |

## A.3.10.6 Gunnery Exercise Surface-to-Surface Boat – Small Caliber

| Surface Warfare | | |
|---|---|---|
| **Gunnery Exercise Surface-to-Surface Boat Small-Caliber** | | |
| **Short Description** | Small boat crews fire small-caliber guns at surface targets. | |
| **Long Description** | Navy and Coast Guard small boat crews fire small-caliber guns at surface targets. Boat crews may use high or low speeds to approach and engage targets simulating other boats, swimmers, floating mines, or nearshore land targets with small-caliber (up to and including 0.50 caliber) weapons. A commonly used target is an empty steel drum.<br><br>Several different types of boats are used depending on the unit using the boat and their mission. Boats are most used to protect ships in harbors and high value units, such as aircraft carriers, nuclear submarines, and liquid natural gas tankers, while entering and leaving ports, as well as to conduct riverine operations, and various naval special warfare operations. The boats used by these units include small unit river craft, combat rubber raiding craft, rigid-hull inflatable boats, patrol craft, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion. | |
| **Typical Components** | **Platforms:** Small Boat<br>**Targets:** Surface Targets - Floating, Surface Targets - Towed<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile - Small Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Non-explosive gunnery<br>Towed in-water devices | |
| **Parameters for Analysis** | Activities will occur relatively nearshore due to short range of boats and safety concerns. Activities mostly occur within 3 NM of the shoreline but can occur further from shore. This training activity is conducted by Navy and USCG.<br><br>This activity occurs > 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |
| | Transit Corridor | |

## A.3.10.7 Gunnery Exercise Surface-to-Surface Ship – Large Caliber

| Surface Warfare | |
|---|---|
| **Gunnery Exercise Surface-to-Surface Ship Large-Caliber** | |
| **Short Description** | Surface ship crews fire large-caliber guns at surface targets. |
| **Long Description** | Navy and Coast Guard gun crews engage surface targets at sea with their main battery large-caliber (typically 57 mm, 76 mm, and 5-inch) guns. Targets include the QST-35 seaborne powered target, high speed maneuverable surface target, or a specially configured remote-controlled watercraft. Some targets are expended during the activity and are not recovered.<br><br>The activity proceeds with the target boat approaching from about 10–NM distance. The target is tracked by radar and when within a predetermined range, it is engaged first with large caliber "warning shots." As threats get closer all weapons may be used to disable the threat.<br><br>This activity may involve a single firing ship or be undertaken in the context of a coordinated larger exercise involving multiple ships, including a major training exercise.<br><br>Large-caliber guns will also be fired during weapon certification events and in conjunction with weapon maintenance.<br><br>During all activities, either high-explosive or non-explosive rounds may be used. High-explosive rounds can either be fused for detonation on impact (with water surface or targets), or for proximity to the target (in air detonation). |
| **Typical Components** | **Platforms:** Patrol Combatant, Surface Combatant<br>**Targets:** Surface Targets - Floating, Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile - Large Caliber |
| **Active Sonar** | No |
| **In-Water Explosives** | E3, E5 |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Explosive gunnery<br>Non-explosive gunnery<br>Towed in-water devices<br>Weapon firing noise |
| **Parameters for Analysis** | For analytical purposes assume all high-explosive rounds are fused to detonate upon impact with the water surface or target.<br>After impacting the water, the high-explosive rounds are expected to detonate within 3 ft. of the surface. Non-explosive rounds, and fragments from the high-explosive rounds will sink to the bottom of the ocean.<br>Assume each projectile will be up to 5 in. in diameter and 30 in. in length, and each firing will also expend an empty propellent cartridge. |

| Surface Warfare | | |
|---|---|---|
| **Gunnery Exercise Surface-to-Surface Ship Large-Caliber** | | |
| | This activity would occur greater than 12 NM from land (FDM excepted).<br>This training activity is conducted by Navy and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area SUA > 12 NM from land | MITT Study Area; Mariana Islands Range Complex |
| | Transit Corridor | MITT Transit Lane |

## A.3.10.8 Gunnery Exercise Surface-to-Surface Ship – Medium Caliber

| Surface Warfare | | |
|---|---|---|
| **Gunnery Exercise Surface-to-Surface Ship Medium-Caliber** | | |
| **Short Description** | Surface ship crews fire medium-caliber guns at surface targets. | |
| **Long Description** | Navy and Coast Guard crews fire medium-caliber guns at surface targets.<br><br>Ships use medium-caliber weapons to practice defensive marksmanship, typically against a stationary floating target (a 10 ft. diameter red balloon [i.e., Killer Tomato]) and high-speed mobile targets. Some targets are expended during the activity and are not recovered.<br><br>Shipboard protection systems (Close-In Weapon System) utilizing medium-caliber projectiles would train against high-speed mobile targets. | |
| **Typical Components** | **Platforms:** Amphibious Warfare Vessels, Patrol Combatant, Surface Combatant<br>**Targets:** Surface Targets - Floating, Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile - Medium Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | E1 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Non-explosive gunnery<br>Explosive gunnery<br>Towed in-water devices | |
| **Parameters for Analysis** | One target is used per activity Approximately 35 percent are high-speed maneuvering targets, which are recovered. Approximately 15 percent of targets are other stationary targets such as a steel drum that are not recovered. The number or rounds per activity varies depending on munitions used.<br>This activity would occur greater than 12 NM from land (FDM excepted).<br>This training activity is conducted by Navy and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area SUA > 12 NM from land | MITT Study Area; Mariana Islands Range Complex |
| | Transit Corridor | |

### A.3.10.9 Gunnery Exercise Surface-to-Surface Ship – Small Caliber

| Surface Warfare | | |
|---|---|---|
| **Gunnery Exercise Surface-to-Surface Ship Small-Caliber** | | |
| **Short Description** | Surface ship crews fire small-caliber guns at surface targets. | |
| **Long Description** | Navy and Coast Guard ship and boat crews fire small-caliber guns at surface targets.<br><br>Ships use small-caliber weapons to practice defensive marksmanship, typically against stationary floating targets. The target may be a 10 ft. diameter red balloon (Killer Tomato), a 50-gallon steel drum, or another available target, such as a cardboard box. Some targets are expended during the activity and are not recovered.<br><br>Ship crew qualifications conducted at sea employ stationary targets on deck. Small-caliber projectiles fired during these activities will be expended in the water.<br><br>Shipboard protection systems utilizing small-caliber projectiles will train against high-speed mobile targets. | |
| **Typical Components** | **Platforms:** Patrol Combatant, Surface Combatant<br>**Targets:** Surface Targets - Floating<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile - Small Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Non-explosive gunnery<br>Towed in-water devices | |
| **Parameters for Analysis** | This activity would occur greater than 12 NM from land (FDM excepted). This training activity is conducted by Navy and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area SUA > 12 NM from land | MITT Study Area; Mariana Islands Range Complex |
| | Transit Corridor | |

### A.3.10.10 Laser Targeting – Aircraft

| Surface Warfare | | |
|---|---|---|
| **Laser Targeting - Aircraft** | | |
| **Short Description** | Fixed-wing and helicopter aircrews illuminate enemy targets with lasers. | |
| **Long Description** | Fixed-winged and helicopter aircrew illuminate enemy targets with lasers for engagement by aircraft with laser guided bombs or missiles. This activity may be conducted alone or in conjunction with other activities utilizing precision guided munitions, such as surface missiles and guided rockets. Activities where weapons are fired are addressed in the appropriate activity (e.g., air-to-surface missile exercise). Lower powered lasers, like those utilized by the Navy and USCG, may also be used as non-lethal deterrents during maritime security operations (force protection). | |
| **Typical Components** | **Platforms:** Fixed Wing – Strike Aircraft, Patrol Combatant, Rotary-Wing Aircraft<br>**Targets:** Air Targets - Drone, Land Targets, Surface Targets - Floating, Surface Targets - Maneuvering, Surface Targets - Towed<br>**Systems being Trained/Tested:** Fixed-wing and helicopter lasers<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Towed in-water devices | |
| **Parameters for Analysis** | Laser targeting for missile/rocket guidance will occur in areas where these activities also occur.<br>Use of lasers as force protection non-lethal deterrents will primarily occur proximate to Navy homeports.<br>This training activity is conducted by the Navy and USCG.<br>All activities involving lasers require careful planning to ensure public safety.<br>Laser targeting activities typically occur in Special Use Airspace. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area SUA > 12 NM from land | MITT Study Area; Mariana Islands Range Complex |

### A.3.10.11 Laser Targeting – Ship

| Surface Warfare | | |
|---|---|---|
| **Laser Targeting - Ship** | | |
| **Short Description** | Surface ship crews illuminate air and surface targets with high-energy laser systems. | |
| **Long Description** | Ship crews employ high-power energy laser systems that are used to create critical failures in airborne and surface targets. System directs a directed energy beam that can penetrate thin layers of metal at short distances (less than 1 nautical mile) that can render air and surface targets inoperative. Laser systems can also be used in a low power setting as non-lethal deterrent during maritime security operations (force protection). The low power capability would not be used against manned platforms during training. | |
| **Typical Components** | **Platforms:** Surface Combatant<br>**Targets:** Air Targets - Drone, Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Shipboard laser systems<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Towed in-water devices | |
| **Parameters for Analysis** | Laser targeting for missile/rocket guidance will occur in areas where these activities also occur.<br>Use of lasers as force protection non-lethal deterrents will primarily occur proximate to Navy homeports.<br>All activities involving lasers require careful planning to ensure public safety.<br>Laser targeting activities typically occur in Special Use Airspace. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area SUA > 12 NM from land | MITT Study Area; Mariana Islands Range Complex |

### A.3.10.12 Maritime Security Operations

| Surface Warfare | |
|---|---|
| **Maritime Security Operations** | |
| **Short Description** | Helicopter, surface ship, and small boat crews conduct a suite of maritime security operations at sea, to include visit, board, search, and seizure; maritime interdiction operations; maritime interdiction operations; maritime infrastructure protection and harbor defense; ship force protection; anti-piracy operations; and drug interdiction by the Coast Guard. |
| **Long Description** | Navy and Coast Guard helicopter and surface ship crews conduct a suite of maritime security operations. These activities involve training of boarding parties delivered by helicopters and surface ships to surface vessels for the purpose of simulating vessel search and seizure operations. Various training scenarios are employed and may include small arms with non-explosive blanks and surveillance or reconnaissance unmanned surface and aerial vehicles.<br><br>Vessel Visit, Board, Search, and Seizure: Military personnel from ships and aircraft board suspect vessels, potentially under hostile conditions.<br><br>Maritime Interdiction Operations: Ships and aircraft train in pursuing, intercepting, and ultimately detaining suspect vessels.<br><br>Maritime Infrastructure Protection and Harbor Defense: Naval personnel train to defend oil platforms, similar at sea structures, harbors, piers, and other infrastructure.<br><br>Warning Shot/Disabling Fire: Naval personnel train in the use of weapons to force fleeing or threatening small boats (typically operating at high speeds) to come to a stop.<br><br>Ship Force Protection: Ship crews train in tracking multiple approaching, circling small craft, assessing threat potential, and communicating amongst crewmates and other vessels to ensure ships are protected against attack.<br><br>Anti-Piracy Training: Naval personnel train in deterring and interrupting piracy activity. Training includes large vessels (pirate “mother ships”), and multiple small, maneuverable, and fast craft.<br><br>Drug Interdiction: Coast Guard helicopter and surface ship crews train in the intercepting, boarding, and searching of suspected drug carrying vessels. |
| **Typical Components** | **Platforms:** Patrol Combatant, Rotary-Wing Aircraft, Small Boat, Surface Combatant<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** Grenades |
| **Active Sonar** | No |
| **In-Water Explosives** | E2 |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):** |

| | | |
|---|---|---|
| **Surface Warfare** | | |
| **Maritime Security Operations** | | |
| | Manned surface vessels<br>Explosive gunnery<br>Non-explosive gunnery | |
| **Parameters for Analysis** | Maritime Security Operations is a broad term used to describe activities intended to train naval forces in the skills necessary to protect naval vessels from small boat attack, counter piracy and drug operations (maritime interdiction operations and visit, board, search, and seizure), and protect key infrastructure (e.g. oil platforms). These activities need to remain broad as naval forces need to be able to tailor training activities to respond to emergent threats. Activities typically do not involve live fire of weapons. All activities involve vessel movement, sometimes at high rates of speed (naval vessels maneuvering to overtake suspect vessel and/or small boats [targets] closing in and maneuvering around naval vessels), and some event involve helicopters and boarding parties.<br><br>Firing of weapons during offshore activities is accounted for in gunnery exercises, surface-to-surface activities. Inshore activities include firing small caliber blank ammunition.<br><br>These activities may occur in the nearshore areas throughout the Study Area.<br><br>This training activity is conducted by Navy and USCG.<br><br>Activities involving explosives should occur > 12 NM. | |
| **Location** | **Phase III Requirement 202-2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | Inner Apra Harbor |
| | Mariana Islands Range Complex | MITT Study Area; Mariana Islands Range Complex |
| | Mariana Littorals | Outer Apra Harbor |

### A.3.10.13 Missile Exercise – Surface-to-Surface

| Surface Warfare | | |
|---|---|---|
| **Missile Exercise - Surface-to-Surface** | | |
| **Short Description** | Surface ship crews defend against surface threats (ships or small boats) and engage them with missiles. | |
| **Long Description** | Surface ships launch missiles at surface maritime targets with the goal of destroying or disabling enemy ships or boats. After detecting and confirming a surface threat, the ship will fire a precision guided surface missile.<br><br>Events with destroyers and cruisers will involve long range (over the horizon) surface missiles.<br>Events with littoral combat ships certify ship's crew to defend against "close-in" surface threats and will use shorter range surface missiles.<br><br>These activities are live fire, meaning that a missile is fired down range. Surface missiles could be equipped with either high-explosive or non-explosive warheads. | |
| **Typical Components** | **Platforms:** Surface Combatant<br>**Targets:** Surface Targets - Maneuvering<br>**Systems being Trained/Tested:**<br>**Munitions:** Air-to-Surface Missiles | |
| **Active Sonar** | No | |
| **In-Water Explosives** | E9 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Explosive missiles and rockets<br>Non-explosive missiles and rockets | |
| **Parameters for Analysis** | Assume one missile and one target used per activity.<br>While missile could explode above the water's surface after contacting target, analysis assumes all warheads explode at or just below the surface.<br>Targets are usually recovered but could be lost due to damage.<br>This activity would occur greater than 50 NM from land (FDM excepted). | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area > 50 NM from land | MITT Study Area; Mariana Islands Range Complex |

### A.3.10.14 Missile Exercise Air-to-Surface – Rocket

| Surface Warfare | | |
|---|---|---|
| **Missile Exercise Air-to-Surface - Rocket** | | |
| **Short Description** | Helicopter aircrews fire both precision-guided and unguided rockets at surface targets. | |
| **Long Description** | Helicopters designate an at-sea surface target with a laser or optics for precision-guided high explosive or non-explosive practice munitions rockets. | |
| **Typical Components** | **Platforms:** Rotary-Wing Aircraft, Unmanned Aerial Vehicles – Rotary Wing<br>**Targets:** Surface Targets - Floating, Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** None<br>**Munitions:** Rockets | |
| **Active Sonar** | No | |
| **In-Water Explosives** | E3 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Explosive missiles and rockets<br>Non-explosive missiles and rockets | |
| **Parameters for Analysis** | Assume all explosive rockets detonate in the water.<br>Rockets may be used in conjunction with force protection events.<br>The in-air low energy laser stressor was used in analysis of potential impacts on human resources.<br>Targets are usually recovered but could be lost due to damage.<br>This activity would occur greater than 12 NM from land (FDM excepted). | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area SUA > 12 NM from land | MITT Study Area; Mariana Islands Range Complex |

### A.3.10.15 Missile Exercise Air-to-Surface

| Surface Warfare | | |
|---|---|---|
| **Missile Exercise Air-to-Surface** | | |
| **Short Description** | Fixed-wing and helicopter aircrews fire air-to-surface missiles at surface targets. | |
| **Long Description** | Fighter, maritime patrol aircraft, and helicopter aircrews fire precision-guided missiles against surface targets. Aircraft involved may be unmanned.<br><br>Fixed-wing aircraft (fighters or maritime patrol aircraft) approach an at-sea surface target from high altitude and launch high-explosive precision guided missiles.<br><br>Helicopters designate at-sea surface targets with a laser or optics for a precision guided high-explosive or non-explosive practice munitions missile. Helicopter launched missiles typically pass through the target's "sail," and, if explosive, detonate at or just below, the water's surface. | |
| **Typical Components** | **Platforms:** Fixed Wing – Patrol Aircraft, Fixed Wing – Strike Aircraft, Rotary-Wing Aircraft, Unmanned Aerial Vehicle – Rotary Wing<br>**Targets:** Surface Targets - Floating, Surface Targets - Maneuvering, Surface Targets - Towed<br>**Systems being Trained/Tested:** None<br>**Munitions:** Air-to-Surface Missiles | |
| **Active Sonar** | No | |
| **In-Water Explosives** | E6, E7, E9, E10 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Explosive missiles and rockets<br>Non-explosive missiles and rockets<br>Towed in-water devices | |
| **Parameters for Analysis** | Assume one missile and one target are used per activity.<br>While missiles could explode above the water's surface after contacting targets, analysis assumes that all warheads explode at or just below the water's surface.<br>Targets are usually recovered but could be lost due to damage.<br>This activity occurs greater than 12 NM from land (FDM excepted). | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area SUA > 12 NM from land | MITT Study Area; Mariana Islands Range Complex |

### A.3.10.16 Sinking Exercise

| Surface Warfare | |
|---|---|
| **Sinking Exercise** | |
| **Short Description** | Aircraft, ship, and submarine crews deliberately sink a seaborne target, usually a decommissioned ship made environmentally safe for sinking according to U.S. Environmental Protection Agency standards, with a variety of ordnance. |
| **Long Description** | Joint Ship personnel and aircrews deliver high-explosive ordnance on a seaborne target, (large, deactivated vessel), which is deliberately sunk using multiple weapon systems. A sinking exercise is typically a joint activity conducted by aircraft, surface vessels, and submarines to train in live ordnance delivery on a full-size ship target. The target is typically a decommissioned ship made environmentally safe for sinking according to U.S. Environmental Protection Agency standards. The location is greater than 50 nautical miles from shore and in water depths greater than 6,000 feet (ft.).<br><br>Ship, aircraft, and submarine crews attack with coordinated tactics and deliver a variety of inert and high-explosive ordnance. Coast Guard cutters and Air Force aircraft may participate in this activity. Typically, the activity lasts for 4 to 8 hours and possibly over 1 to 2 days, however it is unpredictable and ultimately ends when the target ship sinks. |
| **Typical Components** | **Platforms:** Fixed Wing – Strike Aircraft, Fixed Wing – Other, Submarine, Surface Combatant, Unmanned Aerial Vehicle – Fixed Wing, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets:** Surface Targets - Floating<br>**Systems being Trained/Tested:** None<br>**Munitions:** Bombs, Projectile - Large Caliber, Projectile - Medium Caliber, Torpedoes - HE, Air-to-Surface Missiles |
| **Active Sonar** | HFH |
| **In-Water Explosives** | E5, E8, E9, E11, E12 |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels<br>Unmanned vehicles<br>SINKEX |
| **Parameters for Analysis** | Activities occur greater than 50 NM from shore and in water depths greater than 6,000 ft. during daylight hours only.<br>The participants and assets typically include:<br>• 1 full-size target ship hulk<br>• 1-5 CG, DDG, or LCS ships<br>• 1-10 F/A-18, or maritime patrol aircraft<br>• 1 or 2 MH-60 helicopters<br>• 1 E-2 aircraft for Command and Control<br>• 1 submarine<br>• 1-3 range clearance aircraft<br>• 1-2 Harpoon surface-to-surface or air-to-surface missiles<br>• 2-4 Maverick or Hellfire air-to-surface missiles |

<table>
<tr><td colspan="3">Surface Warfare</td></tr>
<tr><td colspan="3">Sinking Exercise</td></tr>
<tr><td></td><td colspan="2">• 2-12 MK-80 series general purpose bombs<br>• 200 rounds large-caliber projectiles<br>• 1-2 MK-48 heavyweight submarine-launched torpedoes<br>• 2,000–10,000 projectiles .50-caliber and 7.62 millimeter<br>• Assume 2 guidance wires expended per event<br>Acoustic effects modeling assumed only a percentage of munitions missed target and exploded in water. Precision guided munitions are assumed to impact target well above waterline and are not modeled (or reported) as in-water explosions.<br><br>This activity occurs >50 NM from land and >1,000 fathoms depth</td></tr>
<tr><td rowspan="2">Location</td><td>Phase III Requirement 2020–2027</td><td>Phase IV Requirement 2027–2034</td></tr>
<tr><td>MITT Study Area</td><td>MITT Study Area; Mariana Islands Range Complex</td></tr>
</table>

### A.3.10.17 Small Boat Attack

| Surface Warfare | | |
|---|---|---|
| **Small Boat Attack** | | |
| **Short Description** | Afloat units defend against small boat or personal watercraft attack. | |
| **Long Description** | For this activity, one or two small boats or personal watercraft conduct simulated attack activities on units afloat, training ship crews how to respond to small boat attack in harbors, restricted channels, and nearshore areas using non-lethal means or armament appropriate to the threat and location. Coast Guard small boats and aircraft may participate in this activity. | |
| **Typical Components** | **Platforms:** Patrol Combatant, Small Boats<br>**Targets:** Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** None<br>**Munitions:** Projectile – Small Caliber | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Non-explosive gunnery | |
| **Parameters for Analysis** | This training activity is conducted by the Navy and USCG.<br><br>Events employing live fire will occur > 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |
| | | Outer Apra Harbor |

## A.3.10.18 Surface Warfare Torpedo Exercise – Submarine

| Surface Warfare | | |
|---|---|---|
| **Surface Warfare Torpedo Exercise - Submarine** | | |
| **Short Description** | Submarine crews search for, detect, and track a surface ship simulating a threat surface ship with the goal of determining a firing solution that could be used to launch a torpedo with the intent to simulate destroying the targets. | |
| **Long Description** | Submarine crews search for, detect, and track a surface ship(s) simulating threat surface ship(s) with the goal of determining a firing solution that could be used to launch torpedoes with the intent to simulate destroying the targets. A single submerged submarine operates at various speeds and depths while using its hull mounted and towed array passive and active sonars and potentially UAVs to track the threat target. Passive sonar is used extensively with active sonar used less frequently. Submarine launched exercise torpedoes are fired at the target surface ship(s) and surface ship targets and/or threat supporting fixed and/or rotary wing aircraft may fire light weight torpedoes at the submarine. All activity participants may employ countermeasures and decoys.<br><br>This activity may involve a single submarine or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. The exercise torpedoes are recovered by helicopter or small craft. The preferred range for this activity is an instrumented underwater range, but it may be conducted off an instrumented range. | |
| **Typical Components** | **Platforms:** Submarine, Unmanned Aerial Vehicles – Rotary Wing<br>**Targets:** Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** None<br>**Munitions:** Torpedoes - Exercise | |
| **Active Sonar** | HFH | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels<br>Towed in-water devices | |
| **Parameters for Analysis** | This activity occurs > 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area > 3 NM from land | MITT Study Area; Mariana Islands Range Complex |

## A.3.11 Other Training Activities

Other training activities includes training that falls outside the Primary Mission Areas.

### A.3.11.1 Direct Action (Tactical Air Control Party)

| **Other Training Activities** | | |
|---|---|---|
| **Direct Action (Tactical Air Control Party)** | | |
| **Short Description** | Military personnel train for controlling of combat support aircraft; providing airspace de-confliction and terminal control for Close Air Support. | |
| **Long Description** | Tactical Air Control personnel, once at Farallon de Medinilla, participate in tactical air control training in conjunction with an Air-to-Ground bombing or missile exercise. They may also employ small arms, grenades, mortars, and crew served weapons in direct action against targets on the island. | |
| **Typical Components** | **Platforms:** Fixed-Wing Aircraft, Rotary-Wing Aircraft<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** Small arms, grenades, mortars | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | None | |
| **Parameters for Analysis** | May involve overnight camping on FDM. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | FDM | FDM; R7201; R7201A |

### A.3.11.2 Maritime Environmental Response

| Other Training Activities | | |
|---|---|---|
| **Maritime Environmental Response – New Activity** | | |
| **Short Description** | Train units to response to maritime environmental incidents. | |
| **Long Description** | USCG conducts spill and hazmat response that occur after ships run aground or oil wells are compromised. Training may include deployment of oil booms. | |
| **Typical Components** | **Platforms:** Patrol Combatant, Small Boats<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | MITT Study Area |

### A.3.11.3 Precision Anchoring

| Other Training Activities | | |
|---|---|---|
| **Precision Anchoring** | | |
| **Short Description** | Surface ship crews release and retrieve anchors in designated locations. | |
| **Long Description** | Navy and Coast Guard ship crews choose the best available anchoring sites. The ship uses all means available to determine its position when anchor is dropped to demonstrate calculating and plotting the anchor's position within 100 yards of center of planned anchorage. | |
| **Typical Components** | **Platforms:** All Navy and Coast Guard Ships and Boats<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | This training activity is conducted by Navy and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Apra Harbor | MIRC Anchorages |
| | Mariana Islands anchorages | |

### A.3.11.4 Search and Rescue

| Other Training Activities | | |
|---|---|---|
| **Search and Rescue** | | |
| **Short Description** | Helicopter and ship crews rescue military personnel at sea. | |
| **Long Description** | Navy and Coast Guard helicopter, ship, and submarine crews practice the skills required to recover personnel lost at sea. Helicopters locate survivors and deploy rescue swimmer and rescue basket. Survivors are winched up to the hovering helicopter. Surface ships would conduct man overboard drills and deploy a dummy figure in the water. Ship crews would launch a small boat, direct the recovery of the dummy, and recover the small boat. Submarine crews would maneuver the submarine to effect recovery of personnel. | |
| **Typical Components** | **Platforms:** All Navy Ships and Boats, Rotary-Wing and Fixed-Wing Aircrafts<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | These events may occur in the nearshore areas throughout the Study Area.<br>This training activity is conducted by Navy and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.3.11.5 Submarine Navigation

| Other Training Activities | | |
|---|---|---|
| **Submarine Navigation** | | |
| **Short Description** | Submarine crews operate sonar for navigation and detection while transiting into and out of port during reduced visibility. | |
| **Long Description** | Submarine crews train to operate sonar for navigation. The ability to navigate using sonar is critical for detection while transiting into and out of port during periods of reduced visibility. During this activity the submarine will be surfaced. | |
| **Typical Components** | **Platforms:** Submarine<br>**Targets:** None<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted<br>**Munitions:** None | |
| **Active Sonar** | MFH, HFH | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources | |
| **Parameters for Analysis** | None | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Apra Harbor and Mariana Littorals | MITT Study Area; Mariana Islands Range Complex |

### A.3.11.6 Submarine Sonar Maintenance

| Other Training Activities | | |
|---|---|---|
| **Submarine Sonar Maintenance and Systems Checks** | | |
| **Short Description** | Maintenance of submarine sonar and other system checks are conducted pierside or at sea. | |
| **Long Description** | A submarine performs periodic maintenance on the submarine sonar systems while in port or at sea. Submarines conduct maintenance to their sonar systems in shallow water near their homeport, however, sonar maintenance could occur anywhere as the system's performance may warrant. | |
| **Typical Components** | **Platforms:** Submarine<br>**Targets:** None<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted<br>**Munitions:** None | |
| **Active Sonar** | MFH | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources | |
| **Parameters for Analysis** | None | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | Inner Apra Harbor |
| | Inner Apra Harbor | MITT Study Area; Mariana Islands Range Complex |
| | Transit Corridor | MITT Transit Lane |

## A.3.11.7 Surface Ship Sonar Maintenance

| Other Training Activities | | |
|---|---|---|
| **Surface Ship Sonar Maintenance and Systems Checks** | | |
| **Short Description** | Maintenance of surface ship sonar and other system checks are conducted pierside or at sea. | |
| **Long Description** | This scenario consists of surface ships performing periodic maintenance to the sonar and other ship systems while in port or at sea. This maintenance takes up to 4 hours. Surface ships operate active sonar systems for maintenance while in shallow water near their homeport, however, sonar maintenance could occur anywhere as the system's performance may warrant. | |
| **Typical Components** | **Platforms:** Surface Combatant<br>**Targets:** None<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted<br>**Munitions:** None | |
| **Active Sonar** | MF1, MF1K | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels | |
| **Parameters for Analysis** | None | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | Inner Apra Harbor |
| | Inner Apra Harbor | MITT Study Area; Mariana Islands Range Complex |
| | Transit Corridor | MITT Transit Lane |

### A.3.11.8 Underwater Survey

| Other Training Activities | | |
|---|---|---|
| **Underwater Survey** | | |
| **Short Description** | Navy divers train in survey of underwater conditions and features in preparation for insertion, extraction, or intelligence, surveillance, and reconnaissance activities. | |
| **Long Description** | A survey of underwater terrain conditions nearshore and a report of findings to provide precise analysis for amphibious landings. Personnel perform methodical reconnoitering of beaches and surf conditions during the day and night to find and clear underwater obstacles and determine the feasibility of landing an amphibious force on a particular beach. | |
| **Typical Components** | **Platforms:** Small Boat, Unmanned Bottom Crawler<br>**Targets:** None<br>**Systems being Trained/Tested:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Unmanned vehicles | |
| **Parameters for Analysis** | Hand-held (or similar) *de minimis* sonar sources may be used. During the conduct of underwater survey activities personnel may stand in the surf zone and walk onto the beach. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |
| | Apra Harbor and Mariana Littorals | |

### A.3.11.9 Unmanned Aerial System Training and Certification

| Other Training Activities | | |
|---|---|---|
| **Unmanned Aerial System Training and Certification** | | |
| **Short Description** | Surface ships and submarines launch unmanned aerial systems to conduct training and certification. | |
| **Long Description** | Navy and Coast Guard forces deploy unmanned aerial systems (UASs) from surface ships and ashore locations to conduct training and certification. These UASs are typically recovered, with flight times lasting from 1-8 hours. Personnel use radio frequency communications to control and communicate with the unmanned aerial system during its flight. For submarine launched UASs, a negatively buoyant capsule is deployed underwater and descends to a programmed depth. The capsule then drops a weight, inflates a flotation collar, rises to the surface, and launches an unmanned aerial system. Submarine launched UASs are not typically recovered. | |
| **Typical Components** | **Platforms:** Unmanned Aerial Vehicle - Fixed Wing<br>**Targets:** None<br>**Systems being Trained/Tested:** Surface Ship and Submarine Launched UASs<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels<br>Unmanned vehicles | |
| **Parameters for Analysis** | This training activity is conducted by Navy, USMC, and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Islands Range Complex | MITT Study Area; Mariana Islands Range Complex |
| | MITT Study Area | |

## A.3.11.10 Unmanned Underwater Vehicle Training

| Other Training Activities | | |
|---|---|---|
| **Unmanned Underwater Vehicle Training - Certification and Development Exercises** | | |
| **Short Description** | Unmanned underwater vehicle certification involves training with unmanned platforms to ensure crew proficiency. Tactical development involves training with various payloads, for multiple purposes to ensure that the systems can be employed effectively in an operational environment. | |
| **Long Description** | Unmanned underwater vehicle certification and tactical development involves the training with unmanned platforms on which various payloads are attached and used for different purposes. Unmanned underwater vehicles may be deployed by surface ships and Coast Guard cutters, small boats, submarines, aircraft, and target support vessels. Payload certification and development training assesses various systems that can be incorporated onto unmanned platforms for mine warfare, bottom mapping, and other missions. Training can range from basic remote control and autonomous navigation tests to deployment and activation of onboard systems which may include hydrodynamic instruments, launchers, and recovery capabilities. | |
| **Typical Components** | **Platforms:** Small Boat, Unmanned Underwater Vehicle<br>**Targets:** Mine Targets<br>**Systems being Trained/Tested:** Unmanned Vehicle Systems, Sonar Systems - Other, Safety and Navigation, Pinger, Acoustic Communications<br>**Munitions:** None | |
| **Active Sonar** | HFM, VHFH, Broadband (MF to HF) | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels<br>Unmanned vehicles | |
| **Parameters for Analysis** | These events may occur in littorals throughout the Study Area.<br>This training activity is conducted by Navy and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Mariana Islands Range Complex | MITT Study Area; Mariana Islands Range Complex |
| | Apra Harbor | |
| | Mariana Littorals | |

### A.3.11.11 Waterborne Training

| Other Training Activities | | |
|---|---|---|
| **Waterborne Training – New Activity** | | |
| **Short Description** | Personnel launch, operate, and recover a variety of small boats to achieve certifications such as coxswain, crewman, and safety observer. | |
| **Long Description** | Waterborne Training includes qualification and certification as safety observer, safety swimmer, coxswain, and crewman utilizing a variety of Navy and Coast Guard small crafts. These craft include, but are not limited, to rigid hull inflatables, aluminum chambered boats, patrol boats, stand-up paddleboards, kayaks, and jet skis. Small boat crews train to launch and recover, moor to buoys, anchor, and operate a variety of missions in shallow waters. | |
| **Typical Components** | **Platforms:** Small Boat<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | This training activity is conducted by Navy and USCG. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | MITT Study Area; Mariana Islands Range Complex |
| | | CNMI Nearshore |
| | | Guam Nearshore |

## A.4 Testing Activities

### A.4.1 Naval Air Systems Command Testing Activities

Naval Air Systems Command (NAVAIR) activities will generally fall under fleet primary mission areas, such as the testing of airborne mine warfare and anti-submarine warfare weapons and systems. NAVAIR activities include, but are not limited to, the testing of new aircraft platforms, weapons, and systems that will ultimately be integrated into fleet training activities. In addition to testing new platforms, weapons, and systems, In addition to testing new platforms, weapons, and systems, NAVAIR also conducts follow-on testing and evaluation of updated systems in support of fleet operational units in the MITT Study Area. In general, the potential environmental effects from most NAVAIR testing events are similar to the associated fleet training events.

While many of these systems tested by NAVAIR will ultimately be used by the fleet, testing activities involving the same or similar systems may be conducted in different locations and manners that when conducted by the fleet. Because of these differences, the results of the analysis for testing activities may differ from the results for training activities.

#### A.4.1.1 Air Warfare

Testing of air warfare systems is required to ensure the equipment is fully functional under the conditions in which it will be used. Tests may be conducted on radar and other early-warning detection and tracking systems, and missiles. Testing of these systems may be conducted on new ships and aircraft, and on existing ships and aircraft following maintenance, repair, or modification. For some systems, tests are conducted periodically to assess operability. Additionally, tests may be conducted in support of scientific research to assess new and emerging technologies.

### A.4.1.1.1 Air Combat Maneuvers Test

| Air Warfare | | |
|---|---|---|
| **Air Combat Maneuvers Test** | | |
| **Short Description** | Aircrews engage in flight maneuvers designed to gain a tactical advantage during combat. | |
| **Long Description** | Air combat maneuver is the general term used to describe an air-to-air test event involving two or more aircraft, each engaged in continuous proactive and reactive changes in aircraft attitude, altitude, and airspeed. No weapons are fired during air combat maneuver activities. | |
| **Typical Components** | **Platforms:** Fixed-Wing Aircraft<br>**Targets:** None<br>**Systems being Trained/Tested:** Aircraft systems<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | None | |
| **Parameters for Analysis** | This activity occurs > 12 NM from land (FDM excepted). Air Combat Maneuver Test was not called out in the previous MITT analyses, but the components of the testing were aligned with the training activity “Air Combat Maneuvers.” | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area, Mariana Islands Range Complex | MITT Study Area; Mariana Islands Range Complex |

### A.4.1.1.2 Intelligence, Surveillance, and Reconnaissance Test

| Air Warfare | | |
|---|---|---|
| **Intelligence, Surveillance, and Reconnaissance Test** | | |
| **Short Description** | Aircrews use all available sensors to collect data on threat vessels. | |
| **Long Description** | An air warfare intelligence, surveillance, and reconnaissance (ISR) test involves evaluating communications capabilities of aircraft, including unmanned aerial systems that can carry cameras, sensors, communications equipment, or other payloads. New systems are tested at sea to ensure proper communications between aircraft and ships.<br><br>ISR aircraft systems act as eyes in the sky, relaying raw imagery back to military personnel on the ground or to ships at-sea. The data is processed, analyzed, and shared with U.S. Navy or other U.S. military aircraft or vessels. New ISR technology systems provide combat identification (friend or foe) and are used for aircraft and ship-based communications. | |
| **Typical Components** | **Platforms:** Fixed-Wing Aircraft, Rotary-Wing Aircraft<br>**Targets:** Air Targets – Drone.<br>**Systems being Trained/Tested:** Aircraft intelligence, surveillance, and reconnaissance systems<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | None | |
| **Parameters for Analysis** | This activity occurs > 3 NM from land (FDM excepted). | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.4.1.2 Anti-Submarine Warfare

Testing of anti-submarine warfare systems is conducted to develop new technologies and assess weapon performance and operability with new systems and platforms, such as unmanned systems. Testing uses ships, submarines, and aircraft to demonstrate capabilities of torpedoes, missiles, countermeasure systems, and underwater surveillance and communications systems. Tests may be conducted as part of a large-scale fleet training event involving submarines, ships, fixed-wing aircraft, and rotary-wing aircraft. These integrated training events offer opportunities to conduct research and acquisition activities and to train aircrew in the use of new or newly enhanced systems during a large-scale, complex exercise.

### A.4.1.2.1 Anti-Submarine Warfare Torpedo Test (Aircraft)

| Anti-Submarine Warfare | | |
|---|---|---|
| **Anti-Submarine Warfare Torpedo Test (Aircraft)** | | |
| **Short Description** | Test evaluates anti-submarine warfare systems onboard rotary-wing and fixed-wing aircraft and the ability to search for, detect, classify, localize, track, and attack a submarine or similar target. | |
| **Long Description** | The Anti-Submarine Warfare Torpedo Test (Aircraft) evaluates anti-submarine warfare systems onboard rotary-wing and fixed-wing aircraft and the ability to search for, detect, classify, localize, track, and attack a submarine or similar target. The focus of the anti-submarine warfare torpedo test is the operation of non-explosive torpedoes, but other anti-submarine warfare systems are often used during the test. Targets simulate a submarine threat and are deployed at varying depths and speeds. If available, tests may be conducted using an actual submarine as the target. This activity can be conducted in shallow or deep waters and aircraft can originate from a land base or from a surface ship. The torpedo test culminates with the release of an exercise torpedo against the target and is intended to evaluate the targeting, release, and tracking process of deploying torpedoes from aircraft. All exercise torpedoes used in testing are either running or non-running and are non-explosive. Eighty-five percent of torpedoes are recovered. A parachute assembly used for aircraft-launched torpedoes is jettisoned and sinks. Ballast (typically lead weights) may be released from the torpedoes to allow for recovery, leaving the ballast to sink to the bottom. | |
| **Typical Components** | **Platforms:** Fixed-Wing Aircraft; Rotary-Wing Aircraft<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonobuoys<br>**Munitions:** Torpedoes - Exercise | |
| **Active Sonar** | MFM, HFH | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources | |
| **Parameters for Analysis** | Assume one torpedo accessory package (e.g., ballast) per torpedo.<br>Assume one target per torpedo.<br>This activity occurs > 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area > 3 NM from land | MITT Study Area; Mariana Islands Range Complex |

### A.4.1.2.2 Anti-Submarine Warfare Tracking Test (Fixed-Wing)

| Anti-Submarine Warfare | | |
|---|---|---|
| **Anti-Submarine Warfare Tracking Test (Fixed-Wing)** | | |
| **Short Description** | The test evaluates the sensors and systems used by fixed-wing aircraft to detect and track submarines and to ensure that aircraft systems used to deploy the tracking systems perform to specifications and meet operational requirements. | |
| **Long Description** | An Anti-Submarine Warfare Tracking Test (Fixed-Wing) evaluates the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications and meet operational requirements.<br>Targets may also be employed during an anti-submarine warfare scenario. If available, tests may be conducted using an actual submarine as the target.<br>This activity would be conducted in deep (typically beyond 100 feet) waters.<br>Some anti-submarine warfare fixed-wing aircraft tracking tests could be conducted as part of a coordinated event with fleet training activities. | |
| **Typical Components** | **Platforms:** Fixed-Wing Aircraft<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonobuoys<br>**Munitions:** None | |
| **Active Sonar** | LFM, LFH, MFM | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources | |
| **Parameters for Analysis** | This activity occurs > 3 NM from land. Submarine may provide service as the target. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area > 3 NM from land | MITT Study Area; Mariana Islands Range Complex |

### A.4.1.2.3 Anti-Submarine Warfare Tracking Test (Rotary-Wing)

| Anti-Submarine Warfare | | |
|---|---|---|
| **Anti-Submarine Warfare Tracking Test (Rotary Wing)** | | |
| **Short Description** | The test evaluates the sensors and systems used to detect and track submarines and to ensure that rotary-wing aircraft systems used to deploy the tracking systems perform to specifications. | |
| **Long Description** | An Anti-Submarine Warfare Tracking Test — Rotary Wing evaluates the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications. Targets may also be employed during an anti-submarine warfare tracking test event. If available, tests may be conducted using an actual submarine as the target. This activity would be conducted in shallow or deep waters and could initiate from a land base or from a surface ship. Some anti-submarine rotary-wing tracking tests could be conducted as part of an anti-submarine tracking coordinated event with fleet training activities. | |
| **Typical Components** | **Platforms:** Rotary-Wing Aircraft<br>**Targets:** Sub-surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Sonar Systems - Dipping, Sonobuoys<br>**Munitions:** None | |
| **Active Sonar** | MFM, MFH | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources | |
| **Parameters for Analysis** | Submarine may provide service as the target.<br>This activity occurs > 3 NM from land. Anti-Submarine Warfare Tracking Test (Rotary-Wing) was not previously identified as an activity, but the components of the activity (e.g., sound sources and platform) were analyzed in the previous MITT analyses as part of other similar activities and are not new to the Study Area. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area; Mariana Islands Range Complex | MITT Study Area; Mariana Islands Range Complex |

### A.4.1.3 Surface Warfare

Testing of weapons used in surface warfare is conducted to develop new technologies and to assess weapon performance and operability with new systems and platforms, such as unmanned systems. Testing events may be integrated into training activities to test aircraft or aircraft systems in the delivery of munitions on a surface target. In most cases the tested systems are used in the same manner in which they are used for fleet training activities.

Training may occur in conjunction with weapons testing to provide Fleet operators unique opportunities to train with combat weapon systems and personnel in scripted warfare environments. For example, Fleet training could occur while testing a weapon system, in which Sailors would experience (be trained in) the use of the system being tested.

### A.4.1.3.1 Air-to-Surface Missile Test

| Surface Warfare | | |
|---|---|---|
| **Air-to-Surface Missile Test** | | |
| **Short Description** | Test may involve both fixed-wing and rotary-wing aircraft launching missiles at surface maritime targets to evaluate the weapons system or as part of another systems integration test. | |
| **Long Description** | An air-to-surface missile test may involve both fixed-wing and rotary-wing aircraft launching missiles at surface maritime targets to evaluate the weapons system or as part of another systems integration test. Air-to-surface missile tests can include high explosive, non-explosive, or non-firing (captive air training missile) weapons. Laser targeting systems may also be used. Both stationary and mobile targets would be utilized during testing. | |
| **Typical Components** | **Platforms:** Fixed-Wing Aircraft, Rotary-Wing Aircraft<br>**Targets:** Surface Targets - Floating, Surface Targets - Maneuvering<br>**Systems being Trained/Tested:** Missile Delivery Systems<br>**Munitions:** Air-to-Surface Missiles | |
| **Active Sonar** | No | |
| **In-Water Explosives** | E6, E9 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Explosive missiles and rockets<br>Non-explosive missiles and rockets | |
| **Parameters for Analysis** | This activity occurs > 12 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area > 50 NM from land | MITT Study Area; Mariana Islands Range Complex |

### A.4.2 Naval Sea Systems Command Testing Activities

Naval Sea Systems Command's testing activities will generally align with the primary mission areas used by the fleet. Naval Sea Systems Command testing activities include, but are not limited to, new ship construction, life cycle support, and other weapons system development and testing.

While many of these systems tested by Naval Sea Systems Command will ultimately be used by the fleet, testing activities involving the same or similar systems may be conducted in different locations and manners that when conducted by the fleet. Because of these differences, the results of the analysis for testing activities may differ from the results for training activities

#### A.4.2.1 Anti-Submarine Warfare

Testing of anti-submarine warfare systems is conducted to develop new technologies and assess weapon performance and operability wit new systems and platforms, such as unmanned systems. Testing uses ships, submarines, and aircraft to demonstrate capabilities of torpedoes, missiles, countermeasure systems, and underwater surveillance and communications systems. Tests may be conducted as part of a large-scale fleet training event involving submarines, ships, fixed-wing aircraft, and helicopters. These integrated training events offer opportunities to conduct research and acquisition activities and to train aircrew in the use of new or newly enhanced systems during a large-scale, complex exercise.

### A.4.2.1.1 At-Sea Sonar Testing

| Anti-Submarine Warfare | | |
|---|---|---|
| **At-Sea Sonar Testing** | | |
| **Short Description** | At-sea testing to ensure systems are fully functional in an open ocean environment. | |
| **Long Description** | At-sea sonar testing is required to calibrate or document the functionality of sonar and torpedo systems while the ship or submarine is in an open ocean environment. At-sea sonar testing is conducted to verify that the ship meets design acoustic specifications, define the underwater characteristics of the ship, determine effects of systems and equipment on the ships acoustic characteristics, and provide technical background necessary to initiate development of design improvements to reduce noise. Tests also consist of electronic support measurement, photonics, and sonar sensor accuracy testing. In some instances, a submarine's passive detection capability is tested when a second submarine utilizes its active sonar or is equipped with a noise augmentation system in order to replicate acoustic or electromagnetic signatures of other vessel types or classes. | |
| **Typical Components** | **Platforms:** Submarine<br>**Targets:** None<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted<br>**Munitions:** None | |
| **Active Sonar** | MFH | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources | |
| **Parameters for Analysis** | This activity occurs > 3 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.4.2.1.2 Pierside Sonar Testing

| Anti-Submarine Warfare | | |
|---|---|---|
| **Pierside Sonar Testing – New Activity** | | |
| **Short Description** | Pierside testing to ensure systems are fully functional in a controlled pierside environment prior to at-sea test activities and complete any required troubleshooting. | |
| **Long Description** | Ships and submarines would activate mid- and high-frequency tactical sonars, underwater communications systems, and navigational devices to ensure they are fully functional prior to at-sea test events. Event duration varies; with average durations of three weeks with active sonar used intermittently over two days during the total event duration. This also includes pierside sonar testing during surface combatant sea trials. | |
| **Typical Components** | **Platforms:** Submarine and Surface Combatant<br>**Targets:** None<br>**Systems being Trained/Tested:** Sonar Systems - Hull Mounted, Acoustic Communications<br>**Munitions:** None | |
| **Active Sonar** | MFH, HFM, HFH | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources | |
| **Parameters for Analysis** | Event duration is 3 weeks with active sonar used intermittently.<br>The facility platform may be a dock or other structure. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | Inner Apra Harbor |

### A.4.2.2 Mine Warfare

Testing and development of mine warfare systems is conducted to improve sonar, laser, and magnetic detectors intended to hunt, locate, and record the positions of mines for avoidance or subsequent neutralization. Mine warfare testing and development falls into two primary categories: mine detection and classification, and mine countermeasure and neutralization. Mine detection and classification testing involves the use of air, surface, and subsurface vessels and uses sonar, including towed and side-scan sonar, and unmanned vehicles to locate and identify objects underwater. Mine detection and classification systems are sometimes used in conjunction with a mine neutralization system. Mine countermeasure and neutralization testing includes the use of air, surface, and subsurface units to evaluate the effectiveness of tracking devices and countermeasure and neutralization systems to neutralize mine threats. Most neutralization tests use mine shapes, or non-explosive practice mines, to evaluate a new or enhanced capability. For example, during a mine neutralization test, a previously located mine is destroyed or rendered nonfunctional using a helicopter or manned/unmanned surface vehicle-based system that may involve the deployment of a towed neutralization system.

A small percentage of mine warfare tests require the use of high-explosive mines to evaluate and confirm the ability of the system to neutralize a high-explosive mine under operational conditions. Most of mine warfare systems are deployed by ships, helicopters, and unmanned vehicles. Tests may also be conducted in support of scientific research to support these new technologies.

### A.4.2.2.1 Mine Countermeasure and Neutralization Testing

| Mine Warfare | | |
|---|---|---|
| **Mine Countermeasure and Neutralization Testing** | | |
| **Short Description** | Air, surface, and subsurface vessels neutralize threat mines and mine-like objects. | |
| **Long Description** | Mine countermeasure-neutralization and mine system testing are required to ensure systems can effectively neutralize threat (live or inert) mines that will otherwise restrict passage through an area and to ensure U.S. Navy mines remain effective against enemy ships. These systems may be deployed with a variety of ships, aircraft, submarines, or unmanned autonomous vehicles. Mines are neutralized by cutting mooring cables of buoyant mines, producing acoustic energy that fires acoustic-influence mines, employing radar or laser fields, producing electrical energy to replicate the magnetic signatures of surface ships in order to detonate threat mines, detonating mines using remotely operated vehicles, and using explosive charges to destroy threat mines. This activity could involve aerial placed non-explosive mine training targets. | |
| **Typical Components** | **Platforms:** Amphibious Warfare Vessel, Mine Warfare Vessel, Rotary-Wing Aircraft, Surface Combatant, Unmanned Aerial Vehicle - Rotary Wing, Unmanned Underwater Vehicle<br>**Targets:** Mine Targets<br>**Systems being Trained/Tested:** Electromagnetic Systems, Mine Warfare Devices, Sonar Systems - Mine Warfare, Sonar Systems - Other, Sonobuoys, Lasers<br>**Munitions:** AMNS Neutralizers | |
| **Active Sonar** | MFM, HFH | |
| **In-Water Explosives** | E4 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Non-explosive aerial deployed mines and bombs<br>Manned surface vessels<br>Explosive mine countermeasures and neutralization (no divers)<br>Unmanned vehicles | |
| **Parameters for Analysis** | Aerial deployed mines and laser use can only occur in authorized areas. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | Agat Bay Mine Neutralization | Agat Bay Mine Neutralization |
| | Helicopter Laser Hazard Area | Helicopter Laser Hazard Area |
| | Piti Floating Mine Neutralization | Piti Floating Mine Neutralization |

## A.4.2.3 Unmanned Systems

### A.4.2.3.1 Unmanned Aerial System Testing

| Unmanned Systems | | |
|---|---|---|
| **Unmanned Aerial System Testing – New Activity** | | |
| **Short Description** | Unmanned aerial systems are launched from a platform (e.g., fixed platform or submerged submarine) to test the capability to extend the surveillance and communications range of unmanned underwater vehicles, manned and unmanned surface vehicles, and submarines. | |
| **Long Description** | Unmanned aerial systems are reusable, uncrewed vehicles capable of controlled, sustained, level flight. Anticipated scenarios of unmanned aerial system testing include both unmanned aerial system launcher testing and using unmanned aerial systems to extend the surveillance and communications range of distributed sensors, unmanned underwater vehicles, manned and unmanned surface vehicles, and submarines. | |
| **Typical Components** | **Platforms:** Submarine, Support Craft, Unmanned Aerial Vehicle - Fixed Wing, Unmanned Aerial Vehicle - Rotary Wing<br>**Targets:** None<br>**Systems being Trained/Tested:** Unmanned aerial systems<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | None | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | MITT Study Area; Mariana Islands Range Complex |

### A.4.2.3.2 Unmanned Surface Vehicle Testing

| Unmanned Systems | | |
|---|---|---|
| **Unmanned Surface Vehicle System Testing – New Activity** | | |
| **Short Description** | Unmanned surface vehicles are primarily autonomous systems designed to augment current and future platforms to help deter maritime threats. They employ a variety of sensors designed to extend the reach of manned ships. | |
| **Long Description** | USVs can include remotely operated craft (e.g., semi-submersible, plane hull, semi-plane hull) and test vehicles. During testing, they can operate autonomously, semi-autonomously, or non-autonomously. Non-autonomous or remotely controlled vehicles may be tethered like remotely operated vehicles (ROVs) or remotely controlled via radio link. USVs may have multiple test objectives or payloads (such as cameras, sonar, or explosives) onboard so that numerous tests can be executed during a single testing activity. USVs may be used in conjunction with unmanned underwater vehicles and unmanned aerial systems to meet test objectives. USV launch and retrieval methods are highly variable because of the differences in vehicle type and size. USV test vehicle launch methods include lowering onto the water from a support craft or pier, deploying from another craft, or launching from a boat ramp. The vehicle will propel itself through the water to complete the test objectives, which could include deployment or recovery of a payload, sonar or other sensor use, or completion of a propulsion test. Occurs year-round, daytime only. | |
| **Typical Components** | **Platforms:** Mine Warfare Vessel, Small Boat, Unmanned Surface Vehicle<br>**Targets:** Surface Targets - Floating<br>**Systems being Trained/Tested:** Unmanned surface vehicles<br>**Munitions:** Explosive payload | |
| **Active Sonar** | No | |
| **In-Water Explosives** | E9 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Explosive payloads<br>Manned surface vessels<br>Unmanned vehicles | |
| **Parameters for Analysis** | Activities involving explosives will occur > 12 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | MITT Study Area; Mariana Islands Range Complex |

## A.4.2.4 Vessel Evaluation

### A.4.2.4.1 In-Port Maintenance Testing

| Vessel Evaluation | | |
|---|---|---|
| **In-Port Maintenance Testing – New Activity** | | |
| **Short Description** | Each ship system is tested to ensure they are functioning in a technically acceptable manner and operationally ready to support maintenance capabilities, including Combat System testing. | |
| **Long Description** | Testing includes general system maintenance capabilities (e.g., verifying that submarine tenders can perform resupply and replenishment capabilities). For Combat Systems, the ship's test plans and procedures, Maintenance Repair/Requirement Cards, and computerized planned maintenance system are used in establishing testing standards. | |
| **Typical Components** | **Platforms:** Submarine, Support Craft<br>**Targets:** None<br>**Systems being Trained/Tested:** None<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | None | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | Guam Nearshore |
| | | CNMI Nearshore |

### A.4.2.4.2 Submarine Sea Trials – Weapons System Testing

| Vessel Evaluation | | |
|---|---|---|
| **Submarine Sea Trials - Weapons System Testing** | | |
| **Short Description** | Submarine weapons and sonar systems are tested at-sea to meet the integrated combat system certification requirements. | |
| **Long Description** | Submarine weapons and sonar systems are tested at-sea to meet the integrated combat system certification requirements. This test involves subjecting the integrated combat system through rigorous testing. | |
| **Typical Components** | **Platforms:** Fixed Wing – Patrol Aircraft, Submarine<br>**Targets:** Surface Targets - Floating<br>**Systems being Trained/Tested:** Sonobuoys<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | This activity is conducted as part of Training's Sinking Exercise. The associated active sonar and explosives use was analyzed under Sinking Exercise. Submarines will not be conducting test constantly for the duration of the allotted time.<br>This activity occurs > 50 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | MITT Study Area; Mariana Islands Range Complex |

### A.4.2.4.3 Undersea Warfare Testing

| Vessel Evaluation | | |
|---|---|---|
| **Undersea Warfare Testing** | | |
| **Short Description** | Ships demonstrate capability of countermeasure systems and underwater surveillance, weapons engagement and communications systems. This tests a ship's ability to detect, track, and engage undersea targets. Testing also includes assessing equipment vulnerability and ordnance lethality. | |
| **Long Description** | Undersea warfare events may be comprised of tracking and firing events or tests of hull-mounted sonar system capabilities to detect and avoid torpedo-like targets. Tracking and firing events ensure the operability of the undersea warfare suite and its interface with the rotary-wing helicopter. Tests include demonstrating the ability of the ship to search, detect, and track a target and conduct attacks with exercise torpedoes. Detection and avoidance events may use surface craft and underwater platforms to test the capability of mid- and high-frequency acoustic sources. Subsurface moving targets, rocket and air-dropped weapons, sonobuoys, towed arrays, and sub-surface torpedo-like devices may be used. Approximately 1 week of in-port training may precede the event. Undersea warfare events also include equipment testing to assess equipment vulnerability to ordnance, which will use explosive demolition charges. | |
| **Typical Components** | **Platforms**: Rotary-Wing, Submarine, Support Craft, Surface Combatant, Unmanned Surface Vehicle, Unmanned Underwater Vehicle<br>**Targets**: Sub-surface Targets - Maneuvering, Sub-surface Targets - Stationary<br>**Systems being Trained/Tested**: Countermeasures, Safety and Navigation, Sonar Systems - Dipping, Sonar Systems - Hull Mounted, Sonobuoys<br>**Munitions:** Demolition Devices, Torpedoes - Exercise | |
| **Active Sonar** | MFM, MFH, HFH, Broadband (MF to HF) | |
| **In-Water Explosives** | E7 | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Active acoustic sources<br>Manned surface vessels<br>Explosive payloads | |
| **Parameters for Analysis** | This activity occurs > 3 NM from land.<br>Activities involving explosives will occur > 12 NM from land. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area | MITT Study Area; Mariana Islands Range Complex |

### A.4.2.4.4 Vessel Signature Evaluation

| Vessel Evaluation | | |
|---|---|---|
| **Vessel Signature Evaluation** | | |
| **Short Description** | Surface ship, submarine, and/or auxiliary system signature assessments. This may include electronic, radar, acoustic, infrared, or magnetic signatures. | |
| **Long Description** | Radar cross signature testing of surface ships and submarines is accomplished on new ships and periodically throughout a ship's life cycle to measure how detectable the ship is to radar. Signature testing of all surface ships and submarines verifies that each vessel's signature is within specifications and may include the use of helicopter-deployed instrumentation, ship-mounted safety and navigation systems, fathometers, tracking devices, radar systems, underwater communications equipment, and passive acoustic sonobuoys. | |
| **Typical Components** | **Platforms:** Surface Combatant<br>**Targets:** None<br>**Systems being Trained/Tested:** Sonobuoys<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vessels | |
| **Parameters for Analysis** | None | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | | MITT Study Area; Mariana Islands Range Complex |

## A.4.3 Office of Naval Research

The Office of Naval Research's mission is to plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future naval power, and the preservation of national security. The Office of Naval Research manages the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test, and evaluation. The Office of Naval Research is also a parent organization for the Naval Research Laboratory, which operates as the Navy's corporate research laboratory and conducts a broad multidisciplinary program of scientific research and advanced technological development.

### A.4.3.1 Acoustic and Oceanographic Science and Technology

Research using active transmissions from sources deployed from ships, aircraft, and unmanned underwater vehicles. Research sources can be used as proxies for current and future Navy systems.

### A.4.3.1.1 Acoustic and Oceanographic Research

| Acoustic and Oceanographic Science and Technology | | |
|---|---|---|
| **Acoustic and Oceanographic Research** | | |
| **Short Description** | Research of oceanographic processes using active transmissions, typically high-frequency (38 kilohertz and above) oceanographic measurement devices, deployed from ships, unmanned vehicles, and on moored platforms. | |
| **Long Description** | Office of Naval Research performs research on oceanographic processes in U.S. territorial waters and international waters using passive measurement devices and active acoustic systems such as Acoustic Doppler Current Profilers and echosounders. Measurement systems may be deployed by ship, unmanned underwater vehicles, or on standard oceanographic moorings. Moorings may be left in place for more than one year. | |
| **Typical Components** | **Platforms:** Moored Platform, Support Craft, Unmanned Aerial Vehicle - Rotary Wing, Unmanned Underwater Vehicle<br>**Targets:** None<br>**Systems being Trained/Tested:** Fathometer, Sonar Systems - Other<br>**Munitions:** None | |
| **Active Sonar** | No | |
| **In-Water Explosives** | No | |
| **Applicable Activity-based Mitigations for Marine Species** | **Mitigation is required for the following stressors as described in Section 4.6 (Activity-Based Mitigation):**<br>Manned surface vehicles<br>Unmanned vehicles | |
| **Parameters for Analysis** | Approximately 12 non-recoverable bottom moorings may be used.<br>Any acoustic sources used would be *de minimis*. | |
| **Location** | **Phase III Requirement 2020–2027** | **Phase IV Requirement 2027–2034** |
| | MITT Study Area; Mariana Islands Range Complex | MITT Study Area; Mariana Islands Range Complex |

## A.5 Range Modernization and Sustainment

This section provides additional information about Modernization and Sustainment activities proposed in this Draft SEIS/OEIS. Examples of Modernization (upgrading or expanding) range and testing/training areas, systems, and associated components include expanding special use airspace and installing permanent in-water structures, such as cables and platforms. Sustainment activities include maintenance and repair of and around existing and upgraded structures within the Study Area.

### A.5.1 Installation and Maintenance of Subsurface Targets and Instrumentation

Support crews deploy, move, and retrieve mine countermeasure (MCM) targets or targets simulating adversary subsea and seabed infrastructure to include cables of varying diameters and lengths, bottom equipment, and equipment tethered to the bottom that is floating in the water column. MCM targets could be inserted on the seafloor (bottom targets) or tethered to anchors that are on the seafloor (moored). MCM targets are non-explosive and emulate real world threats with a variety of sizes and shapes including spheres, cylinders, clamshells, and truncated cones. The Installation and Maintenance of Subsurface Targets and Instrumentation activity can occur anywhere within the Study Area.

Temporary training areas can be established by installing devices that could include hydrophones anchored to the seafloor similarly to anchored mine training shapes or other subsea/seabed targets (Figure A-1). When training or testing is completed in the temporary range, or when onboard batteries run out, the instrumentation is recovered and where feasible, anchors are either removed along with the mine shapes or not recovered.

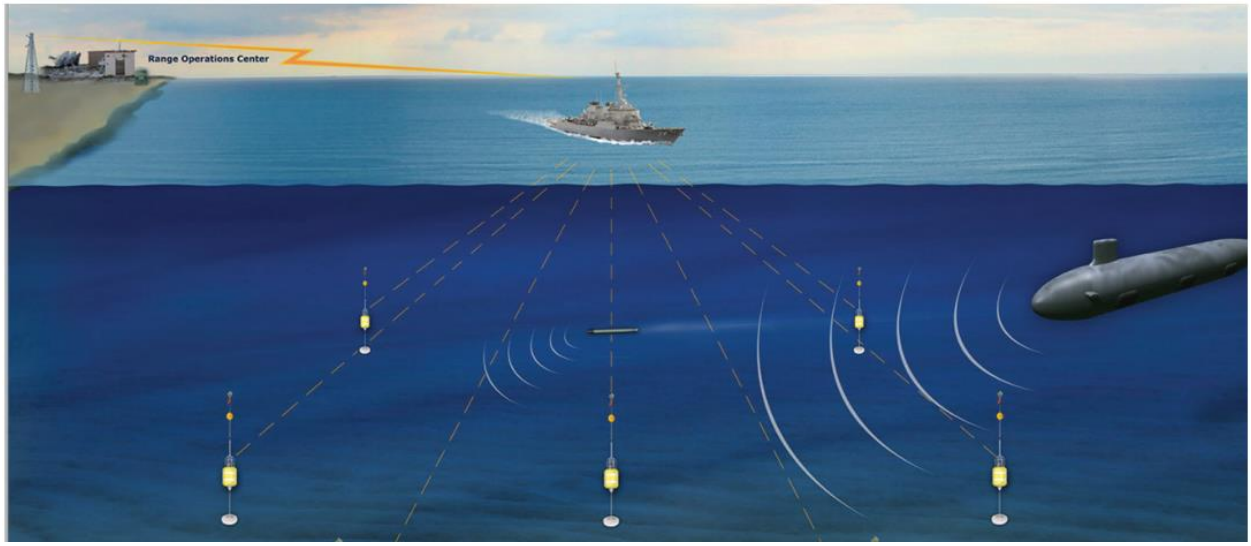


**Figure A-1: Temporary Training Area/Range**
*(Source: Graphic from L3Harris)*

## A.6 Proposed Training Activities by Service

Training activities broken down by each Action Proponent (military service) are presented in Tables A-2 through A-5.

## Table A-2: Navy and USMC Proposed Training Activities

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | 2026 Draft SEIS/OEIS | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| **Major Training Exercises – Large Integrated Anti-Submarine Warfare Training** | | | | | |
| Joint Multi-Strike Group Exercise | 1 | 1 | 1 | 1 | MITT Study Area >3 NM from land |
| Joint Expeditionary Exercise | 1 | 1 | 0 | 0 | MIRC; MITT Study Area |
| **Small Integrated Anti-Submarine Warfare Training** | | | | | |
| Surface Warfare Advanced Tactical Training[3] | 0 | 3 | 1 | 1 | MIRC; MITT Study Area > 3 NM from land |
| Small Integrated Anti-Submarine Warfare Training – NUWTAC/Multi-Sail[3] | 0 | 3 | 7 | 7 | MIRC; MITT Study Area > 3 NM from land |
| **Medium Coordinated Anti-Submarine Warfare Training** | | | | | |
| Medium Coordinated Anti-Submarine Warfare Training[3] | 0 | 3 | 5 | 5 | MIRC; MITT Study Area > 3 NM from land |
| **Small Coordinated Anti-Submarine Warfare Training** | | | | | |
| Independent Deployer Certification Exercise/Tailored Surface Warfare Training[3] | 0 | 3 | 5 | 5 | MIRC; MITT Study Area > 3 NM from land |
| **Air Warfare** | | | | | |
| Air Combat Maneuver[4] | 4,800 | 4,100 | 2,480–2,960 | 2,960 | MITT Study Area >12 NM from land; SUA |
| Air Defense Exercise | 100 | 100 | 630–1,110 | 1,110 | MITT Study Area >12 NM from land; SUA |
| Gunnery Exercise Air-to-Air Medium Caliber | 24 | 24 | 20–24 | 24 | MITT Study Area >12 NM from land; SUA |
| Gunnery Exercise Surface-to-Air Large Caliber | 5 | 9 | 14 | 14 | MITT Study Area SUA > 12 NM from land |
| Gunnery Exercise Surface-to-Air Medium Caliber | 12 | 19 | 23 | 23 | MITT Study Area SUA > 12 NM from land |
| Missile Exercise Air-to-Air | 12 | 12 | 10–12 | 12 | MITT Study Area SUA > 12 NM from land |

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | 2026 Draft SEIS/OEIS | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| Missile Exercise Surface-to-Air | 15 | 27 | 6–8 | 8 | MITT Study Area SUA > 12 NM from land |
| **Amphibious Warfare** | | | | | |
| Amphibious Assault | 6 | 6 | 5–10 | 10 | CNMI Nearshore; Guam Nearshore |
| Amphibious Raid | 6 | 6 | 5–10 | 10 | CNMI Nearshore; Guam Nearshore |
| Amphibious Vehicle Maneuvers/Rehearsals | 12 | 12 | 13–28 | 28 | MITT Study Area; Guam Nearshore; CNMI Nearshore; Apra Harbor |
| Naval Surface Fire Support – Land Based Target | 10 | 15 | 5 | 5 | FDM |
| Non-Combat Amphibious Operation[5] | 10 | 10 | 5–15 | 15 | CNMI Nearshore; Guam Nearshore |
| Unmanned Aerial Vehicle – Intelligence, Surveillance, and Reconnaissance | 100 | 100 | 220–420 | 420 | MIRC; MITT Study Area; SUA |
| Marine Air Ground Task Force Exercise (Amphibious) – Battalion | 4 | 4 | 0 | 0 | MITT Study Area to nearshore; MIRC; Tinian; Guam; Rota; Saipan; FDM |
| Special Purpose Marine Air Ground Task Force Exercise | 2 | 2 | 0 | 0 | Study Area to nearshore; MIRC; Tinian; Guam; Rota; Saipan |
| **Anti-Submarine Warfare** | | | | | |
| Anti-Submarine Warfare Torpedo Exercise – Helicopter | 4 | 6 | 1 | 1 | MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Torpedo Exercise – Maritime Patrol Aircraft | 4 | 6 | 1–2 | 2 | MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Torpedo Exercise – Ship | 3 | 6 | 6–8 | 8 | MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Torpedo Exercise – Submarine | 10 | 4 | 1–2 | 2 | MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Tracking Exercise – Helicopter | 12 | 10 | 16 | 16 | MITT Study Area > 3 NM from land; Transit Corridor |
| Anti-Submarine Warfare Tracking Exercise – Maritime Patrol Aircraft | 34 | 36 | 45–60 | 60 | MITT Study Area > 3 NM from land |

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | 2026 Draft SEIS/OEIS | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| Anti-Submarine Warfare Tracking Exercise – Ship | 132 | 91 | 90 | 90 | MITT Study Area > 3 NM from land |
| Anti-Submarine Warfare Tracking Exercise – Submarine | 12 | 4 | 14 | 14 | MITT Study Area > 3 NM from land; Transit Corridor |
| **Electronic Warfare** | | | | | |
| Counter Targeting Chaff Exercise – Ship | 40 | 60 | 10 | 10 | MITT Study Area > 12 NM from land |
| Counter Targeting Chaff Exercise – Aircraft | 1,600 | 600 | 120–130 | 130 | MITT Study Area > 12 NM from land |
| Counter Targeting Flare Exercise | 1,600 | 600 | 120–130 | 130 | MITT Study Area > 12 NM from land |
| Electronic Warfare Operations | 320 | 362 | 555–1,060 | 1,060 | MITT Study Area |
| **Expeditionary Warfare** | | | | | |
| Dive and Salvage Operations | 0 | 0 | 250 | 250 | CNMI Nearshore; Guam Nearshore |
| Personnel Insertion/Extraction – Air[6] | 80 | 58 | 217 | 217 | CNMI Nearshore; Guam Nearshore |
| Personnel Insertion/Extraction – Surface and Subsurface[6] | 80 | 136 | 86–91 | 91 | CNMI Nearshore; Guam Nearshore |
| Personnel Insertion/Extraction – Swimmer/Diver[6] | 80 | 106 | 52 | 52 | CNMI Nearshore; Guam Nearshore |
| Underwater Construction Team Training | 0 | 0 | 50 | 50 | CNMI Nearshore; Guam Nearshore |
| Port Damage Repair (No Dredging/No Pile Driving) | 0 | 0 | 50 | 50 | CNMI Nearshore; Guam Nearshore |
| **Mine Warfare** | | | | | |
| Mine Countermeasures – Laser Mine Detection | 4 | 4 | 8 | 8 | CNMI Nearshore; Guam Nearshore |
| Mine Countermeasures – Towed Mine Neutralization | 4 | 4 | 8 | 8 | CNMI Nearshore; Guam Nearshore |
| Airborne Mine Laying | 0 | 0 | 0 | 0 | MIRC Warning Areas; MITT Study Area |
| Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises | 1 | 1 | 1 | 1 | CNMI Nearshore; Guam Nearshore |
| Limpet Mine Neutralization System | 40 | 60 | 60 | 60 | Apra Harbor; Agat Bay Mine Neutralization Site |
| Mine Neutralization Explosive Ordnance Disposal | 20 | 20 | 20 | 20 | Agat Bay Mine Neutralization Site; Outer Apra Harbor |

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | 2026 Draft SEIS/OEIS | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| | | | | | UNDET Site; Piti UNDET Site |
| Surface Ship Object Detection | 0 | 6 | 20–30 | 30 | CNMI Nearshore; Guam Nearshore |
| Underwater Demolition Qualification and Certification | 30 | 45 | 45 | 45 | Agat Bay Mine Neutralization Site; Outer Apra Harbor UNDET Site: Piti UNDET Site |
| Underwater Mine Countermeasure – Raise, Tow, Beach, and Exploitation Operations | 0 | 0 | 24 | 24 | Apra Harbor |
| **Strike Warfare** | | | | | |
| Bombing Exercise Air-to-Ground | 1,100 | 1,100 | 710–790 | 790 | FDM |
| Gunnery Exercise Air-to-Ground | 74 | 74 | 75–80 | 80 | FDM |
| Missile Exercise Air-to-Ground | 55 | 45 | 110-130 | 130 | FDM |
| **Surface Warfare** | | | | | |
| Bombing Exercise Air-to-Surface | 30 | 30 | 31 | 31 | MITT Study Area > 50 NM from land |
| Fast Attack Craft and Fast Inshore Attack Craft[7] | 18 | 27 | 22–33 | 33 | MITT Study Area > 3 NM from land |
| Gunnery Exercise Air-to-Surface Medium Caliber | 295 | 120 | 122 | 122 | MITT Study Area SUA > 12 NM from land |
| Gunnery Exercise Air-to-Surface Small Caliber | 242 | 321 | 344–412 | 412 | MITT Study Area SUA > 3 NM from land |
| Gunnery Exercise Surface-to-Surface Boat Medium Caliber | 10 | 14 | 0 | 0 | MITT Study Area SUA > 12 NM from land |
| Gunnery Exercise Surface-to-Surface Boat Small Caliber | 37 | 37 | 15–32 | 32 | MITT Study Area SUA > 3 NM from land; Transit Corridor |
| Gunnery Exercise Surface-to-Surface Ship Large Caliber | 140 | 255 | 180-257 | 257 | MITT Study Area SUA > 12 NM from land; Transit Corridor |
| Gunnery Exercise Surface-to-Surface Ship Medium Caliber[8] | 47 | 117 | 104-150 | 150 | MITT Study Area SUA > 12 NM from land |

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | 2026 Draft SEIS/OEIS | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| Gunnery Exercise Surface-to-Surface Ship Small Caliber[8] | 47 | 113 | 165–220 | 220 | MITT Study Area SUA > 12 NM from land |
| Laser Targeting – Aircraft[9] | 400 | 400 | 110 | 110 | MITT Study Area SUA |
| Laser Targeting – Ship[9] | 600 | 600 | 1–5 | 5 | MITT Study Area SUA |
| Maritime Security Operations | 20 | 40 | 64 | 64 | MITT Study Area > 12 NM from land; MIRC |
| Missile Exercise Air-to-Surface | 20 | 10 | 22–25 | 25 | MITT Study Area SUA > 12 NM from land |
| Missile Exercise Air-to-Surface – Rocket | 3 | 111 | 27–31 | 31 | MITT Study Area SUA > 12 NM from land |
| Missile Exercise Surface-to-Surface | 12 | 28 | 8–9 | 9 | MITT Study Area > 50 NM from land |
| Sinking Exercise | 2 | 1 | 1–2 | 2 | MITT Study Area > 50 NM from land |
| Small Boat Attack | 18 | 27 | 0 | 0 | MITT Study Area > 3 NM from land |
| Torpedo Exercise (Submarine-to-Surface) | 5 | 0 | 1–5 | 5 | MITT Study Area > 3 NM from land |
| **Other Training Activities** | | | | | |
| Direct Action (Tactical Air Control Party) | 18 | 18 | 18 | 18 | FDM |
| Precision Anchoring | 18 | 18 | 20 | 20 | Apra Harbor; Mariana Islands anchorages |
| Search and Rescue at Sea | 20 | 44 | 30 | 30 | MITT Study Area |
| Submarine Navigation | 8 | 8 | 50 | 50 | MITT Study Area; MIRC |
| Submarine Sonar Maintenance | 48 | 86 | 92 | 92 | MITT Study Area > 3 NM from land; Inner Apra Harbor; Transit Corridor |
| Surface Ship Sonar Maintenance | 42 | 44 | 51 | 51 | MITT Study Area > 3 NM from land; Inner Apra Harbor; Transit Corridor |

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | 2026 Draft SEIS/OEIS | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| Underwater Survey | 16 | 32 | 76 | 76 | MITT Study Area; Guam Nearshore; CNMI Nearshore |
| Unmanned Aerial Vehicle Training and Certification | 500 | 451 | 16 | 16 | MITT Study Area; Guam Nearshore; CNMI Nearshore; MIRC SUA |
| Unmanned Underwater Vehicle Training | 0 | 64 | 60 | 60 | MIRC; Guam Nearshore; CNMI Nearshore; MITT Study Area |
| Maritime Environmental Response | 0 | 0 | 0 | 0 | MITT Study Area |
| Waterborne Training | 0 | 0 | 0 | 0 | MIRC; MITT Study Area; Guam Nearshore; CNMI Nearshore |

[1]The Department of the Navy selected Alternative 1, the Preferred Alternative, in the Record of Decision signed 28 August 2015. Activities only occur at-sea and on FDM.

[2]The Department of the Navy selected Alternative 2, the Preferred Alternative, in the Record of Decision signed 29 July 2020 and only occur at-sea and on FDM.

[3]Includes Air Intercept Control activities from 2020 SEIS/OEIS.

[4]Surface Warfare Advanced Tactical Training, Small Integrated Anti-Submarine Warfare Training, Medium Coordinated Anti-Submarine Training, and Independent Deployer Certification Exercise/Tailored Surface Warfare Training were not called out in the 2020 SEIS/OEIS, but the components of the exercises were covered under Combined Small Coordinated ASW Exercise (e.g., Multi-Sail/GUAMEX/SWATT).

[5]Includes Humanitarian Assistance Operations.

[6]Personnel Insertion/Extraction – Air, Surface and Subsurface, and Swimmer/Diver were not called out in the 2020 SEIS/OEIS, but the components of the activities were covered under Personnel Insertion/Extraction.

[7]Fast Attack Craft and Fast Inshore Attack Craft was not called out in the 2020 SEIS/OEIS, but the components of the activity were covered under Small Boat Attack.

[8]Gunnery Exercise Surface-to-Surface Ship Medium Caliber and Gunnery Exercise Surface-to-Surface Ship Small Caliber were not called out in the 2020 SEIS/OEIS, but the components of the activities were covered under Gunnery Exercise Surface-to-Surface Ship Small and Medium Caliber.

[9]Laser Targeting – Aircraft and Laser Targeting – Ship was not called out in the 2020 SEIS/OEIS, but the components of the activities were covered under Laser Targeting at Sea.

Notes: SEIS/OEIS = Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement, MIRC = Mariana Islands Range Complex, FDM = Farallon de Medinilla, NM = nautical mile(s), NUWTAC = Navy Undersea Warfare Training Assessment Course, SUA = Special Use Airspace, UNDET = Underwater Detonation, W = Warning Area

## Table A-3: USCG Proposed Training Activities

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | 2026 Draft SEIS/OEIS | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| **Surface Warfare** | | | | | |
| Gunnery Exercise Air-to-Surface Small Caliber | 0 | 0 | 5–6 | 6 | MITT Study Area SUA > 3 NM from land |
| Gunnery Exercise Surface-to-Surface Boat Medium Caliber | 0 | 6 | 4 | 4 | MITT Study Area SUA > 12 NM from land |
| Gunnery Exercise Surface-to-Surface Boat Small Caliber | 3 | 6 | 4–8 | 8 | MITT Study Area SUA > 3 NM from land; Transit Corridor |
| Gunnery Exercise Surface-to-Surface Ship Large Caliber | 0 | 0 | 8-10 | 10 | MITT Study Area SUA > 12 NM from land; Transit Corridor |
| Gunnery Exercise Surface-to-Surface Ship Medium Caliber | 3 | 4 | 4-6 | 6 | MITT Study Area SUA > 12 NM from land |
| Gunnery Exercise Surface-to-Surface Ship Small Caliber | 3 | 4 | 8–10 | 10 | MITT Study Area SUA > 12 NM from land |
| Laser Targeting – Ship | 0 | 0 | 10–20 | 20 | MITT Study Area SUA |
| Maritime Security Operations | 20 | 0 | 53–75 | 75 | MITT Study Area > 12 NM from land; MIRC |
| Small Boat Attack | 0 | 0 | 6–8 | 8 | MITT Study Area > 3 NM from land |
| **Other Training Activities** | | | | | |
| Search and Rescue at Sea | 20 | 1 | 50–52 | 52 | MITT Study Area |
| Unmanned Aerial Vehicle Training and Certification | 0 | 0 | 10–12 | 12 | MITT Study Area; Guam Nearshore; CNMI Nearshore; MIRC SUA |
| Unmanned Underwater Vehicle Training | 0 | 0 | 5–10 | 10 | MIRC; Guam Nearshore; CNMI Nearshore; MITT Study Area |
| Maritime Environmental Response | 0 | 0 | 1–2 | 2 | MITT Study Area |
| Waterborne Training | 0 | 0 | 50–75 | 75 | MIRC; MITT Study Area; Guam Nearshore; CNMI Nearshore |

[1]The Department of the Navy selected Alternative 1, the Preferred Alternative, in the Record of Decision signed 28 August 2015. Activities only occur at-sea and on FDM.

[2]The Department of the Navy selected Alternative 2, the Preferred Alternative, in the Record of Decision signed 29 July 2020.

Notes: SEIS/OEIS = Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement, MIRC = Mariana Islands Range Complex, NM = nautical mile(s), SUA = Special Use Airspace, W = Warning Area

## Table A-4: USAF Proposed Training Activities

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | 2026 Draft SEIS/OEIS | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| **Air Warfare** | | | | | |
| Air Combat Maneuver[3] | 4,800 | 4,800 | 4,800 | 4,800 | MITT Study Area >12 NM from land; SUA |
| Air Defense Exercise | 0 | 0 | 12 | 12 | MITT Study Area >12 NM from land; SUA |
| Gunnery Exercise Air-to-Air Medium Caliber | 12 | 12 | 12–24 | 24 | MITT Study Area >12 NM from land; SUA |
| Missile Exercise Air-to-Air | 6 | 6 | 6 | 6 | MITT Study Area SUA > 12 NM from land |
| **Amphibious Warfare** | | | | | |
| Unmanned Aerial Vehicle – Intelligence, Surveillance, and Reconnaissance | 0 | 0 | 12 | 12 | MIRC; MITT Study Area; SUA |
| **Electronic Warfare** | | | | | |
| Counter Targeting Chaff Exercise – Aircraft | 1,600 | 1,600 | 1,600 | 1,600 | MITT Study Area >12 NM from land |
| Counter Targeting Flare Exercise | 1,600 | 1,600 | 1,600 | 1,600 | MITT Study Area >12 NM from land |
| Electronic Warfare Operations | 160 | 160 | 100 | 100 | MITT Study Area |
| **Mine Warfare** | | | | | |
| Airborne Mine Laying | 4 | 4 | 4 | 4 | MIRC Warning Areas; MITT Study Area |
| **Strike Warfare** | | | | | |
| Bombing Exercise Air-to-Ground | 1,200 | 1,200 | 1,200 | 1,200 | FDM |
| Gunnery Exercise Air-to-Ground | 22 | 22 | 100 | 100 | FDM |
| Missile Exercise Air-to-Ground | 30 | 30 | 15 | 15 | FDM |
| **Surface Warfare** | | | | | |

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | 2026 Draft SEIS/OEIS | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| Bombing Exercise Air-to-Surface | 7 | 7 | 8 | 8 | MITT Study Area >50 NM from land |
| Laser Targeting – Aircraft | 200 | 200 | 200 | 200 | MITT Study Area SUA |
| Missile Exercise Air-to-Surface | 0 | 0 | 9 | 9 | MITT Study Area SUA > 12 NM from land |
| **Other Training Activities** | | | | | |
| Unmanned Aerial Vehicle Training and Certification | 500 | 500 | 500 | 500 | MITT Study Area; Guam Nearshore; CNMI Nearshore; MIRC SUA |

[1]The Department of the Navy selected Alternative 1, the Preferred Alternative, in the Record of Decision signed 28 August 2015. Activities only occur at-sea and on FDM.
[2]The Department of the Navy selected Alternative 2, the Preferred Alternative, in the Record of Decision signed 29 July 2020.
[3]Includes Air Intercept Control activities from 2020 SEIS/OEIS.
Notes: SEIS/OEIS = Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement, MIRC = Mariana Islands Range Complex, FDM = Farallon de Medinilla, NM = nautical mile(s), SUA = Special Use Airspace, W = Warning Area

**Table A-5: U.S. Army Proposed Training Activities**

| Activity Name | 2015 EIS/OEIS | 2020 SEIS/OEIS | 2026 Draft SEIS/OEIS | | Location |
|---|---|---|---|---|---|
| | Annual # of Activities | Annual # of Activities | Annual # of Activities | | |
| | Alt 1[1] | Alt 2[2] | Alt 1 | Alt 2 | |
| **Surface Warfare** | | | | | |
| Gunnery Exercise Air-to-Surface Small Caliber | 0 | 321 | 8 | 8 | MITT Study Area SUA > 3 NM from land |
| Gunnery Exercise Surface-to-Surface Boat Small Caliber | 0 | 43 | 1–4 | 4 | MITT Study Area SUA > 3 NM from land; Transit Corridor |
| Missile Exercise Air-to-Surface | 0 | 10 | 8–16 | 16 | MITT Study Area SUA > 12 NM from land |
| Missile Exercise Air-to-Surface – Rocket | 0 | 111 | 8–16 | 16 | MITT Study Area SUA > 12 NM from land |

[1]The Department of the Navy selected Alternative 1, the Preferred Alternative, in the Record of Decision signed 28 August 2015. Activities only occur at-sea and on FDM.

[2]The Department of the Navy selected Alternative 2, the Preferred Alternative, in the Record of Decision signed 29 July 2020.

Notes: SEIS/OEIS = Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement, MIRC = Mariana Islands Range Complex; NM = nautical mile(s), SUA = Special Use Airspace, W = Warning Area

## A.7 Territorial Limits

The following figures (Figures A-2 through A-5) outline the 3 nautical mile (NM) and 12 NM territorial limits from the shore within the MITT Study Area. For purposes of this document, waters within the 3 NM line are considered “nearshore.”

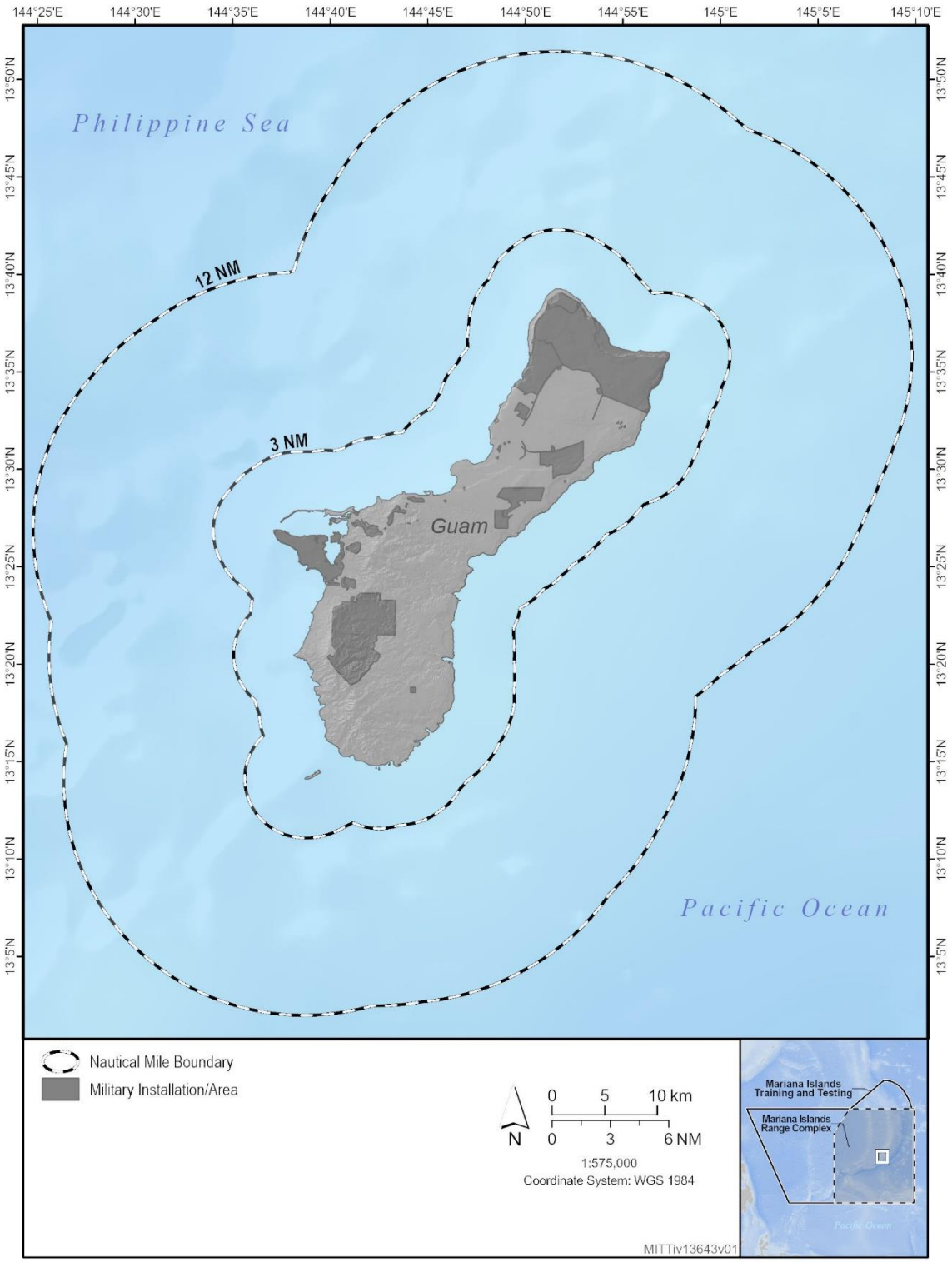


**Figure A-2: 3 NM and 12 NM Territorial Limits of Guam**

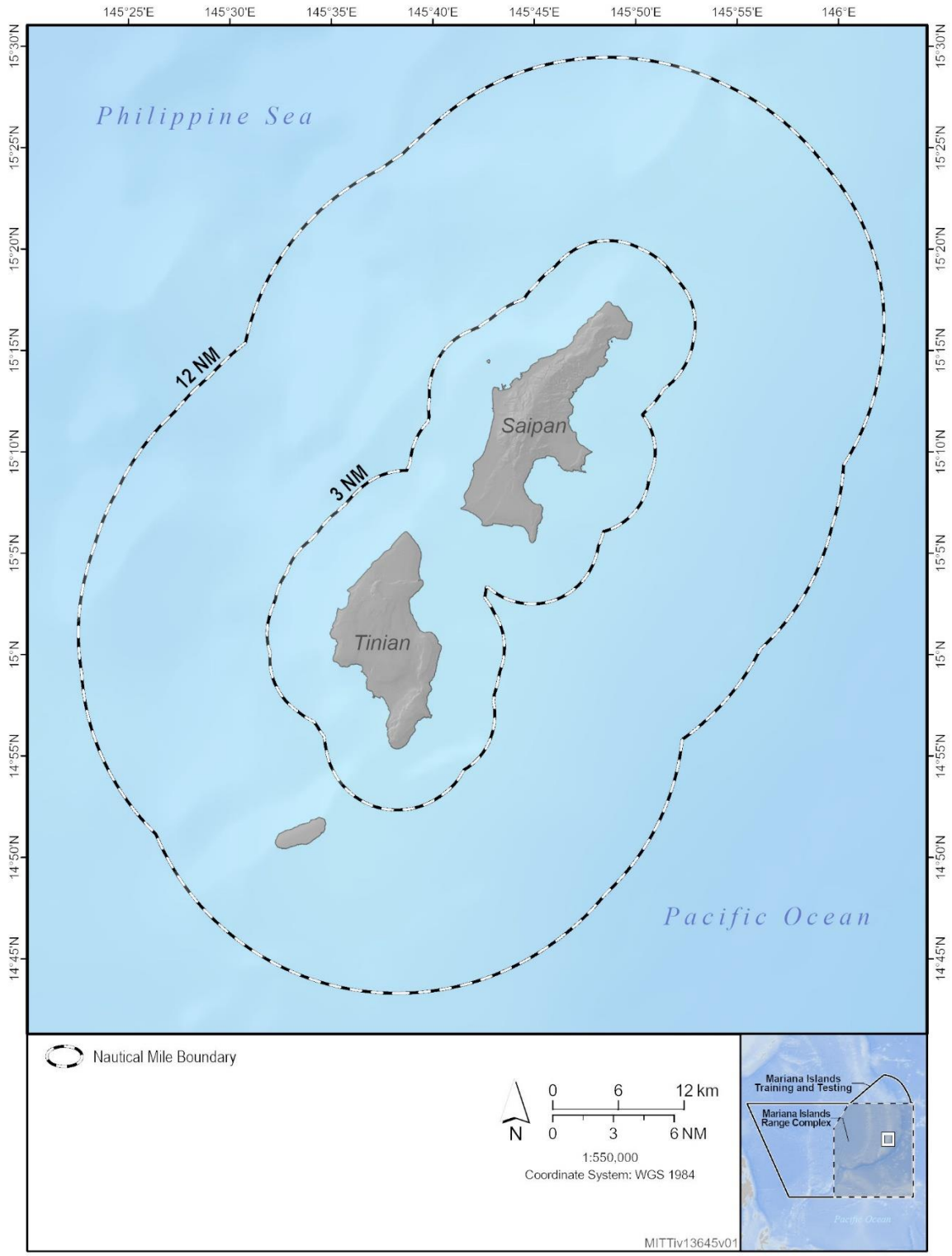


**Figure A-3: 3 NM and 12 NM Territorial Limits of Tinian and Saipan**

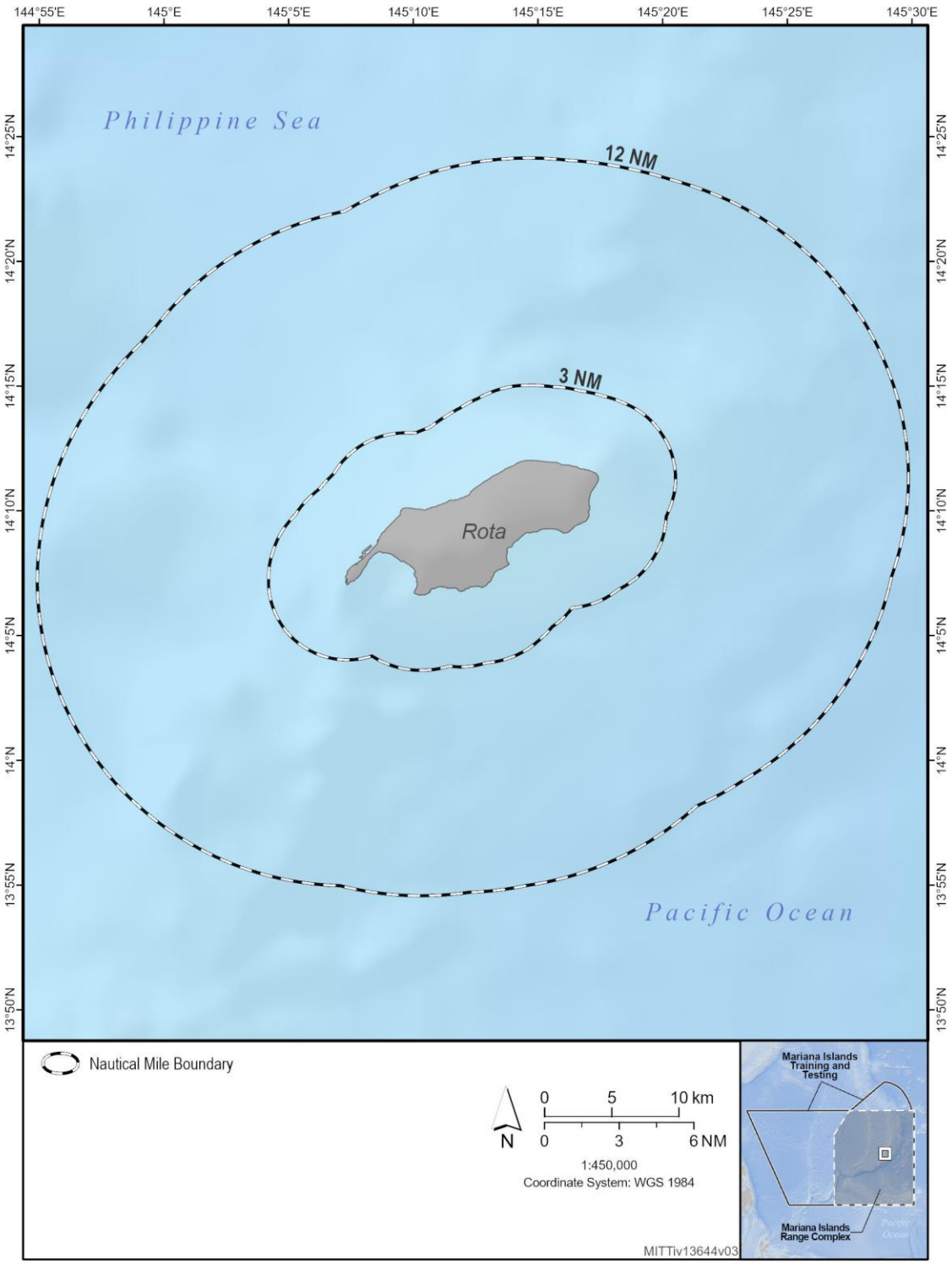


**Figure A-4: 3 NM and 12 NM Territorial Limits of Rota**

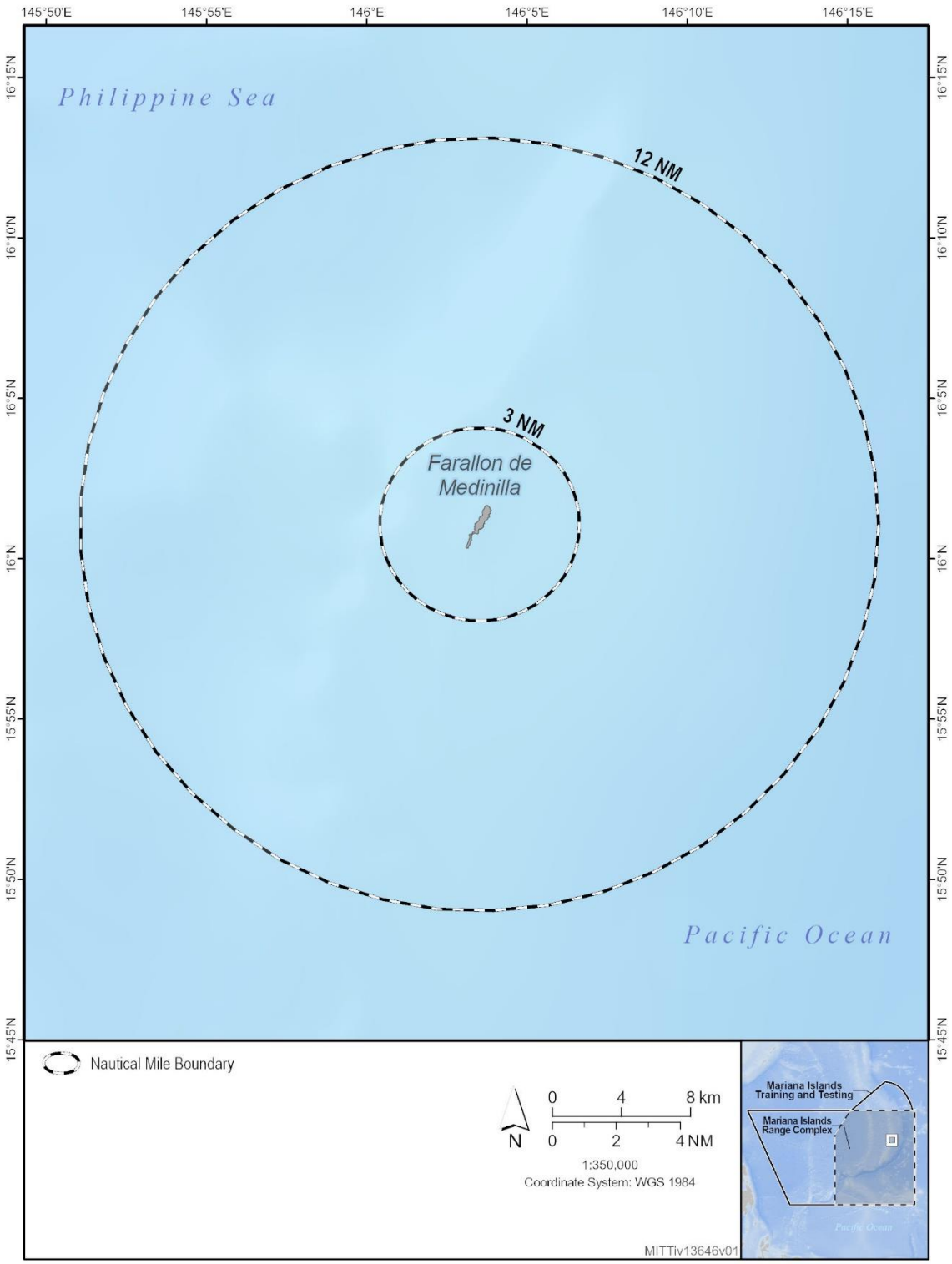


**Figure A-5: 3 NM and 12 NM Hazardous Area Limits of Farallon de Medinilla**

# Appendix A.1 U.S. Coast Guard Supporting Information

# Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Mariana Islands Training and Testing

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# A.1 U.S. COAST GUARD SUPPORTING INFORMATION

## A.1.1 Introduction

This appendix provides more information about the United States (U.S.) Coast Guard (USCG), its missions and assets, and the training and testing performed in support of these missions. This section will also explain how many USCG missions are beneficial to the environment. Due to differing missions from the U.S. Department of the Navy (Navy), many of the Proposed Actions explained in Chapter 2 (Description of Proposed Action and Alternatives) are not performed by the USCG. The use of mid- or low-frequency sonar, missiles, and explosives are examples of actions that are not a part of the USCG's mission requirements. Other training done by the USCG as part of the USCG's national defense training and testing mission is also done in support of many of the other USCG's statutory missions. For example, USCG Search and Rescue training and operations are not just related to our defense mission. The application of the Search and Rescue training in the real world may also be used to rescue boaters, perform law enforcement, or perform drug or migrant interdiction, among other activities.

The USCG's purpose of and need for the Proposed Action, discussed in Chapter 2 (Description of Proposed Action and Alternatives), is to ensure USCG personnel can qualify and train jointly with, and independently of, the Navy and other services in the effective and safe operational use of USCG vessels, aircraft, and weapons under realistic conditions. The USCG has broad, multifaceted, jurisdictional authority for management of activities over all waters subject to jurisdiction of the United States. The USCG's law enforcement and national defense mission authority is based in 14 United States Code (U.S.C.) section 102, requiring the USCG to "maintain a state of readiness to function as a specialized service in the Navy in time of war, including the fulfillment of Maritime Defense Zone command responsibilities." The USCG successfully achieves its missions in part by conducting training and testing within the Study Area of this Draft Supplemental Environmental Impact Statement (SEIS)/Overseas Environmental Impact Statement (OEIS) to develop, sharpen, and maintain tactics, coordination, and personnel readiness. As a multi-mission agency, all training the USCG does in support of national defense also supports many of the USCG's other statutory missions and vice versa.

USCG activities discussed in this Draft SEIS/OEIS encompass the Oceania District (formerly District 14). The USCG Forces Micronesia/Sector Guam within District Oceania that regularly operate in the Study Area are located in Santa Rita, Guam. District Headquarters is in Honolulu, Hawaii. The USCG Oceania District is responsible for directing USCG operations throughout Oceania, including Hawaii, Guam, the Commonwealth of Northern Mariana Islands, American Samoa, and activities in Singapore and Japan.

## A.1.2 Summary of U.S. Coast Guard History

The USCG was established in 1790 by the Secretary of the Treasury Alexander Hamilton as the Revenue Marine Service. It later became the Revenue Cutter Service and, in 1915, was combined with the U.S. Lifesaving Service (formed 1878) to become the USCG. Until Congress established the Navy Department in 1798 it served as the nation's only armed force afloat, making it the longest continuous sea service in the United States. It was under the (peacetime)

jurisdiction of the Treasury Department until 1967, when it was transferred to the Department of Transportation. In 2003, the USCG was placed under the jurisdiction of the newly created Department of Homeland Security.

The USCG is a military service within the U.S. armed forces that is charged with the enforcement of maritime laws. It consists of approximately 44,000 officers and enlisted personnel, in addition to 7,000 civilians. The USCG enforces all applicable federal laws on the high seas and waters within the jurisdiction of the United States. It administers laws and promulgates and enforces regulations for the promotion of safety of life and property along the entire U.S. coast. In the time of war, it functions as part of the Navy.

### A.1.3 U.S. Coast Guard Missions

The USCG manages six major operational mission programs: maritime law enforcement, maritime response, maritime prevention, marine transportation system management, maritime security operations, and defense operations. Within these mission programs there are 11 statutory missions. These statutory missions are described below:

1. **Marine Environmental Protection—**The USCG regulates and inspects vessels and maritime facilities to reduce the risk of marine pollution incidents. The Marine Environmental Protection mission includes the planning, preparations, and operations to prevent, enforce, investigate, respond to, and mitigate the threat, frequency, and consequences of oil discharges and hazardous substance releases in U.S. waters. When spills occur, the USCG leads response efforts to contain the damage.
2. **Living Marine Resources—**U.S. fisheries support over $240 billion in economic activity annually, but nearly 20 percent are considered overfished. The USCG is the lead federal agency for at-sea enforcement of U.S. fisheries laws. The USCG's legal authority to enforce fisheries laws flows from the Magnuson-Stevens Fisheries Conservation and Management Act of 1976. The USCG enforces environmental laws that protect commercial and endangered species.
3. **Ports and Waterway Security—**The USCG is responsible for the security of 361 U.S. ports and 95,000 statute miles (150,000 kilometers) of waterways. The local USCG commander has legal authority over shipping in American waters as Captain of the Port. The Captain of the Port can declare inland waters in his jurisdiction to be "special security zones," wherein commercial vessels must report their movements to the nearest USCG station. The USCG can direct ports closed or opened, and the USCG's vessel traffic managers direct ships on critical waterways.
4. **Other Law Enforcement—**The USCG patrols America's coasts and international waters using cutters, aircraft, and intelligence to detect, intercept, and disrupt dangerous and illegal activities such as drug smuggling and human trafficking.
5. **Drug Interdiction—**The USCG is the lead agency in maritime drug interdiction, which is a shared legal responsibility with U.S. Customs and Border Protection. USCG units coordinate their activities with the Navy.
6. **Migrant Interdiction—**The USCG enforces U.S. immigration law at sea. Many of these missions are also search-and-rescue missions since many migrants take to sea in unseaworthy vessels.

7. **Aids to Navigation—**Recreational and commercial boaters can safely navigate America's waterways due to the USCG's managed and maintained network of buoys, lighthouses, and electronic aids.
8. **Ice Operations—**The opening of the Arctic has heightened its scientific, economic, and national security significance. The USCG operates the only U.S-owned heavy icebreaker capable of supporting missions in both Arctic and Antarctic regions.
9. **Marine Safety—**USCG personnel inspect commercial vessels, respond to pollution, investigate marine casualties and merchant mariners, manage waterways, and license merchant mariners.
10. **Search and Rescue—**Search and Rescue is one of the USCG's oldest missions. The National Search and Rescue Plan designates the USCG as the federal agency responsible for maritime Search and Rescue operations in U.S. and international waters.
11. **Defense Readiness—**During wartime, by order of the President, the USCG can fall under the operational orders of the Navy. Discussion of this mission is expanded below.

### A.1.3.1 U.S. Coast Guard Defense Mission

Under Title 14 U.S.C. section 1, the USCG is "at all times an armed force of the United States." As part of the Joint Forces, the USCG maintains its readiness to carry out military operations in support of the policies and objectives of the U.S. government. As an armed force, the USCG trains and operates in the joint military arena at any time and functioning as a specialized service under the Navy in time of war or when directed by the President. USCG service members are trained to respond immediately to support military operations and national security. As a member of the armed forces (10 U.S.C. section 101), the USCG is purposefully embedded into different national strategic level doctrines that are used to guide the employment of the armed forces. These doctrinal pieces are as follows:

1. **National Strategic Direction—**The National Strategic Direction is governed by the Constitution, federal laws, government policies, internationally recognized laws, and national interest (as represented by national security policies). This directional doctrine provides policy and planning to support the national strategic direction.
2. **National Strategic Strategy—**Issued by the President, the National Strategic Strategy provides a broad strategic context for employing military capabilities in concert with other instruments of national power.
3. **National Defense Strategy—**Issued by the Secretary of Defense, the National Defense Strategy outlines the Department of Defense's approach to implementing the President's National Strategic Strategy.
4. **National Military Strategy—**Issued by the Chairman of the Joint Chiefs of Staff, the National Military Strategy supports the aims of the National Strategic Strategy and implements the National Defense Strategy. It describes the armed forces' plan to achieve military objectives in the near term and provides a vision for maintaining a force capable of meeting future challenges.

Federal law created the framework for the relationship between the Navy and the USCG.[1] To meet these statutory requirements, the USCG must train in a realistic manner to ensure when they perform these similar activities in a "real-world" environment, they are doing so safely and effectively.

The USCG has four major national defense missions:

- Maritime intercept operations
- Deployed port operations/security and defense
- Peacetime engagement
- Environmental defense operations (which includes oil and hazardous substance response)

These missions are essential military tasks assigned to the USCG as a component of joint and combined forces in peacetime, crisis, and war. To effectively carry out these missions, the USCG's air and surface units train using realistic scenarios, to include training with the Navy and the other armed services. Like the other services, the USCG seeks to train in a realistic manner so that when the real-world missions arise, USCG personnel are prepared to respond.

The Defense Readiness mission supports the National Military Strategy and Department of Defense operations by ensuring USCG assets are capable and equipped to deploy and conduct joint operations that support the most critical needs of combatant commanders in the major national-defense missions listed below. Every USCG unit is trained to support all 11 statutory missions, and thus is trained to meet all mission requirements, which includes their defense mission requirements. Since all USCG's missions generally entail the deployment of cutters or boats and either fixed-wing or rotary aircraft, the USCG training requirements for one mission generally overlaps with the training requirements of other missions. Thus, when the USCG is training for its defense mission, the same skill sets are utilized for its other statutory missions.

Table A.1-1 provides examples of how the training skills that assist the USCG with conducting its Defense Readiness Mission are also used to assist the Guard in carrying out its other missions.

**Table A.1-1: USCG Mission Training Overlap with Defense Training**

| Skill/Training Element | Defense Mission | Other USCG Missions |
|---|---|---|
| Stopping, boarding, searching, diverting, or redirecting vessel traffic | Maritime Interception/Interdiction | Drug interdiction; law enforcement; living marine resource protection; safety zone establishment; migrant interdiction |
| Flying helicopters, hovering, swimming in difficult seas | Search and Rescue. Recovering downed pilots, response to natural disasters. | Search and rescue; law enforcement; drug interdiction; migrant interdiction; peacetime operations |
| Clearing battle space of oil and hazardous substances | Environmental Defense Operations. Clearing the sea of obstacles that may adversely affect other armed forces. It could include deployment of oil booms and establishing the National Command Center. Provides | Marine safety; living marine resource protection; safety zone establishment; migrant interdiction; peacetime operations; aids to navigation. As the Vice-Chair of the multi-agency National Response |

[1] 10 U.S.C. section 101; 14 U.S.C. section 2 (7); 22 U.S.C.; 50 U.S.C.

| Skill/Training Element | Defense Mission | Other USCG Missions |
|---|---|---|
| | for efficient, coordinated, and effective response to discharges of oil and releases of hazardous substances, pollutants, and contaminants in accordance with the authorities of federal laws. | Team and a leader of the National Contingency Plan, the USCG (working with many other agencies to include the Navy) utilize many of the same tactics used while training for the defense mission to respond to oil spills in U.S. waters. |
| Ensuring port and harbor areas are free of hostile threats, terrorist actions, and safety deficiencies that would be a threat to the deployment of military resources | Port Operations, Security, and Defense | Law enforcement; drug interdiction; and safety zone establishment; port security; waterways management |
| Conducting humanitarian assistance (providing aid by air or by sea), professional exchanges, combined operations, training, exercises, and other diplomatic activities to foster international cooperation | Theater Security Cooperation | Responding to natural disasters; search and rescue; marine safety; waterways management; marine environmental protection; peacetime engagement |
| Protecting Offshore Strategic Assets by establishing and enforcing security zones | Maritime Interception Operations | Law enforcement; other law enforcement; marine safety; marine environmental protection; living marine resources |
| Conducting national air defense activities with helicopters | Rotary Wing Air Intercept, Port Security, Maritime Interception Operations | Surface and air training in support of the defense mission can be used in all USCG statutory missions |
| Combatting terrorism—Providing special capabilities, such as training host nation forces and building the capacity of foreign maritime security forces that serve as a force multiplier to Department of Defense forces | Peacetime Engagement, Port Operations/Security and Defense; USCG has relationships with many smaller navies/USCGs around the world and trains with these forces regularly | Surface and air training in support of the defense mission can be used in all USCG statutory missions |
| Supporting Department of Defense response to maritime security threats, including terrorism, piracy, and other criminal or unlawful acts | Maritime Operational Threat Response/Defense | Surface and air training in support of the defense mission can be used in all USCG statutory missions |
| Conducting offensive and defensive cyberspace operations to achieve military objectives and preserve system availability, integrity, and confidentiality | Military Cyberspace Operations | Cyberspace units in boat and cutter forces will most likely support maritime interception/interdiction operations; military environment response; and port operations, security, and defense |

There are some USCG similarities and differences with the Navy that are worth noting. These differences and similarities were considered in the analysis within the body of this Draft SEIS/OEIS. Table A.1-2 highlights some of these contrasts/similarities.

## Table A.1-2: Navy–USCG Comparison

| Similarities | Differences |
|---|---|
| Both Navy and USCG are armed services of the United States. | USCG reports to the Department of Homeland Security. The Navy reports to the Secretary of Defense. The Navy has approximately 320,000 personnel while the USCG has approximately 40,000. Deployments by the Navy are normally measured in terms of months, whereas the USCG generally measures time away from port in terms of days or weeks. |
| When joint or combined training occurs, the USCG generally falls under the Navy for purposes of the exercise. USCG will follow the Navy's exercise operations order, which includes environmental mitigation. | USCG training occurs at the unit level and at less intensity than the Navy. |
| USCG trains using Navy procedures. USCG borrows heavily from Shipboard Manuals published by Navy for many common standard operating procedures pertaining to watch stations, and Navy-Type, Navy-Owned equipment such as Weapons Systems. Per Title 14 U.S.C., generally, USCG weapons systems are Navy systems. | Differences are minimal. USCG draws its surface training requirements from the Navy's Surface Force Training Manual. USCG requires many of the same skills as Navy personnel. |
| USCG systems and platforms are Navy systems and platforms. | USCG has similar (or identical) weapons and communications systems to Navy assets, but their weapons and systems are significantly less impactful in terms of types and capabilities than the Navy. For example, the USCG does not have mid-frequency or low-frequency sonar on any of its cutters or boats. USCG explosive rounds are of much less weight and are less impactful. |
| Both Navy and USCG have a global mission and reach. | Due to the size of USCG cutters (and boats), USCG training generally occurs close to the vessel homeport or close to shore, on established Navy ranges. Quite frequently, USCG training commonly occurs en route to a scheduled patrol/mission. |
| Both the Navy and USCG use Navy at-sea training ranges. | The Navy maintains and schedules all usage of their at-sea training ranges. The USCG does not have their own at-sea ranges and regularly schedules usage of the Navy's at-sea ranges. USCG meets with the Navy annually to discuss necessary training in support of the Navy and the common defense mission. Access to Navy ranges and the procedures required on the range are also discussed. |
| Both the Navy and USCG may participate in a Sinking Exercise. | Sinking Exercise (SINKEX) is managed under the Navy's SINKEX program. There is a real-world scenario where the USCG will sink a distressed vessel that is a hazard to navigation. |
| Both the Navy and USCG may participate in a law enforcement action. | The Navy cannot make arrests, but the USCG can. USCG crews with officers or petty officers assigned has law-enforcement authority (14 U.S.C. section 89) and can conduct armed boardings in support of defense or its law enforcement operation. |

| Similarities | Differences |
|---|---|
| Both Navy and USCG participate in dummy/inert mine shape placement. | The USCG does not perform a mine warfare mission but will at times assist the Navy with the placement of mine shapes for Navy training purposes. The USCG's Aids to Navigation platforms may utilize their specialized equipment to place targets in the water. |
| Both Navy and USCG work together as mission requirements dictate. | There are instances when the Navy will depend on the USCG's unique capabilities not possessed by the Navy. For example, as part of Port and Waterway Security, the USCG may escort Navy submarines in and out of harbors. |

Notes: U.S.C. = United States Code, USCG = U.S. Coast Guard

### A.1.4 Platforms, Weapons, Electronic Warfare, and Countermeasures

The platforms, weapons, electronic warfare, and countermeasures discussed below all exist within the Study Area and are utilized by the USCG in the training and testing addressed in this Draft SEIS/OEIS. Since the USCG trains the way it will operate, and many of its missions are emergent (akin to a firefighter responding immediately to a fire), often there is no time to consult with regulators or do environmental studies before responding to an emergent issue that may lead to the loss of life or property. The impacts on the environment caused by USCG defense training and testing activities discussed in the body of this Draft SEIS/OEIS are like those that would be caused by USCG operations associated with responding to various emergent non-defense related issues such as Search and Rescue for a fishing boat in distress, or a boarding done for law enforcement.

#### A.1.4.1 Cutters

Whereas the Navy has ships (that are much larger than the USCG cutters), carriers, fixed-wing aircraft (including fighter aircraft), rotary aircraft, and submarines, the USCG deploys cutters, boats, and fixed-wing and rotary aircraft. A USCG cutter is any vessel which has a permanently assigned crew and accommodations for the extended support of that crew, and includes all vessels of 65 feet (ft.) (20 meters [m]) or more in length.

The USCG currently operates approximately 240 cutters. Larger cutters are controlled by Area Commands—Atlantic Area (located in Portsmouth, Virginia) or Pacific Area (located in Alameda, California). Smaller cutters come under control of district commands. There are five districts within the Atlantic Area and four districts in the Pacific Area. Cutters usually carry a motor surf boat or a rigid-hulled inflatable boat. Polar-class icebreakers carry an Arctic survey boat and landing craft.

The endurance of a cutter to operate without provisioning is highly dependent upon several variables that change based on mission conditions. USCG cutters are not designed to a specific endurance standard but rather to a set of performance requirements. The performance requirements are utilized to determine such parameters as maximum and cruising speeds, fuel capacity, water capacity, stores capacity, armament, crew size, and special mission characteristics (e.g., ice breaking, buoy handling, towing, defense). The original performance requirements assume a specific set of operating conditions such as most economical speed. Actual endurance will vary depending on mission demands. Endurance is measured in days, whereas most Navy ships measure endurance in terms of months.

### A.1.4.2 Boats

The USCG operates approximately 1,400 boats, defined as any vessel less than 65 ft. (20 m) in length, which generally operate near shore and on inland waterways. The most common is 25 ft. (7.6 m) long, of which the USCG has more than 350; the shortest is 13 ft. (4 m). Boat training includes small boat crews engaging surface targets with small- and medium-caliber weapons. Boat crews may use high or low speeds to approach and engage targets simulating other boats, floating mines, or nearshore land targets with up to 7.62 mm weapons. A commonly used target is an empty steel drum. Table A.1-3 describes different types of surface vessels.

**Table A.1-3: List of USCG Surface Platforms**

| Type | Weapons | Length (Feet) | Notes |
|---|---|---|---|
| **Cutters** | | | |
| Legend Class (replacing Hamilton Class) | MK 110 57-mm gun<br>20-mm Phalanx Close-In Weapons System<br>Crew-served .50-caliber Browning M2 machine guns<br>Crew served 7.62-mm machine guns.<br>Various small arms | Approximately 420 | Known as National Security Cutter, there are approximately 12 in service or scheduled to be in service. |
| Famous-Class | 76-mm/62-caliber naval gun<br>50-caliber (12.7-mm) machine guns<br>Various small arms | > 250 | Entered service in 1983. There are 13 in the inventory, and they are being phased out as they reach their maximum service life. |
| Juniper-Class | .50-caliber (12.7 mm) machine guns<br>Various small arms | Approximately 225 | The Juniper-Class buoy tenders are responsible for maintaining short- and long-range aids to navigation such as fixed structures and buoys. Buoy tenders are multi-mission vessels and conduct maritime law enforcement, homeland security, and defense operations, as well as providing Search and Rescue (SAR) as needed. Entered service in 1996. Sixteen are in the inventory. **Maximum Speed**: 15 knots. |
| Reliance-Class | 25-mm gun<br>.50-caliber (12.7 mm) machine guns<br>Various small arms | Approximately 210 | Entered service in 1964. |
| Keeper-Class | None | Approximately 175 | Entered service in 1997. Fourteen are in the inventory. |
| 160-Foot-Class Island Construction Tender | None | Approximately 160 | Entered service in 1976. Four are in the inventory.<br>**Maximum Speed**: 11 knots. |
| Sentinel-Class | 25-mm autocannon | Approximately 150 | Ultimately approximately 64 will be in service, and there will be multi-mission |

| Type | Weapons | Length (Feet) | Notes |
|---|---|---|---|
| | Crew-served Browning M2 machine guns | | platforms capable of performing most of the USCG's statutory missions. |
| Bay-Class | M240 machine guns | 140 | Entered service in 1979. Up to 10 will be built. |
| Island-Class | 25-mm chain gun<br>.50-cal machine gun | 110 | (WPB): Entered service in 1985. These multi-mission platforms are being phased out and will be replaced by the Sentinel-Class cutters. |
| Marine Protector-Class | .50-caliber M2 Browning machine guns | 87 | Entered service in 1998. Approximately 70 are in the inventory. |
| Small Harbor Tug (WYTL) | None | 65 | These 65-foot tugs are multi-mission platforms. |
| **Boats** | | | |
| Aids to Navigation Boats | Small arms | Approximately 20–70 | Varies in size. |
| Screening Vessels | Small arms | Approximately 60 | Multi-mission. |
| Motor Lifeboat | Small arms | Approximately 50 | Also known as "Special Purpose Craft – Heavy Weather (SPC-HWX)." Only located in the Pacific Northwest. |
| Response Boat-Medium | None | Approximately 50 | The USCG has a contract for 180 Response Boat—Medium (RB-M) boats that were delivered starting in 2008 to replace the 41-foot utility boats. The RB-M is a multi-mission capable boat, operable from USCG shore stations, whose missions include PWCS, maritime law enforcement, and SAR. |
| Buoy Utility Stern Loading | None | Approximately 50 | |
| Training Boats | None | Approximately 40 | |
| Near-Shore Lifeboats | None | Approximately 40 | |
| Boarding Team Delivery | Small arms | Approximately 40 | |
| Long-Range Interceptor | Small arms | Approximately 40 | Launched by National Security Cutters. |
| 33-Foot Law Enforcement | Small arms | Approximately 30 | |
| Response Boat-Small II | Replacement for Defender Class | Approximately 30 | The Response Boat-Small II (RB-SII) is a multi-mission capable boat, operable from USCG shore stations and designed to operate year round in shallow waters. RB-S II missions include PWCS, maritime law enforcement, and SAR. |
| Cutter Boat Over the Horizon | Small arms | 25 | |
| Transportable Security Boats | Small arms | 25 | Used for Port Security. |
| Response Small Boat | None | 25 | To be replaced by a 29-foot boat. |

Notes: > = greater than; cal = caliber; mm = millimeter; PWCS = Ports, Waterways, and Coastal Security; RB-M = Response Boat—Medium; RB-SII = Response Boat-Small II; SAR = Search and Rescue; SPC-HWX = Special Purpose Craft – Heavy Weather

### A.1.4.3 Aircraft

The USCG operates approximately 210 aircraft. Fixed-wing aircraft (e.g., Lockheed HC-130 Hercules turboprops) operate from air stations on long-duration missions. Helicopters (e.g., Airbus MH-65 Dolphin and Sikorsky MH-60T Jayhawk) operate from air stations, air facilities, and flight-deck equipped cutters; and can rescue people, intercept smuggling vessels, or perform defense-related missions. Some special MH-designated helicopters are armed with guns, and some are equipped with armor to protect against small arms fire. Table A.1-4 describes different types of USCG aircraft.

**Table A.1-4: Aircraft**

| Name | Quantity | Notes |
|---|---|---|
| Lockheed HC-130 Hercules | Approximately 30 | Multi-mission aircraft utilized in nearly all the USCG statutory missions. No weapons. |
| HC-27J Spartan | Approximately 10 | Fourteen on order. |
| CASA HC-144A Ocean Sentry | Approximately 20 | - |
| Gulfstream C-37A | 2 | Aircraft is used as a VIP transport for high-ranking USCG and Homeland Security officials. |
| Airbus MH-65 Dolphin | Approximately 100 | Helicopters are used for most of the USCG missions. |
| Sikorsky MH-60T Jayhawk | Approximately 40 | Helicopters are used for most of the USCG missions. |
| RG-8A Condors | Unspecified number | - |
| Boeing Insitu ScanEagle | Unspecified number | - |

Note: VIP = very important person, USCG = U.S. Coast Guard

### A.1.5 Pyrotechnics, Electronic Warfare, and Countermeasures

Table A.1-5, Table A.1-6, and Table A.1-7 list pyrotechnics, electronic warfare, and countermeasures used by the USCG.

**Table A.1-5: Pyrotechnics**

| *Item* |
|---|
| 7.62-mm Grenade |
| Signal Kits |
| Flares |
| Marine Location Markers |
| Warning Flash Bang |

Note: mm = millimeter

**Table A.1-6: Electronic Warfare Systems**

| Name | Notes |
|---|---|
| Surface search and navigation radar | None of these systems are unique to the USCG. The Navy uses these same systems. |
| SCCS-Lite combat data system | - |
| AN/SLQ-32B(V)2 Electronic Warfare System | - |
| L-3 C4ISR suite | - |
| Sea Commander Aegis derived combat system | - |
| AN/SPS-50 surface search radar | - |
| AN/APX-123(V)1 IFF (ship automation system) | - |

**Table A.1-7: Decoys and Countermeasures**

| Name | Notes |
|---|---|
| Mark 36 SRBOC | Chaff countermeasures |
| Nulka | MK 53 Mod 10 |

### A.1.6 U.S. Coast Guard Activities Analyzed in this Document

**Maritime Security Operations:** Helicopter and surface ship crews conduct a suite of maritime security operations (e.g., visit, board, search and seizure, maritime interdiction operations, force protection, and anti-piracy operations). These activities involve training boarding parties delivered by helicopters and surface ships to surface vessels for the purpose of simulating vessel search and seizure operations. Various training scenarios are employed and may include small arms with non-explosive blanks and surveillance or reconnaissance unmanned surface and aerial vehicles. The entire exercise may last two to three hours. This USCG training is critical for all USCG statutory missions.

**Vessel Visit, Board, Search, and Seizure:** Military personnel from ships and aircraft train to board suspect vessels, potentially under hostile conditions.

**Maritime Interdiction Operations:** Ships and aircraft train in pursuing, intercepting, and ultimately detaining suspect vessels.

**Maritime Infrastructure Protection and Harbor Defense:** Naval and USCG personnel train to defend oil platforms, similar at-sea structures, harbors, piers, and other infrastructure.

**Warning Shot/Disabling Fire:** USCG personnel train in the use of weapons to force fleeing or threatening small boats (typically operating at high speeds) to come to a stop.

**Ship Force Protection:** USCG personnel train in tracking multiple approaching, circling small craft, assessing threat potential, and communicating among crewmates and other vessels to ensure ships are protected against attack.

**Precision Anchoring:** Ship crews train to choose the best available anchoring sites. The ship uses all means available to determine its position when anchor is dropped to demonstrate calculating and plotting the anchor's position within 100 yards of center of planned anchorage.

**Waterborne Training:** Waterborne training may include qualification and certification as safety observer, safety swimmer, coxswain, and crewman utilizing a variety of small crafts, including but not limited to rigid hull inflatables, aluminum chambered boat, stand-up paddleboards, kayaks, and jet skis. Boat crews train to launch and recover boats, operate crew-served unmanned vehicles, moor to buoys, anchor, and operate a variety of missions in shallow waters. USCG may perform this training enroute to a scheduled patrol.

**Civilian Port Defense—Homeland Security Anti-Terrorism/Force Protection Exercises:** The USCG provides close support to Naval forces Mine Warfare capabilities to support Department of Homeland Security-sponsored events. The USCG is a component of the Department of Homeland Security. The three pillars of mine warfare, airborne (helicopter), surface (surface ships), and undersea (divers, marine mammals, and unmanned vehicles) mine countermeasures will be brought to bear to ensure strategic U.S. ports remain free of mine threats. Various mine

warfare sensors, which utilize active acoustics, will be employed in the detection, classification, and neutralization of mines. Along with traditional mine warfare techniques, such as helicopter-towed mine countermeasures, new technologies (unmanned vehicles) will be utilized. Marine mammal systems may be used during this exercise. Event locations and scenarios will vary according to the Department of Homeland Security's strategic goals and evolving world events.

**Humanitarian Assistance Operations:** This activity entails training for military units that evacuate noncombatants from hostile or unsafe areas to safe havens or that provide humanitarian assistance in times of disaster. The USCG has a leadership role in many disaster relief operations, with their aircraft and surface vessels significantly contributing to the humanitarian assistance operations.

**Search and Rescue:** The USCG maintains Search and Rescue facilities on the East, West, and Gulf coasts; Hawaii; Alaska; Guam; and inland waterways. To maintain this perishable skill, the USCG trains its helicopter and fixed-wing crews and Search and Rescue personnel in the air and on the water. Helicopter, ship, and submarine crews practice the skills required to recover personnel lost at sea. Helicopters locate survivors and deploy rescue swimmers and rescue baskets. Survivors are winched up to the hovering helicopter. Surface ships would conduct man overboard drills and deploy a dummy figure in the water. Ship crews would launch a small boat, direct the recovery of the dummy, and recover the small boat.

**Maritime Environmental Response:** This defense mission, which is also an extremely important stand-alone mission, entails the USCG conducting spill response to events that may prevent the Navy access to a beach or a port. USCG is a leader of the National Response Team that trains to respond to events such as those that have occurred after ships run aground or oil wells are compromised, which result in oil or hazardous materials releasing into the Waters of the U.S. USCG, as the Federal On-Scene Coordinator, may deploy oil booms and set up the National Command Center. Training for this mission directly supports its Defense Mission.

**Gunnery Exercise:** As an armed force, the USCG may be called to perform gunnery operations as a part of its mission. This same training directly correlates to its law enforcement mission that may require a warning shot to get a vessel to stop or make it necessary for USCG to board a vessel.

**Small Boat Attacks:** This defense mission is also a law enforcement mission, and the USCG trains in a similar manner for both missions.

### A.1.7 U.S. Coast Guard and the Protection of Marine Resources

Many of the USCG missions provide a direct and measurable positive impact on the marine environment, to include marine mammals, birds, coral reefs, and fishes. The inherent protective measures that the USCG provides by conducting these missions are discussed below.

Through the Marine Environmental Protection program, the USCG develops and enforces regulations to avert the introduction of invasive species into the maritime environment, stop unauthorized ocean dumping, and prevent oil and chemical spills. The USCG serves as the Federal On-Scene Coordinator for oil spills and hazardous waste incidents in the marine environment. In this capacity, the USCG oversees the clean-up of the marine environment, including authorizing

wildlife operations to do reconnaissance and recovery of marine mammals (and other animals impacted). In a time of conflict, the USCG would perform this function as a defense mission if there were oil spills, whether it be a result of the conflict or intentionally done by an adversary.

The USCG spends tens of millions of dollars annually protecting living marine resources, to include an estimated $65 million in fiscal year 2021 enforcing the Endangered Species Act. The USCG is also a member of the National Marine Fisheries Service (NMFS) marine mammal stranding network and, in this capacity, assists NMFS and stranding response partners in aiding marine mammals in distress. USCG assets have also been used to transport marine mammals to be taken in for rehabilitation or release.

Additionally, the Ports and Waterways Safety Act includes USCG's responsibility in designating Traffic Separation Schemes for commercial vessels across the United States. The USCG works with the National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries and NMFS to develop Traffic Separation Schemes that reduce the spatial overlap of commercial ships and large whales on the East Coast (to protect North Atlantic right whales) and off California (to protect blue, fin, and humpback whales). The USCG provides marine mammal information to all mariners via weekly notice to mariners (online) and broadcast notice to mariners (immediate information via very high frequency broadcasts). Both formats are used to convey information about whales and any closures implemented by NMFS to reduce the risk of strikes, and to raise general awareness of marine mammals in specific areas.

The USCG protects our ocean environment and the marine life that inhabits it by enforcing domestic and international fisheries laws, as well as by protecting the U.S. Exclusive Economic Zone from foreign encroachment. The U.S. Exclusive Economic Zone is the largest in the world, comprising 3.4 million square miles of ocean and more than 90,000 miles of coastline. Keeping these waters clean and safe is critical to both our nation's economy and its environment. Using its law enforcement function, the USCG enforces fisheries regulations from NMFS designed to reduce interactions with fisheries and marine mammals (e.g., patrols of groundfish fisheries in Alaska near Steller sea lion closed areas). USCG auxiliarists help to raise awareness by providing information about protected species, including marine mammals, at various events. For example, USCG is part of NMFS' "Be Whale Wise" campaign to promote safe vessel practices around endangered southern resident killer whales. This often entails the need for USCG personnel to board a fishing vessel, which is also a requirement of the USCG defense mission.

Protecting the integrity of the nation's maritime borders and ensuring the health of U.S. fisheries is a vital part of the USCG mission. The USCG also enforces international agreements to suppress illegal, unreported, and unregulated fishing activity in international waters. This provides a direct benefit to the marine environment and its resources.

Another important mission entrusted to the USCG is the care and maintenance of maritime aids to navigation and the marine safety that this service provides. Much like drivers need stoplights, street signs, and universally accepted driving rules, boaters also need the nautical equivalent "rules of the road." The USCG is responsible for ensuring this network of signs, symbols, buoys, markers, and lighthouses, are functioning properly so recreational and commercial boaters can safely navigate the maritime environment. This function has a direct

impact on the safety of navigation and helps to prevent accidents that could harm the environment and its marine resources.

The United States has vital national interests in the polar regions. Polar security cutters enable the United States to maintain defense readiness in the Arctic and Antarctic regions; enforce treaties and other laws needed to safeguard both industry and the environment; provide ports, waterways, and coastal security; and provide logistical support—including vessel escort—to facilitate the movement of goods and personnel necessary to support scientific research, commerce, national security activities, and maritime safety. Ice operations in areas like the Great Lakes and the Northeast Atlantic and rivers like the Hudson River facilitate the safe movement of ships delivering vital cargo, thus providing the added benefits of both marine safety and preventing pollution through avoidance of accidents caused by iced waterways.

To safely perform these statutory missions that provide direct benefits to the environment, the USCG must provide its people with realistic training. Defense training relating to aircraft and ship operations, and all the missions that relate to the usage of these assets, directly impact the ability of the USCG to perform all their missions. The training utilized in support of defense readiness directly overlaps with many of the other USCG missions that rely on ship and aircraft operations. USCG personnel not only may perform these missions supporting the Navy and the Defense Readiness mission, but they also require the same skills for their law enforcement, marine protection, and other related missions.

# Appendix B Activity Stressor Matrices

# Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Mariana Islands Training and Testing

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**APPENDIX B ACTIVITY STRESSOR MATRICES ..... B-1**

## List of Figures

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# APPENDIX B ACTIVITY STRESSOR MATRICES

This appendix contains four matrices. The first two matrices in this appendix list the Training and Testing activities that occur in the Mariana Islands Training and Testing (MITT) Study Area and their associated stressors. The third matrix shows the stressors associated with the Range Modernization and Sustainment activity. The fourth matrix lists the resources analyzed in the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (SEIS/OEIS) and the stressors they are potentially affected by.

Activities and their associated stressors that have been introduced in this SEIS/OEIS are listed in blue.

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## Table B-1: Stressors by Training Activity

| Mariana Islands Training Activity | Biological Resources | | | | | | | | | | | | | | | | | | Physical Resources | | | | | Human Resources | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acoustic Stressors | | | | Explosive Stressors | | Energy Stressors | | | Physical Disturbance and Strike Stressors | | | | | Entanglement Stressors | | Ingestion Stressors | | Air Quality Stressors | Sediments and Water Quality Stressors | | | | Cultural Resource Stressors[1] | | Socioeconomic Resource Stressors | | | Public Health & Safety Stressors | | |
| | Sonar & Other Transducers | Vessel Noise | Aircraft Noise | Weapons Noise | Explosions in Water | Explosions in Air | In-Water Electromagnetic Devices | In-Air Electromagnetic Devices | High-Energy Lasers | Vessels & In-Water Device Strike | Aircraft & Aerial Target Strike | Military Expended Material | Seafloor Device | Personnel Disturbance | Wires & Cables | Decelerators/Parachutes | Military Expended Materials – Munitions | Military Expended Materials – Other than Munitions | Criteria Air Pollutants Hazardous Air Pollutants | Explosives and explosive by-products | Metals | Chemicals other than explosives | Other Materials | Explosives | Physical Disturbance and Strike | Accessibility | Airborne Acoustics | Physical Disturbance and Strike | In-Water Energy | In-Air Energy | Physical Interactions |
| **Major Training Exercise – Large Integrated Anti-Submarine Warfare Training** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Joint Multi-Strike Group Exercise | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| **Small Integrated Anti-Submarine Warfare Training** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Small Integrated Anti-Submarine Warfare – NUWTAC/Multi-Sail | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Surface Warfare Advanced Tactical Training | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| **Medium Coordinated Anti-Submarine Warfare Training** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Medium Coordinated Anti-Submarine Warfare Training | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Small Coordinated Anti-Submarine Warfare Training** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Independent Deployer Certification Exercise/Tailored Surface Warfare Training | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | | | | | | | | ✓ | | | | | | | | | | | | |
| **Air Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Air Combat Maneuvers | | | ✓ | | | | | ✓ | | | ✓ | | | | | | | | ✓ | | | | | | | | | | | | |
| Air Defense Exercise | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | | | | | | | | ✓ | | | | | | | | | | | | |
| Gunnery Exercise Air-to-Air – Medium Caliber | | | ✓ | ✓ | | | | ✓ | | | ✓ | ✓ | | | | | ✓ | | ✓ | | ✓ | | ✓ | | | | | | | | |
| Gunnery Exercise Surface-to-Air – Large Caliber | | ✓ | | ✓ | | | | ✓ | | ✓ | | ✓ | | | | | ✓ | | ✓ | | ✓ | | ✓ | | | | | | | | |
| Gunnery Exercise Surface-to-Air – Medium Caliber | | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | ✓ | | | | | | | | |
| Missile Exercise Air-to-Air | | | ✓ | ✓ | | ✓ | | ✓ | | | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| Missile Exercise Surface-to-Air | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| **Amphibious Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Amphibious Assault | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | | | ✓ | | | | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Amphibious Raid | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | | | ✓ | | | | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Amphibious Vehicle Maneuvers/Rehearsals | | ✓ | | | | | | ✓ | | ✓ | | | ✓ | | | | | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Naval Surface Fire Support Exercise – Land-Based Target | | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Non-Combatant Amphibious Operation | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | | ✓ | | | | | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Unmanned Aerial Vehicle – Intelligence, Surveillance, and Reconnaissance | | | ✓ | | | | | ✓ | | | ✓ | | | | | | | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ |

| Mariana Islands Training Activity | Biological Resources | | | | | | | | | | | | | | | | | | Physical Resources | | | | | Human Resources | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acoustic Stressors | | | | Explosive Stressors | | Energy Stressors | | | Physical Disturbance and Strike Stressors | | | | | Entanglement Stressors | | Ingestion Stressors | | Air Quality Stressors | Sediments and Water Quality Stressors | | | | Cultural Resource Stressors[1] | | Socioeconomic Resource Stressors | | | Public Health & Safety Stressors | | |
| | Sonar & Other Transducers | Vessel Noise | Aircraft Noise | Weapons Noise | Explosions in Water | Explosions in Air | In-Water Electromagnetic Devices | In-Air Electromagnetic Devices | High-Energy Lasers | Vessels & In-Water Device Strike | Aircraft & Aerial Target Strike | Military Expended Material | Seafloor Device | Personnel Disturbance | Wires & Cables | Decelerators/Parachutes | Military Expended Materials – Munitions | Military Expended Materials – Other than Munitions | Criteria Air Pollutants Hazardous Air Pollutants | Explosives and explosive by-products | Metals | Chemicals other than explosives | Other Materials | Explosives | Physical Disturbance and Strike | Accessibility | Airborne Acoustics | Physical Disturbance and Strike | In-Water Energy | In-Air Energy | Physical Interactions |
| **Anti-Submarine Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Anti-Submarine Warfare Torpedo Exercise – Helicopter | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Anti-Submarine Warfare Torpedo Exercise – Maritime Patrol Aircraft | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Anti-Submarine Warfare Torpedo Exercise – Ship | ✓ | ✓ | | | | | | ✓ | | ✓ | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Anti-Submarine Warfare Torpedo Exercise – Submarine | ✓ | ✓ | | | | | | ✓ | | ✓ | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Anti-Submarine Warfare Tracking Exercise – Helicopter | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Anti-Submarine Warfare Tracking Exercise – Maritime Patrol Aircraft | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Anti-Submarine Warfare Tracking Exercise – Ship | ✓ | ✓ | | | | | | ✓ | | ✓ | | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Anti-Submarine Warfare Tracking Exercise – Submarine | ✓ | ✓ | | | | | | ✓ | | ✓ | | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| **Electronic Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Counter Targeting Chaff Exercise – Aircraft | | | ✓ | | | | | ✓ | | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Counter Targeting Chaff Exercise – Ship | | ✓ | | | | | | ✓ | | ✓ | | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Counter Targeting Flare Exercise | | | ✓ | | | | | ✓ | | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Electronic Warfare Operations | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | | | | | | | | ✓ | | | | | | | | | | | | |
| **Expeditionary Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Dive and Salvage Operations*** | | ✓ | | | | | | ✓ | | ✓ | | | | | | | | | ✓ | | | | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| Personnel Insertion/Extraction – Air | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | | | ✓ | | | | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Personnel Insertion/Extraction – Surface and Subsurface | | ✓ | | | | | | | | ✓ | | | | ✓ | | | | | ✓ | | | | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| Personnel Insertion/Extraction – Swimmer/Diver | | ✓ | | | | | | | | ✓ | | | | ✓ | | | | | ✓ | | | | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| ***Underwater Construction Team Training*** | | ✓ | | | | | | | | ✓ | | | ✓ | | | | | | ✓ | | | | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| ***Port Damage Repair (No Dredging/No Pile Driving)*** | | ✓ | | | | | | | | ✓ | | | ✓ | | | | | | ✓ | | | | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| **Mine Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Airborne Mine Laying | | ✓ | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises | ✓ | ✓ | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| Mariana Islands Training Activity | Biological Resources | | | | | | | | | | | | | | | | | Physical Resources | | | | | Human Resources | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acoustic Stressors | | | | Explosive Stressors | | Energy Stressors | | | Physical Disturbance and Strike Stressors | | | | | Entanglement Stressors | | Ingestion Stressors | | Air Quality Stressors | Sediments and Water Quality Stressors | | | | Cultural Resource Stressors[1] | | Socioeconomic Resource Stressors | | | Public Health & Safety Stressors | | |
| | Sonar & Other Transducers | Vessel Noise | Aircraft Noise | Weapons Noise | Explosions in Water | Explosions in Air | In-Water Electromagnetic Devices | In-Air Electromagnetic Devices | High-Energy Lasers | Vessels & In-Water Device Strike | Aircraft & Aerial Target Strike | Military Expended Material | Seafloor Device | Personnel Disturbance | Wires & Cables | Decelerators/Parachutes | Military Expended Materials – Munitions | Military Expended Materials – Other than Munitions | Criteria Air Pollutants Hazardous Air Pollutants | Explosives and explosive by-products | Metals | Chemicals other than explosives | Other Materials | Explosives | Physical Disturbance and Strike | Accessibility | Airborne Acoustics | Physical Disturbance and Strike | In-Water Energy | In-Air Energy | Physical Interactions |
| Limpet Mine Neutralization System | | | | | ✓ | | | ✓ | | ✓ | | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Mine Countermeasures –Mine Detection | | ✓ | | | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Mine Countermeasures – Towed Mine Neutralization | | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | | | | | | | | ✓ | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Mine Neutralization – Explosive Ordnance Disposal | | ✓ | | | ✓ | | | ✓ | | ✓ | | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Surface Ship Object Detection | ✓ | ✓ | | | | | | ✓ | | ✓ | | | | | | | | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| Underwater Demolition Qualification and Certification | | ✓ | | | ✓ | | | ✓ | | ✓ | | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Underwater Mine Countermeasure – Raise, Tow, Beach, and Exploitation Operations | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Strike Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bombing Exercise Air-to-Ground | | | ✓ | | ✓ | | | ✓ | | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Gunnery exercise Air-to-Ground | | | ✓ | ✓ | ✓ | | | ✓ | | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Missile Exercise Air-to-Ground | | | ✓ | ✓ | ✓ | | | ✓ | | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Surface Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bombing Exercise | | ✓ | ✓ | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| Fast Attack Craft and Fast Inshore Attack Craft | | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | | | | | | | | |
| Gunnery Exercise Air-to-Surface Medium-Caliber | | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| Gunnery Exercise Air-to-Surface Small-Caliber | | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Gunnery Exercise Surface-to-Surface Boat Medium-Caliber | | ✓ | | ✓ | ✓ | | | | | ✓ | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Gunnery Exercise Surface-to-Surface Boat Small-Caliber | | ✓ | | ✓ | | | | | | ✓ | | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Gunnery Exercise Surface-to-Surface Ship Large-Caliber | | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | ✓ | | | | | | | | |
| Gunnery Exercise Surface-to-Surface Ship Medium-Caliber | | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| Gunnery Exercise Surface-to-Surface Ship Small-Caliber | | ✓ | | ✓ | | | | ✓ | | ✓ | | ✓ | | | | | ✓ | | ✓ | | ✓ | | ✓ | | | | | | | | |
| Laser Targeting – Aircraft | | | ✓ | | | | | ✓ | | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Laser Targeting – Ship | | ✓ | ✓ | | | | | | ✓ | ✓ | ✓ | | | | | | | | ✓ | | | | | | | | | | | | |
| Maritime Security Operations | | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Missile Exercise – Surface-to-Surface | | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |

| Mariana Islands Training Activity | Biological Resources | | | | | | | | | | | | | | | | | Physical Resources | | | | | Human Resources | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acoustic Stressors | | | | Explosive Stressors | | Energy Stressors | | | Physical Disturbance and Strike Stressors | | | | | Entanglement Stressors | | Ingestion Stressors | | Air Quality Stressors | Sediments and Water Quality Stressors | | | | Cultural Resource Stressors[1] | | Socioeconomic Resource Stressors | | | Public Health & Safety Stressors | | |
| | Sonar & Other Transducers | Vessel Noise | Aircraft Noise | Weapons Noise | Explosions in Water | Explosions in Air | In-Water Electromagnetic Devices | In-Air Electromagnetic Devices | High-Energy Lasers | Vessels & In-Water Device Strike | Aircraft & Aerial Target Strike | Military Expended Material | Seafloor Device | Personnel Disturbance | Wires & Cables | Decelerators/Parachutes | Military Expended Materials – Munitions | Military Expended Materials – Other than Munitions | Criteria Air Pollutants Hazardous Air Pollutants | Explosives and explosive by-products | Metals | Chemicals other than explosives | Other Materials | Explosives | Physical Disturbance and Strike | Accessibility | Airborne Acoustics | Physical Disturbance and Strike | In-Water Energy | In-Air Energy | Physical Interactions |
| Missile Exercise Air-to-Surface - Rocket | | | ✓ | | ✓ | | | ✓ | | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| Missile Exercise Air-to-Surface | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| Sinking Exercise | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| Small Boat Attack | | ✓ | | ✓ | | | | ✓ | | ✓ | | ✓ | | | | | ✓ | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Torpedo Exercise (Submarine-to-Surface) | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | |
| **Other Training Activities** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Direct Action (Tactical Air Control Party) | | | ✓ | | | | | ✓ | | | ✓ | | | | | | | | ✓ | | | | | | ✓ | | | | | |
| *Maritime Environmental Response* | | ✓ | | | | | | | | ✓ | | | | | | | | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Precision Anchoring | | ✓ | | | | | | | | ✓ | | | ✓ | | | | | | ✓ | | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Search and Rescue | | ✓ | ✓ | | | | | | | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Submarine Navigation | ✓ | | | | | | | | | ✓ | | | | | | | | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Submarine Sonar Maintenance and Systems Checks | ✓ | | | | | | | | | ✓ | | | | | | | | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Surface Ship Sonar Maintenance and Systems Checks | ✓ | ✓ | | | | | | ✓ | | ✓ | | | | | | | | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Underwater Survey | | ✓ | | | | | | | | ✓ | | | ✓ | | | | | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Unmanned Aerial System Training | | | ✓ | | | | | ✓ | | ✓ | ✓ | | | | | | | | ✓ | | | | | | | | | | | |
| Unmanned Underwater Vehicle Training – Certification and Development Exercises | ✓ | ✓ | | | | | | | | ✓ | | ✓ | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| *Waterborne Training* | | ✓ | | | | | | | | ✓ | | | | | | | | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ |

[1] Cultural Resources include the following Sub-Stressors: Accessibility, Cables & Wires, Pile Driving, Seafloor Devices, and Personnel Disturbance

## Table B-2: Stressors by Testing Activity

| Mariana Islands Testing Activity | Biological Resources | | | | | | | | | | | | | | | | | | Physical Resources | | | | | Human Resources | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acoustic Stressors | | | | Explosive Stressors | | Energy Stressors | | | Physical Disturbance and Strike Stressors | | | | | Entanglement Stressors | | Ingestion Stressors | | Air Quality Stressors | Sediments and Water Quality Stressors | | | | Cultural Resource Stressors[1] | | Socioeconomic Resource Stressors | | | Public Health & Safety Stressors | | |
| | Sonar & Other Transducers | Vessel Noise | Aircraft Noise | Weapons Noise | Explosions in Water | Explosions in Air | In-Water Electromagnetic Devices | In-Air Electromagnetic Devices | High-Energy Lasers | Vessels & In-Water Device Strike | Aircraft & Aerial Target Strike | Military Expended Material | Seafloor Device | Personnel Disturbance | Wires & Cables | Decelerators/Parachutes | Military Expended Materials - Munitions | Military Expe4ndedExpe4ndedExpe4nded Materials – Other than Munitions | Criteria Air Pollutants | Explosives and explosive by-products | Metals | Chemicals other than explosives | Other Materials | Explosives | Physical Disturbance and Strike | Accessibility | Airborne Acoustics | Physical Disturbance and Strike | In-Water Energy | In-Air Energy | Physical Interactions |
| **Naval Air Systems Command** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Air Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Air Combat Maneuver Test | | | ✓ | | | | | ✓ | | | ✓ | | | | | | | | ✓ | | | | | | | | | | | | |
| Intelligence, Surveillance, and Reconnaissance Test | | | ✓ | | | | | ✓ | | | ✓ | | | | | | | | ✓ | | | | | | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| **Anti-Submarine Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Anti-Submarine Warfare Torpedo Test | ✓ | | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Anti-Submarine Warfare Tracking Test (Fixed-Wing) | ✓ | | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| Anti-Submarine Warfare Tracking Test (Rotary-Wing) | ✓ | | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | |
| **Surface Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Air-to-Surface Missile Test | | | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| **Naval Sea Systems Command** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Anti-Submarine Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Pierside Sonar Testing* | ✓ | ✓ | | | | | | ✓ | | ✓ | | | | | | | | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| At-Sea Sonar Testing | ✓ | ✓ | | | | | | ✓ | | ✓ | | | | | | | | | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| **Mine Warfare** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mine Countermeasure and Neutralization Testing | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Unmanned Systems** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Unmanned Aerial System Testing* | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | | | | | | | | ✓ | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| *Unmanned Surface Vehicle System Testing* | | ✓ | | | ✓ | | | ✓ | | ✓ | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| **Vessel Evaluation** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Undersea Warfare Testing | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| *In-Port Maintenance Testing* | | ✓ | | | | | | ✓ | | ✓ | | | | | | | | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| Submarine Sea Trials – Weapons System Testing | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Vessel Signature Evaluation | | ✓ | | | | | | ✓ | | ✓ | | ✓ | ✓ | | ✓ | | | ✓ | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| **Office of Naval Research** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Acoustic and Oceanographic Science and Technology** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Acoustic and Oceanographic Research | | ✓ | ✓ | | | | | | | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

[1] Cultural Resources include the following Sub-Stressors: Accessibility, Cables & Wires, Pile Driving, Seafloor Devices, and Personnel Disturbance

## Table B-3: Stressors by Range Modernization and Sustainment Activity

| Mariana Islands Training Activity | Biological Resources | | | | | | | | | | | | | | | | | | Physical Resources | | | | | Human Resources | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acoustic Stressors | | | | Explosive Stressors | | Energy Stressors | | | Physical Disturbance and Strike Stressors | | | | | Entanglement Stressors | | Ingestion Stressors | | Air Quality Stressors | Sediments and Water Quality Stressors | | | | Cultural Resource Stressors | | Socioeconomic Resource Stressors | | | Public Health & Safety Stressors | | |
| | Sonar & Other Transducers | Vessel Noise | Aircraft Noise | Weapons Noise | Explosions in Water | Explosions in Air | In-Water Electromagnetic Devices | In-Air Electromagnetic Devices | High-Energy Lasers | Vessels & In-Water Device Strike | Aircraft & Aerial Target Strike | Military Expended Material | Seafloor Device | Personnel Disturbance | Wires & Cables | Decelerators/Parachutes | Military Expended Materials - Munitions | Military Expe4nded Materials – Other than Munitions | Criteria Air Pollutants | Explosives and explosive by-products | Metals | Chemicals other than explosives | Other Materials | Explosives | Physical Disturbance and Strike | Accessibility | Airborne Acoustics | Physical Disturbance and Strike | In-Water Energy | In-Air Energy | Physical Interactions |
| **Range Modernization and Sustainment** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Installation and Maintenance of Subsurface Targets and Instrumentation* | | ✓ | | | | | | ✓ | | ✓ | | ✓ | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

[1] Cultural Resources include the following Sub-Stressors: Accessibility, Cables & Wires, Pile Driving, Seafloor Devices, and Personnel Disturbance.

## Table B-4: Stressors by Resource

| Stressors vs. Resources | | Biological Resources | | | | | | | | | | | | | | | | | Physical Resources* | | | | | Human Resources* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Acoustic Stressors | | | | Explosive Stressors | | Energy Stressors | | | Physical Disturbance and Strike Stressors[1] | | | | | Entanglement Stressors | | Ingestion Stressors | | Air Quality Stressors | Sediments and Water Quality Stressors | | | | Cultural Resource Stressors | | Socioeconomic Resource Stressors | | | Public Health & Safety Stressors | | |
| | | Sonar & Other Transducers | Vessel Noise | Aircraft Noise | Weapons Noise | Explosions in Water | Explosions in Air | In-Water Electromagnetic Devices | In-Air Electromagnetic Devices | High-Energy Lasers | Vessels & In-Water Device Strike | Aircraft & Aerial Target Strike | Military Expended Material | Seafloor Device | Personnel Disturbance | Wires & Cables | Decelerators/Parachutes | Military Expended Materials - Munitions | Military Expended Materials – Other than Munitions | Criteria Air Pollutants Hazardous Air Pollutants | Explosives and explosive by-products | Metals | Chemicals other than explosives | Other Materials | Explosives | Physical Disturbance and Strike | Accessibility | Airborne Acoustics | Physical Disturbance and Strike | In-Water Energy | In-Air Energy | Physical Interactions |
| Physical | Air Quality | | | | | | | | | | | | | | | | | | | ✓ | | | | | | | | | | | | |
| | Sediments and Water Quality | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| Biological | Vegetation | | | | | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | | |
| | Invertebrates | ✓ | | | | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | | | |
| | Marine Habitats | | | | | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | | |
| | Fishes | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | | | | | | | |
| | Marine Mammals | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | | |
| | Sea Turtles | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | | | | | | | |
| | Seabirds | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | ✓ | | | ✓ | ✓ | ✓ | | | | | | | | | | | | | | |
| | Terrestrial Species and Habitats | | | | ✓ | | ✓ | | | | | | ✓ | | | | | | | | | | | | | | | | | | | |
| Human | Cultural Resources | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | | | |
| | Socioeconomic Resources | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | | | |
| | Public Health and Safety | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ✓ | ✓ | ✓ |

*Substressors related to Physical Resources and Human Resources are addressed within their respective resource sections.

[1] Wildfires and Ground Disturbance stressors are not considered in this Draft SEIS/OEIS because proposed activities at FDM are reduced from what was analyzed in the 2020 SEIS/OEIS. The change in tempo of these activities on FDM would not change the analysis conclusions reached in the 2020 SEIS/OEIS.

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# Appendix C Acoustic and Non-Acoustic Effects Supporting Information

# Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Mariana Islands Training and Testing

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# APPENDIX C ACOUSTIC AND NON-ACOUSTIC EFFECTS SUPPORTING INFORMATION

## C.1 Biological Resource Methods

The analysis of effects on biological resources focused on the likelihood of encountering the stressor, the primary stimulus, response, and recovery of individual organisms. Where appropriate, the potential of a biological resource to overlap with a stressor was analyzed with consideration given to the specific geographic area (large marine ecosystems, open ocean areas, range complexes, Study Areas, and other training and testing areas) in which the overlap could occur. Additionally, the differential effects of training versus testing activities that introduce stressors to the resource were considered.

Information supporting the analysis of effects from energy, physical disturbance and strike, entanglement, ingestion, and secondary stressors on all biological resources is presented in this appendix. Supporting information on the analysis of effects from acoustic and explosive stressors on vegetation, invertebrates, marine habitats, and birds is also presented in this section; however, effects from acoustic and explosive stressors on marine mammals, fishes, and reptiles is presented in the *Acoustic and Explosives Concepts Technical Report*.

For each of the non-biological resources considered in this Supplemental Environmental Impact Statement (SEIS)/Overseas Environmental Impact Statement (OEIS), the methods are unique to each specific resource and are therefore described in each resource section.

### C.1.1 Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities

This conceptual framework describes the potential effects from exposure to acoustic and explosive activities and the accompanying short-term costs to the animal (e.g., expended energy or missed feeding opportunity). It then outlines the conditions that may lead to long-term consequences for the individual if the animal cannot fully recover from the short-term costs and how these in turn may affect the population. Within each biological resource section (e.g., marine mammals, birds, and fishes) the detailed methods to predict effects on specific taxa are derived from this conceptual framework.

An animal is considered “exposed” to a sound if the received sound level at the animal’s location is above the background ambient noise level within a similar frequency band. A variety of effects may result from exposure to acoustic and explosive activities.

The categories of potential effects are shown in the box below:

- ***Injury and other non-auditory injury*** *- Injury to organs or tissues of an animal.*
- ***Hearing loss*** *- A noise-induced decrease in hearing sensitivity which can be either temporary or permanent and may be limited to a narrow frequency range of hearing.*
- ***Masking*** *- When the perception of a biologically important sound (i.e., signal) is interfered with by a second sound (i.e., noise).*
- ***Physiological stress*** *- An adaptive process that helps an animal cope with changing conditions; although, too much stress can result in physiological problems.*
- ***Behavioral response*** *- A reaction ranging from very minor and brief changes in attentional focus, changes in biologically important behaviors, and avoidance of a sound source or area, to aggression or prolonged flight.*

Figure C-1 is a flowchart that diagrams the process used to evaluate the potential effects to marine animals exposed to sound-producing activities. The shape and color of each box on the flowchart represent either a decision point in the analysis (green diamonds); specific processes such as responses, costs, or recovery (blue rectangles); external factors to consider (purple parallelograms); and final outcomes for the individual or population (orange ovals and rectangles). Each box is labeled for reference throughout the following sections. For simplicity, sound is used here to include not only sound waves but also blast waves generated from explosive sources. Box A1, the Sound-Producing Activity, is the source of this stimuli and therefore the starting point in the analysis.

The first step in predicting whether an activity is capable of affecting a marine animal is to define the stimuli experienced by the animal. The stimuli include the overall level of activity, the surrounding acoustical environment, and characteristics of the sound when it reaches the animal.

Sounds emitted from a sound-producing activity (Box A1) travel through the environment to create a spatially variable sound field. The received sound by the animal (Box A2) determines the range of possible effects. The received sound can be evaluated in several ways, including number of times the sound is experienced (repetitive exposures), total received energy, or highest sound pressure level (SPL) experienced.

Sounds that are higher than the ambient noise level and within an animal's hearing sensitivity range (Box A3) have the potential to cause effects. There can be any number of individual sound sources in a given activity, each with its own unique characteristics. For example, a Navy training exercise may involve several ships and aircraft using several types of sonar. Environmental factors such as temperature and bottom type impact how sound spreads and attenuates through the environment. Additionally, independent of the sounds, the overall level of activity and the number and movement of sound sources are important to help predict the probable reactions.

The magnitude of the responses is based on the characteristics of the acoustic stimuli and the characteristics of the animal (species, susceptibility, life history stage, size, and past

experiences). Very high exposure levels close to explosives have the potential to cause injury. High-level, long-duration, or repetitive exposures may potentially cause some hearing loss. All perceived sounds may lead to behavioral responses, physiological stress, and masking. Many sounds, including sounds that are not detectable by the animal, could have no effect (Box A4).

### C.1.1.1 Injury

Injury (Box B1) refers to the direct injury of tissues and organs by shock or pressure waves impinging upon or traveling through an animal's body. Marine animals are well adapted to large, but relatively slow, hydrostatic pressure changes that occur with changing depth. However, injury may result from exposure to rapid pressure changes, such that the tissues do not have time to adequately adjust.

Therefore, injury is normally limited to relatively close ranges from explosions. Injury can be mild and fully recoverable or, in some cases, lead to mortality.

Injury includes both auditory and non-auditory injury. Auditory injury is the direct mechanical injury to hearing-related structures, including tympanic membrane rupture, disarticulation of the middle ear ossicles, and injury to the inner ear structures such as the organ of Corti and the associated hair cells.

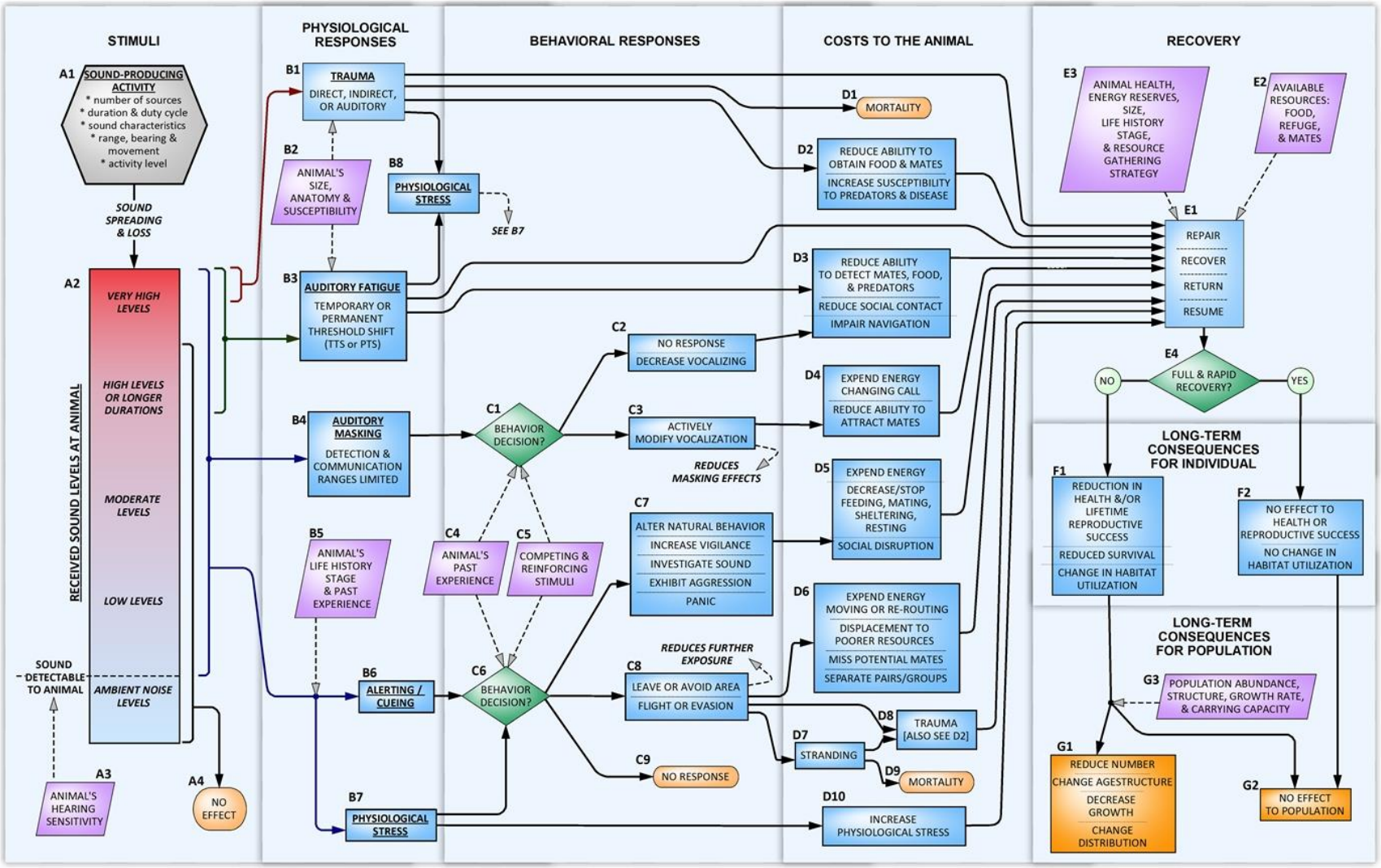



**Figure C-1: Flow Chart of the Evaluation Process of Sound-Producing Activities**

Auditory injury differs from auditory fatigue in that the latter involves the overstimulation of the auditory system at levels below those capable of causing direct mechanical damage. Auditory injury is always injurious but can be temporary. One of the most common consequences of auditory injury is hearing loss.

Non-auditory injury can include hemorrhaging of small blood vessels and the rupture of gas-containing tissues such as the lung, swim bladder, or gastrointestinal tract. After the ear (or other sound-sensing organs), these are usually the organs and tissues most sensitive to explosive injury. An animal's size and anatomy are important in determining its susceptibility to non-auditory injury (Box B2). Larger size indicates more tissue to protect vital organs. Therefore, larger animals should be less susceptible to injury than smaller animals. In some cases, acoustic resonance of a structure may enhance the vibrations resulting from noise exposure and result in an increased susceptibility to injury. The size, geometry, and material composition of a structure determine the frequency at which the object will resonate. Because most biological tissues are heavily damped, the increase in susceptibility from resonance is limited.

Vascular and tissue bubble formation resulting from sound exposure is a hypothesized mechanism of injury to breath-holding marine animals. Bubble formation and growth due to direct sound exposure have been hypothesized (Crum et al., 2005; Crum & Mao, 1996); however, the experimental laboratory conditions under which these phenomena were observed would not be replicated in the wild. Certain dive behaviors by breath-holding animals are predicted to result in conditions of blood nitrogen super-saturation, potentially putting an animal at risk for decompression sickness (Fahlman et al., 2014), although this phenomena has not been observed (Houser et al., 2009). In addition, animals that spend long periods of time at great depths are predicted to have super-saturated tissues that may slowly release nitrogen if the animal then spends a long time at the surface (i.e., stranding) (Houser et al., 2009).

Injury could increase the animal's physiological stress (Box B8), which feeds into the stress response (Box B7) and also increases the likelihood or severity of a behavioral response. Injury may reduce an animal's ability to secure food by reducing its mobility or the efficiency of its sensory systems, making the injured individual less attractive to potential mates, increasing an individual's chances of contracting diseases, falling prey to a predator (Box D2), or increasing an animal's overall physiological stress level (Box D10). Severe injury can lead to the death of the individual (Box D1).

Damaged tissues from mild to moderate injury may heal over time. The predicted recovery of direct injury is based on the severity of the injury, availability of resources, and characteristics of the animal. The animal may also need to recover from any potential costs due to a decrease in resource gathering efficiency and any secondary effects from predators or disease. Severe injuries can lead to reduced survivorship (longevity), elevated stress levels, and prolonged alterations in behavior that can reduce an animal's lifetime reproductive success. An animal with decreased energy stores or a lingering injury may be less successful at mating for one or more breeding seasons, thereby decreasing the number of offspring produced over its lifetime.

### C.1.1.2 Hearing Loss

Hearing loss, also called a noise-induced threshold shift, is possibly the most studied type of effect from sound exposures to animals. Hearing loss manifests itself as loss in hearing sensitivity across part of an animal's hearing range, which is dependent upon the specifics of the noise exposure. Hearing loss may be either permanent threshold shift (PTS or AINJ), or temporary threshold shift (TTS). If the threshold shift eventually returns to zero (the animal's hearing returns to pre-exposure value), the threshold shift is a TTS. If the threshold shift does not return to zero but leaves some finite amount of threshold shift, then that remaining threshold shift is a PTS. Figure C-2 shows one hypothetical threshold shift that completely recovers, a TTS, and one that does not completely recover, leaving some PTS or AINJ.

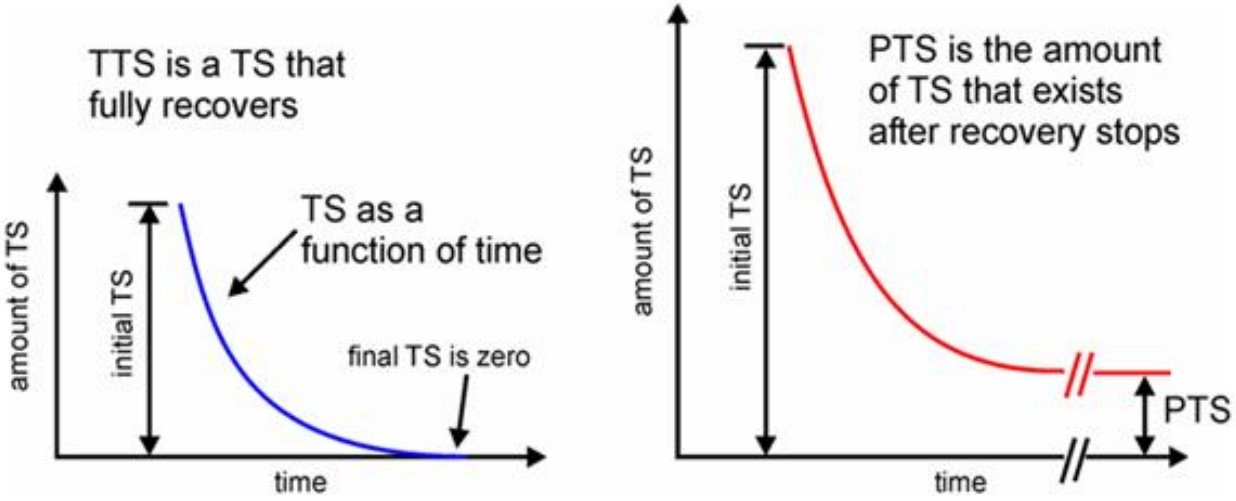



**Figure C-2: Two Hypothetical Threshold Shifts**

The characteristics of the received sound stimuli are used and compared to the animal's hearing sensitivity and susceptibility to noise (Box A3) to determine the potential for hearing loss. The amplitude, frequency, duration, and temporal pattern of the sound exposure are important parameters for predicting the potential for hearing loss over a specific portion of an animal's hearing range. Duration is particularly important because hearing loss increases with prolonged exposure time. Longer exposures with lower sound levels can cause more threshold shift than a shorter exposure using the same amount of energy overall. The frequency of the sound also plays an important role. Experiments show that animals are most susceptible to hearing loss (Box B3) within their most sensitive hearing range. Sounds outside of an animal's audible frequency range do not cause hearing loss.

The mechanisms responsible for hearing loss may consist of a variety of mechanical and biochemical processes in the inner ear, including physical damage or distortion of the tympanic membrane (not including tympanic membrane rupture which is considered auditory injury), physical damage or distortion of the cochlear hair cells, hair cell death, changes in cochlear blood flow, and swelling of cochlear nerve terminals (Henderson et al., 2006; Kujawa & Liberman, 2009). Although the outer hair cells are the most prominent target for fatigue effects, severe noise exposures may also result in inner hair cell death and loss of auditory nerve fibers (Henderson et al., 2006).

The relationship between TTS and PTS is complicated and poorly understood, even in humans and terrestrial mammals, where numerous studies failed to delineate a clear relationship between the two. Relatively small amounts of TTS (e.g., less than 40–50 decibels [dB] measured two minutes after exposure) will recover with no apparent permanent effects; however, terrestrial mammal studies revealed that larger amounts of threshold shift can result in permanent neural degeneration, despite the hearing thresholds returning to normal (Kujawa & Liberman, 2009). The amounts of threshold shift induced by Kujawa and Liberman (2009) were described as being "at the limits of reversibility." It is unknown whether smaller amounts of threshold shift can result in similar neural degeneration, or if effects would translate to other species such as marine animals.

Hearing loss can increase an animal's physiological stress (Box B8), which feeds into the stress response (Box B7). Hearing loss increases the likelihood or severity of a behavioral response and increase an animal's overall physiological stress level (Box D10). Hearing loss reduces the distance over which animals can communicate and detect other biologically important sounds (Box D3). Hearing loss could also be inconsequential for an animal if the frequency range affected is not critical for that animal to hear within, or the hearing loss is of such short duration (e.g., a few minutes) that there are no costs to the individual.

Small to moderate amounts of hearing loss may recover over a period of minutes to days, depending on the amount of initial threshold shift. Severe noise-induced hearing loss may not fully recover, resulting in some amount of PTS. An animal whose hearing does not recover quickly and fully could suffer a reduction in lifetime reproductive success. An animal with PTS may be less successful at mating for one or more breeding seasons, thereby decreasing the number of offspring it can produce over its lifetime.

### C.1.1.3 Masking

Masking occurs if the noise from an activity interferes with an animal's ability to detect, understand, or recognize biologically relevant sounds of interest (Box B4). In this context noise refers to unwanted or unimportant sounds that mask an animal's ability to hear sounds of interest. Sounds of interest include those from conspecifics such as offspring, mates, and competitors; echolocation clicks; sounds from predators; natural, abiotic sounds that may aid in navigation; and reverberation, which can give an animal information about its location and orientation within the ocean. The probability of masking increases as the noise and sound of interest increase in similarity and the masking noise increases in level. The frequency, received level, and duty cycle of the noise determines the potential degree of auditory masking. Masking only occurs during the sound exposure.

A behavior decision (either conscious or instinctive) is made by the animal when the animal detects increased background noise, or possibly, when the animal recognizes that biologically relevant sounds are being masked (Box C1). An animal's past experiences can be important in determining the behavioral response when dealing with masking (Box C4). For example, an animal may modify its vocalizations to reduce the effects of masking noise. Other stimuli present in the environment can influence an animal's behavior decision (Box C5) such as the presence of predators, prey, or potential mates.

An animal may exhibit a passive behavioral response when coping with masking (Box C2). It may simply not respond and keep conducting its current natural behavior. An animal may also stop calling until the background noise decreases. These passive responses do not present a direct energetic cost to the animal; however, masking will continue, depending on the acoustic stimuli.

An animal may actively compensate for masking (Box C3). An animal can vocalize more loudly to make its signal heard over the masking noise. An animal may also shift the frequency of its vocalizations away from the frequency of the masking noise. This shift can actually reduce the masking effect for the animal and other animals that are listening in the area.

If masking impairs an animal's ability to hear biologically important sounds (Box D3) it could reduce an animal's ability to communicate with conspecifics or reduce opportunities to detect or attract more distant mates, gain information about their physical environment, or navigate. An animal that modifies its vocalization in response to masking could also incur a cost (Box D4). Modifying vocalizations may cost the animal energy, interfere with the behavioral function of a call, or reduce a signaler's apparent quality as a mating partner. For example, songbirds that shift their calls up an octave to compensate for increased background noise attract fewer or less-desirable mates, and many terrestrial species advertise body size and quality with low-frequency vocalizations (Slabbekoorn & Ripmeester, 2007). Masking may also lead to no measurable costs for an animal. Masking could be of short duration or intermittent such that biologically important sounds that are continuous or repeated are received by the animal between masking noise.

Masking only occurs when the sound source is operating; therefore, direct masking effects stop immediately upon cessation of the sound-producing activity. Masking could have long-term consequences for individuals if the activity was continuous or occurred frequently enough.

### C.1.1.4 Physiological Stress

Marine animals naturally experience physiological stress as part of their normal life histories. The physiological response to a stressor, often termed the stress response, is an adaptive process that helps an animal cope with changing external and internal environmental conditions. Sound-producing activities have the potential to cause additional stress. However, too much of a stress response can be harmful to an animal, resulting in physiological dysfunction.

If a sound is detected (i.e., heard or sensed) by an animal, a stress response can occur (Box B7). The severity of the stress response depends on the received sound level by the animal (Box A2), the details of the sound-producing activity (Box A1), and the animal's life history stage (e.g., juvenile or adult, breeding or feeding season), and past experience with the stimuli (Box B5). An animal's life history stage is an important factor to consider when predicting whether a stress response is likely (Box B5). An animal's life history stage includes its level of physical maturity (i.e., larva, infant, juvenile, sexually mature adult) and the primary activity in which it is engaged such as mating, feeding, or rearing/caring for young. Prior experience with a stressor may be of particular importance because repeated experience with a stressor may dull the stress response via acclimation (St. Aubin & Dierauf, 2001) or increase the response via sensitization.

Additionally, if an animal suffers injury or hearing loss, a physiological stress response will occur (Box B8).

The generalized stress response is characterized by a release of hormones (Reeder & Kramer, 2005) and other chemicals (e.g., stress markers) such as reactive oxidative compounds associated with noise-induced hearing loss (Henderson et al., 2006). Stress hormones include norepinephrine and epinephrine (i.e., the catecholamines), which produce elevations in the heart and respiration rate, increase awareness, and increase the availability of glucose and lipid for energy. Other stress hormones are the glucocorticoid steroid hormones cortisol and aldosterone, which are classically used as an indicator of a stress response and to characterize the magnitude of the stress response (Hennessy et al., 1979).

An acute stress response is traditionally considered part of the startle response and is hormonally characterized by the release of the catecholamines. Annoyance type reactions may be characterized by the release of either or both catecholamines and glucocorticoid hormones. Regardless of the physiological changes that make up the stress response, the stress response may contribute to an animal's decision to alter its behavior.

Elevated stress levels may occur whether or not an animal exhibits a behavioral response (Box D10). Even while undergoing a stress response, competing stimuli (e.g., food or mating opportunities) may overcome any behavioral response. Regardless of whether the animal displays a behavioral response, this tolerated stress could incur a cost to the animal. Reactive oxygen compounds produced during normal physiological processes are generally counterbalanced by enzymes and antioxidants; however, excess stress can lead to damage of lipids, proteins, and nucleic acids at the cellular level (Berlett & Stadtman, 1997; Sies, 1997; Touyz, 2004).

Frequent physiological stress responses may accumulate over time increasing an animal's chronic stress level. Each component of the stress response is variable in time, and stress hormones return to baseline levels at different rates. Elevated chronic stress levels are usually a result of a prolonged or repeated disturbance. Chronic elevations in the stress levels (e.g., cortisol levels) may produce long-term health consequences that can reduce lifetime reproductive success.

### C.1.1.5 Behavioral Reactions

Behavioral responses fall into two major categories: alterations in natural behavior patterns and avoidance. These types of reactions are not mutually exclusive, and many overall reactions may be combinations of behaviors or a sequence of behaviors. Severity of behavioral reactions can vary drastically between minor and brief reorientations of the animal to investigate the sound, to severe reactions such as aggression or prolonged flight. The type and severity of the behavioral response will determine the cost to the animal. The total number of vessels and platforms involved, the size of the activity area, the distance between the animal and activity, and the duration of the activity are important considerations when predicting the initial behavioral responses.

A physiological stress response (Box B7) such as an annoyance or startle reaction, or cueing or alerting (Box B6) may cause an animal to make a behavior decision (Box C6). Any exposure that

produces an injury or hearing loss is also assumed to produce a stress response (Box B7) and increase the severity or likelihood of a behavioral reaction. Both an animal's experience (Box C4) and competing and reinforcing stimuli (Box C5) can affect an animal's behavior decision. The decision can result in three general types of behavioral reactions: no response (Box C9), area avoidance (Box C8), or alteration of a natural behavior (Box C7).

An animal's past experiences can be important in determining what behavior decision it may make when dealing with a stress response (Box C4). Habituation is the process by which an animal learns to ignore or tolerate stimuli over some period and return to a normal behavior pattern, perhaps after being exposed to the stimuli with no negative consequences. Sensitization is when an animal becomes more sensitive to a set of stimuli over time, perhaps as a result of a past, negative experience that could result in a stronger behavioral response.

Other stimuli (Box C5) present in the environment can influence an animal's behavioral response. These stimuli may be conspecifics or predators in the area or the drive to engage in a natural behavior. Other stimuli can also reinforce the behavioral response caused by acoustic stimuli. For example, the awareness of a predator in the area coupled with the sound-producing activity may elicit a stronger reaction than the activity alone would have.

An animal may reorient, become more vigilant, or investigate if it detects a sound-producing activity (Box C7). These behaviors all require the animal to divert attention and resources, therefore slowing or stopping their presumably beneficial natural behavior. This can be a very brief diversion, or an animal may not resume its natural behaviors until after the activity has concluded. An animal may choose to leave or avoid an area where a sound-producing activity is taking place (Box C8). A more severe form of this comes in the form of flight or evasion. Avoidance of an area can help the animal avoid further effects by avoiding or reducing further exposure. An animal may also choose not to respond to a sound-producing activity (Box C9).

An animal that alters its natural behavior in response to stress or an auditory cue may slow or cease its natural behavior and instead expend energy reacting to the sound-producing activity (Box D5). Natural behaviors include feeding, breeding, sheltering, and migrating. The cost of feeding disruptions depends on the energetic requirements of individuals and the potential amount of food missed during the disruption. Alteration in breeding behavior can result in delaying reproduction. The costs of a brief interruption to migrating or sheltering are less clear.

An animal that avoids a sound-producing activity may expend additional energy moving around the area, be displaced to poorer resources, miss potential mates, or have social interactions affected (Box D6). The amount of energy expended depends on the severity of the behavioral response. Missing potential mates can result in delaying reproduction. Groups could be separated during a severe behavioral response such as flight and offspring that depend on their parents may die if they are permanently separated. Splitting up an animal group can result in a reduced group size, which can have secondary effects on individual foraging success and susceptibility to predators.

Some severe behavioral reactions can lead to stranding (Box D7) or secondary injury (Box D8). Animals that take prolonged flight, a severe avoidance reaction, may injure themselves or strand in an environment for which they are not adapted. Some injury is likely to occur to an

animal that strands (Box D8). Injury can reduce the animal's ability to secure food and mates, and increase the animal's susceptibility to predation and disease (Box D2). An animal that strands and does not return to a hospitable environment may die (Box D9).

### C.1.1.6 Long-Term Consequences

The potential long-term consequences from behavioral responses are difficult to discern. Animals displaced from their normal habitat due to an avoidance reaction may return over time and resume their natural behaviors. This is likely to depend upon the severity of the reaction and how often the activity is repeated in the area. In areas of repeated and frequent acoustic disturbance, some animals may habituate to the new baseline; conversely, species that are more sensitive may not return, or return but not resume use of the habitat in the same manner. For example, an animal may return to an area to feed but no longer rest in that area. Long-term abandonment or a change in the utilization of an area by enough individuals can change the distribution of the population. Frequent disruptions to natural behavior patterns may not allow an animal to recover between exposures, which increase the probability of causing long-term consequences to individuals.

The magnitude and type of effect and the speed and completeness of recovery (i.e., return to baseline conditions) must be considered in predicting long-term consequences to the individual animal (Box E4). The predicted recovery of the animal (Box E1) is based on the cost to the animal from any reactions, behavioral or physiological. Available resources fluctuate by season, location, and year and can play a major role in an animal's rate of recovery (Box E2). Recovery can occur more quickly if plentiful food resources, many potential mates, or refuge or shelter is available. An animal's health, energy reserves, size, life history stage, and resource gathering strategy affect its speed and completeness of recovery (Box E3). Animals that are in good health and have abundant energy reserves before an effect takes place will likely recover more quickly.

Animals that recover quickly and completely are unlikely to suffer reductions in their health or reproductive success, or experience changes in habitat utilization (Box F2). No population-level effects would be expected if individual animals do not suffer reductions in their lifetime reproductive success or change their habitat utilization (Box G2). Animals that do not recover quickly and fully could suffer reductions in their health and lifetime reproductive success; they could be permanently displaced or change how they use the environment; or they could die (Box F1). These long-term consequences to the individual can lead to consequences for the population (Box G1); although, population dynamics and abundance play a role in determining how many individuals would need to suffer long-term consequences before there was an effect on the population.

Long-term consequences to individuals can translate into consequences for populations dependent upon population abundance, structure, growth rate, and carry capacity. Carrying capacity describes the theoretical maximum number of animals of a particular species that the environment can support. When a population nears its carrying capacity, its growth is naturally limited by available resources and predator pressure. If one, or a few animals, in a population are removed or gather fewer resources, then other animals in the population can take advantage of the freed resources and potentially increase their health and lifetime reproductive

success. Abundant populations that are near their carrying capacity (theoretical maximum abundance) that suffer consequences on a few individuals may not be affected overall. Populations that exist well below their carrying capacity may suffer greater consequences from any lasting consequences to even a few individuals. Population-level consequences can include a change in the population dynamics, a decrease in the growth rate, or a change in geographic distribution.

### C.1.2 Conceptual Framework for Assessing Effects from Energy-Producing Activities

#### C.1.2.1 Stimuli

##### C.1.2.1.1 Magnitude of the Energy Stressor

Regulations do not provide threshold criteria to determine the significance of the potential effects from activities that involve the use of varying electromagnetic frequencies or lasers. Many organisms, primarily marine vertebrates, have been studied to determine their thresholds for detecting electromagnetic fields, as reviewed by Normandeau et al. (2011); however, there are no data on predictable responses to exposure above or below detection thresholds. The types of electromagnetic fields discussed are those from mine neutralization activities (magnetic influence minesweeping). High-energy and low-energy lasers were considered for analysis. Low-energy lasers (e.g., targeting systems, detection systems, laser light detection and ranging) do not pose a risk to organisms (U.S. Department of the Navy, 2010b) and, therefore, will not be discussed further. Radar was also considered for analysis and was determined not to pose a risk to biological resources.

##### C.1.2.1.2 Location of the Energy Stressor

Evaluation of potential energy exposure risks considered the spatial overlap of the resource occurrence and electromagnetic field and high-energy laser use. Wherever appropriate, specific geographic areas of potential effect were identified and the relative location of the resource with respect to the source was considered. For example, the greatest potential electromagnetic energy exposure is at the source, where intensity is greatest and the greatest potential for high energy laser exposure is at the ocean's surface, where high-energy laser intensity is greatest. All light energy, including laser light, entering the ocean becomes absorbed and scattered at a rate that is dependent on the frequency of the light. For most laser applications, the energy is rapidly reduced as the light penetrates the ocean.

##### C.1.2.1.3 Behavior of the Organism

Evaluation of potential energy exposure risk considered the behavior of the organism, especially where the organism lives and feeds (e.g., surface, water column, seafloor). The analysis for electromagnetic devices considered those species with the ability to perceive or detect electromagnetic signals. The analysis for high-energy lasers and radar particularly considered those species known to occur at or above the surface of the ocean.

#### C.1.2.2 Immediate Response and Costs to the Individual

Many different types of organisms (e.g., some invertebrates, fishes, turtles, birds, mammals) are sensitive to electromagnetic fields (Normandeau et al., 2011). An organism that encounters

a disturbance in an electromagnetic field could respond by moving toward the source, moving away from it, or not responding at all. The types of electromagnetic devices used in the Proposed Action simulate the electromagnetic signature of a vessel passing through the water column, so the expected response would be similar to that of vessel movement. However, since there would be no actual strike potential, a physiological response would be unlikely in most cases. Recovery of an individual from encountering electromagnetic fields would be variable, but since the physiological response would likely be minimal, as reviewed by Normandeau et al. (2011), any recovery time would also be minimal.

Very little data are available to analyze potential effects on organisms from exposure to high energy lasers. For all but the highest-energy lasers, the greatest laser-related concern for marine species is damage to an organism's ability to see.

#### C.1.2.3 Long-Term Consequences to the Individual and Population

Long-term consequences are considered in terms of a resource's existing population level, growth and mortality rates, other stressors on the resource from the Proposed Action, cumulative effects on the resource, and the ability of the population to recover from or adapt to effects. Effects of multiple or repeated stressors on individuals are cumulative.

### C.1.3 Conceptual Framework for Assessing Effects from Physical Disturbance or Strike

#### C.1.3.1 Stimuli

##### C.1.3.1.1 Size and Weight of the Objects

To determine the likelihood of a strike and the potential effects on an organism or habitat that would result from a physical strike, the size and weight of the striking object relative to the organism or habitat must be considered. For example, most small organisms and early life stages would simply be displaced by the movement generated by a large object moving through, or falling into, the water, whereas a larger organism could potentially be struck by an object since it may not be displaced by the movement of the water. The weight of the object is also a factor that would determine the severity of a strike. A strike by a heavy object would be more severe than a strike by a low-weight object (e.g., a decelerator/parachute, flare end cap, or chaff canister).

##### C.1.3.1.2 Location and Speed of the Objects

Evaluation of potential physical disturbance or strike risk considered the spatial overlap of the resource occurrence and potential striking objects. Analysis of effects from physical disturbance or strike stressors focuses on proposed activities that may cause an organism or habitat to be struck by an object moving through the air (e.g., aircraft), water (e.g., vessels, in-water devices, towed devices), or dropped into the water (e.g., non-explosive practice munitions and seafloor devices). The area of operation, vertical distribution, and density of these items also play central roles in the likelihood of effect. Wherever appropriate, specific geographic areas of potential effect are identified. Analysis of potential physical disturbance or strike risk also considered the speed of vessels as a measure of intensity. Some vessels move slowly, while others are capable of high speeds.

#### C.1.3.1.3 Buoyancy of the Objects

Evaluation of potential physical disturbance or strike risk in the ocean considered the buoyancy of targets or expended materials during operation, which will determine whether the object will be encountered at the surface, within the water column, or on the seafloor.

#### C.1.3.1.4 Behavior of the Organism

Evaluation of potential physical disturbance or strike risk considered where organisms occur and if they occur in the same geographic area and vertical distribution as those objects that pose strike risks.

### C.1.3.2 Immediate Response and Costs to the Individual

Before being struck, some organisms would sense a pressure wave through the water and respond by remaining in place, moving away from the object, or moving toward it. An organism displaced a small distance by movements from an object falling into the water nearby would likely continue on with no response. However, others could be disturbed and may exhibit a generalized stress response. If the object actually hit the organism, direct injury in addition to stress may result. The function of the stress response in vertebrates is to rapidly raise the blood sugar level to prepare the organism to flee or fight. This generally adaptive physiological response can become a liability if the stressor persists and the organism cannot return to its baseline physiological state.

Most organisms would respond to sudden physical approach or contact by darting quickly away from the stimulus. Other species may respond by freezing in place or seeking refuge. In any case, the individual must stop whatever it was doing and divert its physiological and cognitive attention to responding to the stressor. The energy costs of reacting to a stressor depend on the specific situation, but in all cases the caloric requirements of stress reactions reduce the amount of energy available to the individual for other functions such as predator avoidance, reproduction, growth, and metabolism.

The ability of an organism to return to what it was doing following a physical strike (or near miss resulting in a stress response) is a function of fitness, genetic, and environmental factors. Some organisms are more tolerant of environmental or human-caused stressors than others and become acclimated more easily. Within a species, the rate at which an individual recovers from a physical disturbance or strike may be influenced by its age, sex, reproductive state, and general condition. An organism that has reacted to a sudden disturbance by swimming at burst speed would tire after some time; its blood hormone and sugar levels may not return to normal for 24 hours. During the recovery period, the organism may not be able to attain burst speeds and could be more vulnerable to predators. If the individual were not able to regain a steady state following exposure to a physical stressor, it may suffer depressed immune function and even death.

### C.1.3.3 Long-Term Consequences to the Population

Long-term consequences are considered in terms of a resource's existing population level, growth and mortality rates, other stressors on the resource from the Proposed Action,

cumulative effects on the resource, and the ability of the population to recover from or adapt to effects. Effects of multiple or repeated stressors on individuals are cumulative.

### C.1.4 Conceptual Framework for Assessing Effects from Entanglement

#### C.1.4.1 Stimuli

##### C.1.4.1.1 Physical Properties of the Objects

For an organism to become entangled in military expended materials, the materials must have certain properties, such as the ability to form loops and a high breaking strength. Some items could have a relatively low breaking strength on their own, but that breaking strength could be increased if multiple loops were wrapped around an entangled organism.

##### C.1.4.1.2 Physical Features of the Resource

The physical makeup of the organism itself is also considered when evaluating the risk of entanglement. Some species, by their size or physical features, are more susceptible to entanglement than others. For example, more rigid bodies with protruding snouts (e.g., hammerhead shark) or large, rigid fins (e.g., humpback whale) would have an increased risk of entanglement when compared to species with smoother, streamlined bodies such as lamprey or eels.

##### C.1.4.1.3 Location of the Objects

Evaluation of potential entanglement risk considered the spatial overlap of the resource occurrence and military expended materials. Distribution and density of expended items play a central role in the likelihood of effect. Wherever appropriate, specific geographic areas of potential effect are identified.

##### C.1.4.1.4 Behavior of the Organism

Evaluation of potential entanglement risk considered the general behavior of the organism, including where the organism typically occurs (e.g., surface, water column, seafloor). The analysis particularly considered those species known to become entangled in nonmilitary expended materials (e.g., “marine debris”) such as fishing lines, nets, rope, and other derelict fishing gear that often entangle marine organisms.

#### C.1.4.2 Immediate Response and Costs to the Individual

The potential effects of entanglement on a given organism depend on the species and size of the organism. Species that have protruding snouts, fins, or appendages are more likely to become entangled than smooth-bodied organisms. Also, items could get entangled by an organism's mouth, if caught on teeth or baleen, with the rest of the item trailing alongside the organism. Materials similar to fishing gear, which is designed to entangle an organism, would be expected to have a greater entanglement potential than other materials. An entangled organism would likely try to free itself of the entangling object and in the process may become even more entangled, possibly leading to a stress response. The net result of being entangled by an object could be disruption of the normal behavior, injury due to lacerations, and other sublethal or lethal effects.

### C.1.4.3 Long-Term Consequence to the Individual and Population

Consequences of entanglement could range from an organism successfully freeing itself from the object or remaining entangled indefinitely, possibly resulting in lacerations and other sublethal or lethal effects. Stress responses or infection from lacerations could lead to latent mortality. The analysis will focus on reasonably foreseeable long-term consequences of the direct effect, particularly those that could affect the fitness of an individual. Changes in an individual's growth, survival, annual reproductive success, or lifetime reproductive success could have population-level effects if enough individuals are affected. This population-level effect would vary among species and taxonomic groups.

## C.1.5 Conceptual Framework for Assessing Effects from Ingestion

### C.1.5.1 Stimuli

#### C.1.5.1.1 Size of the Objects

To assess the ingestion risk from military expended materials, this analysis considered the size of the object relative to the animal's ability to swallow it. Some items are too large to be ingested (e.g., non-explosive practice bombs and most targets) and effects from these items are not discussed further. However, these items may potentially break down into smaller ingestible pieces over time. Items that are of ingestible size when they are introduced into the environment are carried forward for analysis within each resource section where applicable.

#### C.1.5.1.2 Location of the Objects

Evaluation of potential ingestion risk considered the spatial overlap of the resource occurrence and military expended materials. The distribution and density of expended items play a central role in the likelihood of effect. Wherever appropriate, specific geographic areas of potential effect were identified.

#### C.1.5.1.3 Buoyancy of the Objects

Evaluation of potential ingestion risk considered the buoyancy of military expended materials to determine whether the object will be encountered within the water column (including the surface) or on the seafloor. Less buoyant materials, such as solid metal materials (e.g., projectiles or munitions fragments), sink rapidly to the seafloor. More buoyant materials include less dense items (e.g., target fragments and decelerators/parachutes) that may be caught in currents and gyres or entangled in floating algal mats. These materials can remain in the water column for an indefinite period of time before sinking. However, decelerators/parachutes are weighted and would generally sink, unless that sinking is suspended, in the scenario described here.

#### C.1.5.1.4 Feeding Behavior

Evaluation of potential ingestion risk considered the feeding behavior of the organism, including where (e.g., surface, water column, seafloor) and how (e.g., filter feeding) the organism feeds and what it feeds on. The analysis particularly considered those species known to ingest nonfood items (e.g., plastic or metal items).

### C.1.5.2 Immediate Response and Costs to the Individual

Potential effects of ingesting foreign objects on a given organism depend on the species and size of the organism. Species that normally eat spiny hard-bodied invertebrates would be expected to have tougher mouths and guts than those that normally feed on softer prey. Materials similar in size and shape to the normal diet of an organism may be more likely to be ingested without causing harm to the animal; however, some general assumptions were made. Relatively small objects with smooth edges, such as shells or small-caliber projectiles, might pass through the digestive tract without causing harm. A small sharp-edged item may cause the individual immediate physical distress by tearing or cutting the mouth, throat, or stomach. If the object is rigid and large (relative to the individual's mouth and throat), it may block the throat or obstruct digestive processes. An object may even be enclosed by a cyst in the gut lining. The net result of ingesting large foreign objects is disruption of the normal feeding behavior, which could be sublethal or lethal.

### C.1.5.3 Long-Term Consequences to the Individual and Population

The consequences of ingesting nonfood items could be nutrient deficiency, bioaccumulation, uptake of toxic chemicals, compaction, and mortality. The analysis focused on reasonably foreseeable long-term consequences of the direct effect, particularly those that could affect the fitness of an individual. Changes in an individual's growth, survival, annual reproductive success, or lifetime reproductive success could have population-level effects if enough individuals were affected. This population-level effect would vary among species and taxonomic groups.

## C.1.6 Conceptual Framework for Assessing Effects from Secondary Stressors

This conceptual framework describes the potential effects to marine species exposed to stressors indirectly through effects on habitat and prey availability (e.g., sediment or water quality, and physical disturbance). Stressors from Navy military readiness activities could pose indirect effects on marine biological resources via indirect effects to habitat or to prey. These include indirect effects from (1) explosives, explosion byproducts, and unexploded munitions; (2) metals; (3) chemicals; and (4) transmission of disease and parasites. The methods used to determine secondary stressors on marine resources are presented below. Once a category of primary stressor has been analyzed to determine how a marine biological resource is affected, an analysis follows of how a secondary stressor is potentially affecting a marine resource. After the secondary stressors are identified, a determination on the significance of the secondary effect is made. The same criteria to determine the level of significance for primary effects are used for secondary stressors. In addition, it is possible for a significant primary effect to produce a beneficial indirect effect. For example, sinking exercises could generate a significant effect to the seafloor and surrounding habitats, while causing a potential beneficial secondary effect by creating hard-bottom habitat for invertebrates, producing a food source for fishes, and creating structural refuges for other biological resources.

### C.1.6.1 Secondary Stressors

#### C.1.6.1.1 Effects on Habitat

Primary effects defined in each marine resource section were used to develop a conceptual model to predict the potential secondary stressors on each habitat or resource. This conceptual model incorporated factors such as the co-occurrence of stressors in space and time, the effects or assessment endpoints of individual stressors (e.g., habitat alteration, changes in animal behavior or physiology, injury, mortality, or changes in human use), and the duration and intensity of the effects of individual stressors. For example, a secondary stressor from a munitions strike could be habitat degradation. The primary effect or stressor is the actual strike on the habitat such as the seafloor, with the introduction of military expended materials, munitions, and fragments inducing further habitat degradation.

Secondary stressors can also induce additive effects on habitats. These types of effects are also determined by summing the individual stressors with identical and quantifiable assessment endpoints. For example, if one stressor disturbed 0.25 square nautical miles ($NM^2$) of benthic habitat, a second stressor disturbed 0.5 $NM^2$, and all other stressors did not disturb benthic habitat, then the total benthic habitat disturbed would be 0.75 $NM^2$. For stressors with identical but not quantifiable assessment endpoints, potential additive effects were qualitatively evaluated using available scientific knowledge and best professional judgment. Other habitat effects such as underwater detonations were assessed by size of charge (net explosive weight), charge radius, height above the seafloor, substrate types in the area, and equations linking all these factors. The analysis also considered that effects of underwater explosions vary with the bottom substrate type and that the secondary effects would also be variable among substrate types.

#### C.1.6.1.2 Effects on Prey Availability

Assessing the effects of secondary stressors on prey availability falls into two main areas over different temporal scales: the cost to an individual over a relatively short amount of time (short-term) and the cost to an individual or population over a longer period of time (long-term).

### C.1.6.2 Immediate Response and Costs to the Individual

After a primary effect was identified, an analysis of secondary stressors on that resource was initiated. This analysis examined whether indirect effects would occur after the initial (primary) effect and at what temporal scale that secondary stressor would affect the resource (short-term or long-term). An assessment was then made as to whether the secondary stressor would affect an individual or a population. For example, an underwater explosion could affect a single resource such as a fish or multiple other species in the food web (e.g., prey species such as plankton). The analysis also took into consideration whether the primary effect affected more than an individual or single species. For example, a prey species that would be directly injured or killed by an explosive blast could draw in predators or scavengers from the surrounding waters that would feed on those organisms, and in turn could be more directly susceptible to being injured or killed by subsequent explosions. For purposes of this analysis, indirect effects on a resource did not require trophic transfer (e.g., bioaccumulation) in order to be observed. It

is important to note that the terms “indirect” and “secondary” describe how the effect may occur in an organism or its ecosystem and does not imply reduced severity of environmental consequences.

### C.1.6.3 Long-Term Consequences to the Individual and Population

Long-term consequences of secondary stressors on an individual or population are often difficult to determine. Once a primary effect is identified, the severity of that effect helps to determine the temporal scale at which the secondary stressor can be measured. For most marine resources, the abundance of prey species near a detonation point would be diminished for a short period (weeks to months) before being repopulated by animals from adjacent waters. In some extreme cases, recovery of the habitat or prey resources could occur over a relatively long-time frame (months to years). It is important to note that indirect effects often differ among resources, spatial, and temporal scales.

## C.2 Sediments and Water Quality

### C.2.1 Explosives and Explosive Byproducts

Explosives may be introduced into the seawater and sediments by the Proposed Action. The explosive fillers contained within the munitions used during training and testing activities and their degradation products can enter the environment through high-order detonations (i.e., the munition functions as intended and the vast majority of explosives are consumed), low-order detonations (i.e., the munition partially functions with only a portion of the explosives consumed), or unexploded munitions (i.e., the munition fails to detonate and explosives remain in the casing). In the case of a successful detonation, only a small or residual amount of explosives may enter the marine environment (U.S. Environmental Protection Agency, 2012). A low-order detonation would result in some residual explosives and some unconsumed explosives remaining in the munitions casing entering the water. In the case of unexploded munitions, the explosives contained in the munition would not be consumed and would remain encased within the munition as it enters the marine environment. The munitions casing may corrode or rupture over time and release explosives into the sediments and water column.

The behavior of explosives and explosives byproducts in marine environments and the extent to which those constituents of explosives have adverse effects are influenced by a number of processes, including the ease with which the explosive dissolves in a liquid such as water (solubility), the degree to which explosives are attracted to other materials in the water (e.g., clay-sized particles and organic matter, sorption), and the tendency of the explosives to evaporate (volatilization). These characteristics, in turn, influence the extent to which the material is subject to biotic (biological) and abiotic (physical and chemical) transformation and degradation (Pennington & Brannon, 2002). The solubility of various explosives is provided in Table C-1. In the table, higher values indicate greater solubility. For example, high melting explosive is virtually insoluble in water. Table salt, which dissolves easily in water, is included in the table for comparison.

**Table C-1: Water Solubility of Common Explosives and Explosive Degradation Products**

| Compound | Water Solubility[1] (mg/L at 20 ˚C) |
|---|---|
| Table salt (sodium chloride)[2] | 357,000 |
| Ammonium perchlorate (O) | 249,000 |
| Picric acid (E) | 12,820 |
| Nitrobenzene (D) | 1,900 |
| Dinitrobenzene (E) | 500 |
| Trinitrobenzene (E) | 335 |
| Dinitrotoluene (D) | 160 |
| TNT (E) | 130 |
| Tetryl (E) | 51 |
| Pentaerythritoltetranitrate (E) | 43 |
| Royal Demolition Explosive (E) | 38 |
| High Melting Explosive (E) | 7 |

Source: U.S. Department of the Navy (2008)
[1] Units are milligrams per liter at 20 degrees Celsius
[2]Table salt is not an explosive degradation product
Notes: D = explosive degradation product, E = explosive, O = oxidizer additive, TNT = trinitrotoluene

According to Walker et al. (2006), trinitrotoluene (TNT), royal demolition explosive, and high melting explosive experience rapid biological and photochemical degradation in marine systems. The authors noted that productivity in marine and estuarine systems is largely controlled by the limited availability of nitrogen. Because nitrogen is a key component of explosives, they are attractive as substrates for marine bacteria that metabolize other naturally occurring organic matter, such as polycyclic aromatic hydrocarbons. Juhasz and Naidu (2007) also noted that microbes use explosives as sources of carbon and energy.

Carr and Nipper (2003) indicated that conversion of TNT to carbon dioxide, methane, and nitrates in coastal sediments (a process referred to as "mineralization") occurred at rates that were typical for naturally occurring compounds such as phenanthrene, fluoranthene, toluene, and naphthalene. They noted that transformation of 2, 6-dinitrotoluene and picric acid by organisms in sediments is dependent on temperature and type of sediment (e.g., finer-grained). Pavlostathis and Jackson (2002) reported that the marine microalgae *Anabaena* spp. was highly efficient at the removal and metabolism of TNT in a continuous flow experiment. Nipper et al. (2002) noted that irreversible binding to sediments and biodegradation of 2, 6-dinitrotoluene, tetryl, and picric acid occurred in fine-grained sediments high in organic carbon resulting in lower concentrations of the contaminants. Cruz-Uribe et al. (2007) noted that three species of marine macroalgae metabolize TNT to 2-amino-4,6-dinitrotoluene and 4-amino-2, 6-dinitrotoluene, and speculate that "the ability of marine macroalgae to metabolize TNT is widespread, if not generic." The studies cited above indicate that TNT and its constituent

products can be removed from the environment by naturally occurring biological processes in sediments, reducing sediment toxicity from these chemical contaminants.

Singh et al. (2009) indicated that biodegradation of royal demolition explosive and high melting explosive occurs with oxygen (aerobic) and without oxygen (anoxic or anaerobic), but that they were more easily degraded under anaerobic conditions. Crocker et al. (2006) indicated that the mechanisms of high melting explosive and royal demolition explosive biodegradation are similar, but that high melting explosive degrades more slowly. Singh et al. (2009) noted that royal demolition explosive and high melting explosive are biodegraded under a variety of anaerobic conditions by specific microbial species and by mixtures of such species. Zhao et al. (2004a); Zhao et al. (2004b) found that biodegradation of royal demolition explosive and high melting explosive occurs in cold marine sediments.

According to Singh et al. (2009), typical end products of the degradation of royal demolition explosive include nitrite, nitrous oxide, nitrogen, ammonia, formaldehyde, formic acid, and carbon dioxide. Crocker et al. (2006) stated that many of the primary and secondary intermediate compounds from biodegradation of royal demolition explosive and high melting explosive are unstable in water and spontaneously decompose. Thus, these explosives are degraded by a combination of biotic and abiotic reactions. Formaldehyde is subsequently metabolized to formic acid, methanol, carbon dioxide, or methane by various microorganisms (Crocker et al., 2006).

A series of research efforts focused on World War II underwater munitions disposal sites in Hawaii (Briggs et al., 2016; Kelley et al., 2016; Koide et al., 2016) and an intensively used live fire range in the Mariana Islands (Smith & Marx, 2016) provide information in regard to the effects of undetonated materials and unexploded munitions on marine life.

On a localized scale, research at World War II munitions ocean disposal sites in Hawaii investigated nearby sediments, seawater, or marine life to determine if released constituents from the munitions (including explosive materials and metals) could be detected. Comparisons were made between disposal site samples and "clean" reference sites. Analysis of the samples showed no confirmed detection for explosive materials.

Investigations by Kelley et al. (2016) and Koide et al. (2016) found that intact munitions (i.e., ones that failed to detonate or non-explosive practice munitions) residing in or on soft sediments habitats provided hard substrate similar to other disposed objects or "artificial reefs" that attracted "hard substrate species," which would not have otherwise colonized the area. Sampling these species revealed that there was no bioaccumulation of munitions-related chemicals in the species (Koide et al., 2016).

On a broader scale, the island of Farallon De Medinilla (in the Mariana Islands) has been used as a target area for both explosive and non-explosive munitions since 1971. Between 1997 and 2012, the Navy conducted 14 underwater scientific surveys around the island, providing a consistent, long-term investigation of a single site where munitions have been used regularly (Smith & Marx, 2016). Marine life assessed during these surveys included algae, corals, benthic invertebrates, sharks, rays, bony fishes, and sea turtles. The investigators found no evidence over the 16-year period that the condition of the physical or biological resources had been

adversely affected to a significant degree by the training activities (Smith & Marx, 2016). Furthermore, they found that the health, abundance, and biomass of fishes, corals and other marine resources were comparable to or superior to those in similar habitats at other locations within the Mariana Archipelago.

In summary, multiple investigations since 2007 involving survey and sampling of World War II munition dump sites off Oahu Hawaii and other locations, have found the following: (1) chemicals and degradation products from underwater munitions "do not pose a risk to human health or to fauna living in direct contact with munitions,"(2) metals measured in sediment samples next to World War II munitions are lower than naturally occurring marine levels and "do not cause a significant effect on the environment," and (3) sediment is not a significant sink of chemicals released by degradation of the explosive components in munitions (Edwards et al., 2016).

The concentration of explosive munitions and any associated explosives byproducts at any single location in the Study Area would be a small fraction of the totals that have accumulated over decades at World War II era dump sites and military ranges. Based on findings from much more intensively used locations, effects on sediments from the use of explosive munitions during training and testing activities would be negligible by comparison. As a result, explosives by-products and unexploded munitions would have no meaningful effect on sediments.

Most explosive material is consumed in an explosion, so the vast majority of explosive material entering the marine environment would be encased in munitions that failed to detonate. Failure rates for all of the munitions used in the Proposed Action are not available; however, based on the data that are available, a 5 percent munitions failure rate was applied to estimate failure rates for all munitions used in the Proposed Action. Based on the available data, low-order detonation rates are assumed to be at least an order of magnitude less than failure rates for all munitions and are not considered in the analysis. Table C-2 provides information about the rates of failure and low-order detonations for explosives and other munitions (MacDonald & Mendez, 2005).

**Table C-2: Failure and Low-Order Detonation Rates of Military Munitions**

| Munitions | Failure Rate (Percent) | Low-Order Detonation Rate (Percent) |
|---|---|---|
| Guns/artillery | 4.68 | 0.16 |
| Hand grenades | 1.78 | n/a |
| Explosive munitions | 3.37 | 0.09 |
| Rockets | 3.84 | n/a |
| Submunitions | 8.23 | n/a |

Source: MacDonald and Mendez (2005)

Note: n/a = not available

Most activities involving explosives and explosives byproducts would be conducted more than 3 nautical miles (NM) offshore in each range complex. Activities in these areas (3–200 NM) would be subject to federal sediment and water quality standards and guidelines.

Explosives are also used in nearshore areas (low tide line to 3 NM) specifically designated for mine countermeasure and mine neutralization activities. These activities would be subject to state sediment and water quality standards and guidelines.

For explosives byproducts, "local" refers to the water column in the vicinity of the underwater detonation. For unconsumed explosives, "local" refers to the area of potential effect from explosives in a zone of sediment about 6 feet (ft.) in diameter around the unconsumed explosive where it comes to rest on the seafloor.

### C.2.2 Chemicals Other Than Explosives

Under the Proposed Action, chemicals other than explosives are associated with the following military expended materials: (1) solid-fuel propellants in missiles and rockets; (2) Otto Fuel II torpedo propellant and combustion byproducts; (3) polychlorinated biphenyls (PCBs) in target vessels used during sinking exercises; (4) other chemicals associated with munitions; and (5) chemicals that simulate chemical warfare agents, referred to as "chemical simulants."

Hazardous air pollutants from explosives and explosives byproducts are discussed in Section 3.2 (Air Resources). Fuels onboard manned aircraft and vessels are not reviewed, nor are fuel-loading activities, onboard operations, or maintenance activities reviewed, because normal operation and maintenance of Navy equipment is not part of the Proposed Action.

Navy pilots are prohibited from dumping fuel below 1,800 meters (m) (6,000 ft.) above ground level, except in an emergency situation (U.S. Department of the Navy, 2023). However, during aerial refueling, there is a possibility of incidental fuel spillage. At altitudes greater than 1,500 m above ground level, fuel is expected to volatilize before reaching ground level (Good & Clewell III, 1980). Vapor resulting from incidental fuel spillage would be widely dispersed at altitude by winds, resulting in concentrations too low to create any perceptible changes in atmospheric composition. The study conducted by Good and Clewell III (1980) used JP-5 jet fuel; however, the authors state that their results are generally applicable to other jet fuel types. Based on these considerations, aerial refueling will not be further analyzed in this document.

The largest chemical constituent of missiles is solid propellant. Solid propellant contains both the fuel and the oxidizer, a source of oxygen needed for combustion. An extended-range Standard Missile-2 typically contains 1,822 pounds (lb.) of solid propellant. Ammonium perchlorate is the oxidizing agent used in most modern solid-propellant formulas (Chaturvedi & Dave, 2015). It normally accounts for 50 to 85 percent of the propellant by weight. Ammonium dinitramide may also be used as an oxidizing agent. Aluminum powder as a fuel additive ranges from 5 to 22 percent by weight of solid propellant; it is added to increase missile range and payload capacity. The explosives high melting explosive (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine) and royal demolition explosive (hexahydro-1,3,5-trinitro-1,3,5-triazine) may be added, although they usually comprise less than 30 percent of the propellant by weight. Many of the constituents used in propellants are also commonly used for commercial purposes but require additional processing to achieve certain properties necessary for rocket and missile propulsion. (Missile Technology Control Regime, 1996).

The U.S. Environmental Protection Agency (USEPA) issued a paper characterizing the munitions constituents accumulated at over 30 military sites around the United States and Canada where

explosives and propellants have been used (U.S. Environmental Protection Agency, 2012). The sites assessed in the paper were all land-based ranges; however, the results are useful for analyzing similar activities conducted at sea. The paper noted that perchlorate was generally not detected at anti-tank ranges and that perchlorate is so soluble in water and mobile in soil that surface accumulation apparently does not occur. The paper includes a case study that estimates the amount of residual perchlorate deposited from a rocket fired at a test track. The rocket propellant contained 68 lb. of ammonium perchlorate. Samples were collected both behind the firing point and along the test track before and after the rocket was fired. No differences in perchlorate concentrations in soils were detected at any location before or after the firing, and all measurements recorded perchlorate concentrations of less than 1 microgram per kilogram. That case study concluded that 99.997 percent of perchlorate is consumed by the rocket motor (U.S. Environmental Protection Agency, 2012). Fitzpatrick et al. (2006) found similar results from an air-launched AIM-7 missile, a missile used by the Navy and similar to missiles used in the Proposed Action. These studies, and others cited in each paper, demonstrate that the motors used in rockets and missiles are highly efficient at burning propellant fuels, leaving only trace amounts often at undetectable levels in the environment.

Several torpedoes (e.g., MK-54) use Otto Fuel II as a liquid propellant. Otto Fuel II is composed of primarily three synthetic substances: Propylene glycol dinitrate and nitro-diphenylamine (76 percent), dibutyl sebacate (22 percent), and 2-nitrodiphenylamine as a stabilizer (2 percent). Propylene glycol dinitrate, which is a liquid, is the explosive component of Otto Fuel II. Dibutyl sebacate, also known as sebacic acid, is also a liquid. It is used commercially to make plastics, many of which are used for packaging food, and to enhance flavor in foods such as ice cream, candy, baked goods, and nonalcoholic drinks. The third component, 2-nitrodiphenylamine, is a solid substance used to control the combustion of the propylene glycol dinitrate (Espinoza & Wehrtmann, 2008). Combustion byproducts of Otto Fuel II include nitrous oxides, carbon monoxide, carbon dioxide, hydrogen, nitrogen, methane, ammonia, and hydrogen cyanide. During normal venting of excess pressure or upon failure of the torpedo's buoyancy bag, the following constituents are discharged: carbon dioxide, water, hydrogen, nitrogen, carbon monoxide, methane, ammonia, hydrochloric acid, hydrogen cyanide, formaldehyde, potassium chloride, ferrous oxide, potassium hydroxide, and potassium carbonate (Waters et al., 2013).

Target vessels are only used during sinking exercises, which occur infrequently. Polychlorinated biphenyls are a concern because they are present in certain solid materials (e.g., insulation, wires, felts, and rubber gaskets) on vessels used as targets for sinking exercises. These vessels are selected from a list of Navy-approved vessels that have been cleaned in accordance with USEPA guidelines (U.S. Environmental Protection Agency, 2014c). By rule, a sinking exercise must be conducted at least 50 NM offshore and in water at least 6,000 ft. deep (40 Code of Federal Regulations 229.2).

The USEPA estimates that as much as 100 lb. of PCBs remain onboard sunken target vessels. The USEPA considers the contaminant levels released during the sinking of a target to be within the standards of the Marine Protection, Research, and Sanctuaries Act (16 United States Code 1341, et seq.) (U.S. Environmental Protection Agency, 2014b). Under the 2014 agreement with the USEPA, the Navy will not likely use aircraft carriers or submarines as the targets for a sinking

exercise (U.S. Environmental Protection Agency, 2014a). Based on these considerations, PCBs will not be considered further.

Table C-3 lists the chemical constituents produced in the combustion of propellants and fuels, as described above, and list constituents remaining after the detonations of non-munitions, such as spotting charges and tracers. Not all of the listed chemical constituents in propellant and Otto Fuel II would be used in combination; some are substitutes that would replace another chemical in the list, depending on the type of propellant used. For example, ammonium perchlorate is the preferred oxidizer in propellant, but ammonium dinitramide could act as the oxidizer in some propellants.

**Table C-3: Constituents in Munitions Other Than Explosives**

| Munitions Component | Constituent |
|---|---|
| Pyrotechnics<br>Tracers<br>Spotting Charges | Barium chromate<br>Potassium perchlorate<br>Chlorides<br>Phosphorus<br>Titanium compounds |
| Oxidizers | Lead (II) oxide |
| Propellant (rockets and missiles) | Ammonium perchlorate (50 to 85 percent by weight)<br>Ammonium dinitramide<br>Aluminum powder (5 to 21 percent by weight)<br>High melting explosive<br>Royal demolition explosive<br>Hydroxyl-terminated polybutadiene<br>Carboxyl-terminated polybutadiene<br>Polybutadiene-acrylic acid-acrylonitrile<br>Triphenyl bismuth<br>Nitrate esters<br>Nitrated plasticizers<br>Polybutadiene-acrylic acid polymer<br>Elastomeric polyesters<br>Polyethers<br>Nitrocellulose plasticized with nitroglycerine<br>2-nitrodiphenylamine<br>N-methyl-4-nitroaniline<br>Hydrazine |
| Otto Fuel II (torpedoes) | Propylene glycol dinitrate and Nitro-diphenylamine (76 percent by weight)<br>dibutyl sebacate (22 percent by weight)<br>2-nitrodiphenylamine (2 percent by weight)<br>Combustion products (nitrous oxides, carbon monoxide, carbon dioxide, hydrogen, nitrogen, methane, ammonia, hydrogen cyanide)<br>Venting or buoyancy bag failure (hydrochloric acid, hydrogen cyanide, formaldehyde, potassium chloride, ferrous oxide, potassium hydroxide, and potassium carbonate) |
| Chemical Simulants | Navy Chemical Agent Simulant 82<br>glacial acetic acid<br>triethyl phosphate<br>sulfur hexafluoride<br>1,1,1,2 tetrafluoroethane |

| Munitions Component | Constituent |
|---|---|
| | 1,1-difluoroethane |
| Delay Elements | Barium chromate<br>Potassium perchlorate<br>Lead chromate |
| Fuses | Potassium perchlorate |
| Detonators | Fulminate of mercury<br>Potassium perchlorate |
| Primers | Lead azide |

Sources: Chaturvedi and Dave (2015) for Oxidizers and Propellants; Waters et al. (2013) for Otto Fuel II.

The environmental fate of Otto Fuel II and its components is largely unknown. Neither the fuel mixture nor its three main components are particularly volatile or soluble in water; however, when mixed with water propylene glycol dinitrate forms a volatile mixture, making evaporation an important fate process (Espinoza & Wehrtmann, 2008). The compound 2-Nitrodiphenylamine may precipitate from water or be taken up by particulates. Dibutyl sebacate is rapidly biodegraded. Neither propylene glycol dinitrate nor 2-nitrodiphenylamine are readily biodegradable, but both of these chemicals break down when exposed to ultraviolet light (Powell et al., 1998).

Lead azide, titanium compounds, perchlorates, barium chromate, and fulminate of mercury are not natural constituents of seawater. Lead oxide is a rare, naturally occurring mineral. It is one of several lead compounds that form films on lead objects in the marine environment (Agency for Toxic Substances and Disease Registry, 2007). Metals are discussed in more detail in Section 3.1 (Sediments and Water Quality).

Because chemical and biological warfare agents remain a security threat, the Department of Defense uses relatively harmless compounds (chemical simulants) as substitutes for chemical and biological warfare agents to test equipment intended to detect their presence. Chemical and biological agent detectors monitor for the presence of chemical and biological warfare agents and protect military personnel and civilians from the threat of exposure to these agents. The simulants trigger a response by sensors in the detection equipment without irritating or injuring personnel involved in testing detectors.

Navy Chemical Agent Simulant 82 (commonly referred to as NCAS-82), glacial acetic acid, triethyl phosphate, sulfur hexafluoride, 1,1,1,2 tetrafluoroethane (a refrigerant commonly known as R134), and 1,1-difluoroethane (a refrigerant commonly known as R-152a) are also referred to as gaseous simulants and can be released in smaller quantities in conjunction with glacial acetic acid or triethyl phosphate releases. The types of biological simulants that may be used include spore-forming bacteria, non-spore-forming bacteria, ovalbumin, bacteriophage MS2, and *Aspergillus niger*. The simulants are generally dispersed by hand at the detector or by aircraft as a fine mist or aerosol. The exposure of military personnel or the public to even small amounts of real warfare agents, such as nerve or blistering agents, or harmful biological organisms, such as anthrax, is potentially harmful and is illegal in most countries, including the United States. Furthermore, their use, including for the testing of detection equipment, is banned by international agreement.

Simulants must have one or more characteristic of a real chemical or biological agents—size, density, or aerosol behavior—to effectively mimic the agent. Simulants must also pose a minimal risk to human health and the environment to be used safely in outdoor tests. Simulants are selected using the following criteria: (1) safety to humans and the environment, and (2) the ability to trigger a response by sensors used in the detection equipment. Simulants must be relatively benign (e.g., low toxicity or effects potential) from a human health, safety, and environmental perspective. Exposure levels during testing activities should be well below concentrations associated with any adverse human health or environmental effects. The degradation products of simulants must also be harmless. Given these criteria for choosing simulants for use in testing activities, it is reasonable to conclude that simulants would have no effect on sediments and water quality in the Study Area. Simulants are not analyzed further in this section.

### C.2.3 Metals

Anthropogenic sources of metals include the processing of industrial ores (e.g., iron ore), production of chemicals, fertilizers used in agriculture, the marine industry (e.g., anti-fouling anti-corrosion paints), runoff from urban and suburban sprawl, dredge spoil disposal, exhaust from automotive transportation, atmospheric deposition, and industrial emissions (Haugland et al., 2006). Metals would be introduced into nearshore and offshore marine waters and sediments by the Proposed Action. Because of the physical and chemical reactions that occur with metals in marine systems, many metals will precipitate out of seawater and settle in solid form on the seafloor where they can concentrate in sediments. Thus, metal contaminants in sediments pose a greater environmental concern than metals in the water column.

Military expended materials such as steel bomb bodies or fins, missile casings, small arms projectiles, and naval gun projectiles may contain small percentages (less than 1 percent by weight) of lead, manganese, phosphorus, sulfur, copper, nickel, tungsten, chromium, molybdenum, vanadium, boron, selenium, columbium, or titanium. Small-caliber projectiles are composed of steel with small amounts of aluminum and copper and brass casings that are 70 percent copper and 30 percent zinc. Medium- and large-caliber projectiles are composed of steel, brass, copper, tungsten, and other metals. The 20 mm cannon shells used in close-in weapons systems are composed mostly of tungsten alloy. Some projectiles have lead cores (U.S. Department of the Navy, 2008). Torpedo guidance wire is composed of copper and cadmium coated with plastic (U.S. Department of the Navy, 2008). Sonobuoy components include batteries and battery electrodes, lead solder, copper wire, and lead used for ballast. Thermal batteries in sonobuoys are contained in an airtight, sealed and welded stainless steel case that is 0.03–0.1 inch (in.) thick and resistant to the battery electrolytes (U.S. Department of the Navy, 2008). Rockets are usually composed of steel and steel alloys, although composite cases made of glass, carbon, or Kevlar fiber are also used (Missile Technology Control Regime, 1996). Anchors used to moor mine shapes or other seafloor devices are often recovered but in some cases may be left on the seafloor to facilitate recovery of the device (see Chapter 3, Affected Environment and Environmental Consequences). Metal anchors and other types of anchors (e.g., concrete blocks) with metal components are composed primarily of steel.

Non-explosive practice munitions consist of ammunition and components that contain no explosive material, and may include (1) ammunition and components that have had all explosive material removed and replaced with non-explosive material, (2) empty ammunition or components, and (3) ammunition or components that were manufactured with non-explosive material in place of all explosive material. These practice munitions vary in size from 25 to 500 lb. and are designed to simulate the characteristics of explosive munitions for training and testing activities. Some non-explosive practice munitions may also contain unburned propellant (e.g., rockets), and some may contain spotting charges or signal cartridges for locating the point of effect (e.g., smoke charges for daylight spotting or flash charges for night spotting) (U.S. Department of the Navy, 2010c). Large, non-explosive bombs—also called "practice" or "bomb dummy units"—are composed mainly of iron and steel casings filled with sand, concrete, or vermiculite. These materials are similar to those used to construct artificial reefs. Non-explosive bombs are configured to have the same weight, size, center of gravity, and ballistics as explosive bombs (U.S. Department of the Navy, 2006b). Practice bombs do not contain the explosive materials.

Decommissioned vessels used as targets for sinking exercises are selected from a list of U.S. Navy-approved vessels that have been cleaned or remediated in accordance with USEPA guidelines. By rule, vessel-sinking exercises must be conducted at least 50 NM offshore and in water at least 6,000 ft. deep (40 Code of Federal Regulations part 229.2). The USEPA requires the contaminant levels released during the sinking of a target to be within the standards of the Marine Protection, Research, and Sanctuaries Act (16 United States Code 1341, et seq.).

In general, three things happen to materials that come to rest on the ocean floor: (1) they lodge in sediments where there is little or no oxygen below 4 in., (2) they remain on the ocean floor and begin to react with seawater, or (3) they remain on the ocean floor and become encrusted by marine organisms. As a result, rates of deterioration depend on the metal or metal alloy and the conditions in the immediate marine and benthic environment. If buried deep in ocean sediments, materials tend to decompose at much lower rates than when exposed to seawater (Ankley, 1996). With the exception of torpedo guidance wires and sonobuoy components, sediment burial appears to be the fate of most munitions used in marine warfare (Environmental Science Advisory Committee, 2005).

When metals are exposed to seawater, they begin to slowly corrode, a process that creates a layer of corroded material between the seawater and uncorroded metal. This layer of corrosion removes the metal from direct exposure to the corrosiveness of seawater, a process that further slows movement of the metals into the adjacent sediments and water column. This is particularly true of aluminum. Elevated levels of metals in sediments would be restricted to a small zone around the metal, and any release to the overlying water column would be diluted. In a similar fashion, as materials become covered by marine life, both the direct exposure of the material to seawater and the rate of corrosion decrease. Dispersal of these materials in the water column is controlled by physical mixing and diffusion, both of which tend to vary with time and location. The analysis of metals in marine systems begins with a review of studies involving metals used in military training and testing activities that may be introduced into the marine environment.

In one study, the water was sampled for lead, manganese, nickel, vanadium, and zinc at a shallow bombing range in Pamlico Sound (estuarine waters of North Carolina) immediately following a training event with non-explosive practice bombs. All water quality parameters tested, except nickel, were within the state limits. The nickel concentration was significantly higher than the state criterion, although the concentration did not differ significantly from the control site located outside the bombing range. The results suggest that bombing activities were not responsible for the elevated nickel concentrations (U.S. Department of the Navy, 2010c). A recent study conducted by the U.S. Marine Corps sampled sediments and water quality for 26 different constituents, including lead and magnesium, related to munitions at several U.S. Marine Corps water-based training ranges. These areas also were used for bombing practice. No munitions constituents were detected above screening values used at the U.S. Marine Corps water ranges (U.S. Department of the Navy, 2010c).

A study by Pait et al. (2010b) of previous Navy training areas at Vieques, Puerto Rico, found generally low concentrations of metals in marine sediments. Areas in which live ammunition and loaded weapons were used ("live-fire areas") were included in the analysis. These results are relevant because the concentrations of expended munitions at Vieques are significantly greater than would be found anywhere in the Study Area. Table C-4 compares the sediment concentrations of several metals from those naval training areas with sediment screening levels established by the National Oceanic and Atmospheric Administration (Buchman, 2008).

As shown in Table C-4, average sediment concentrations of the metals evaluated, except for copper, were below both the threshold and probable effects levels (metrics similar to the effects range levels). The average copper concentration was above the threshold effect level, but below the probable effect level. For other elements: (1) the mean sediment concentration of arsenic at Vieques was 4.37 micrograms per gram (µg/g), and the highest concentration was 15.4 µg/g. Both values were below the sediment quality guidelines examined; and (2) the mean sediment concentration of manganese in sediment was 301 µg/g, and the highest concentration was 967 µg/g (Pait et al., 2010b). The National Oceanic and Atmospheric Administration did not report threshold or probable effects levels for manganese.

**Table C-4: Concentrations of and Screening Levels for Selected Metals in Marine Sediments, Vieques, Puerto Rico**

| Metal | Sediment Concentration (µg/g) | | | Sediment Guidelines – National Oceanic and Atmospheric Administration (µg/g) | |
|---|---|---|---|---|---|
| | Minimum | Maximum | Average | Threshold Effects Level* | Probable Effects Level* |
| Cadmium | 0 | 1.92 | 0.15 | 0.68 | 4.21 |
| Chromium | 0 | 178 | 22.5 | 52.3 | 160 |
| Copper | 0 | 103 | 25.9 | 18.7 | 390 |
| Lead | 0 | 17.6 | 5.42 | 30.24 | 112 |
| Mercury | N/R | 0.112 | 0.019 | 130 | 700 |
| Nickel | N/R | 38.3 | 7.80 | 15.9 | 42.8 |
| Zinc | N/R | 130 | 34.4 | 124 | 271 |

Source: Pait et al. (2010a)

Notes: N/R = not reported, µg/g = micrograms per gram

*Threshold Effects Level and Probable Effects Level are metrics similar to the effects range metrics (i.e., Effects Range Low and Effects Range Median) used to assess potential effects of contaminants on sediments. The Threshold Effects Levels is the average of the 50th percentile and the 15th percentile of a dataset and the Probable Effects Level is the average of the 50th percentile and the 85th percentile of a dataset.

The effects of lead and lithium were studied at the Canadian Forces Maritime Experimental and Test Ranges near Nanoose Bay, British Columbia, Canada (Environmental Science Advisory Committee, 2005). These materials are common to expendable mobile anti-submarine warfare training targets, acoustic device countermeasures, sonobuoys, and torpedoes. The study noted that lead is a naturally occurring metal in the environment and that typical concentrations of lead in seawater in the test range were between 0.01 and 0.06 parts per million (ppm), while concentration of lead in sediments was between 4 and 16 ppm. Cores of marine sediments in the test range show a steady increase in lead concentration from the bottom of the core to a depth of approximately 8 in. (20.3 centimeters [cm]). This depth corresponds to the late 1970s and early 1980s, and the lead contamination was attributed to atmospheric deposition of lead from gasoline additives. The sediment cores showed a general reduction in lead concentration to the present time, coincident with the phasing out of lead in gasoline by the mid-1980s. The study also noted that other training ranges have shown minimal effects of lead ballasts because they are usually buried deep in marine sediments where they are not biologically available. The study concluded that the lead ballasts would not adversely affect marine organisms because of the low probability of mobilization of lead.

A study by the Navy examined the effects of materials from activated seawater batteries in sonobuoys that freely dissolve in the water column (e.g., lead, silver, and copper ions), as well as nickel-plated steel housing, lead solder, copper wire, and lead shot used for sonobuoy ballast (U.S. Department of the Navy, 1993). The study concluded that constituents released by saltwater batteries as well as the decomposition of other sonobuoy components did not exceed state or federal standards, and that the reaction products are short-lived in seawater.

A series of research efforts focused on World War II underwater munitions disposal sites in Hawaii (Briggs et al., 2016; Kelley et al., 2016; Koide et al., 2016; University of Hawaii, 2010) and an intensively used live fire range in the Mariana Islands (Smith & Marx, 2016) provide information in regard to the effects of undetonated materials and unexploded munitions on marine life.

On a localized scale, research at World War II munitions ocean disposal sites in Hawaii investigated nearby sediments, seawater, or marine life to determine if metals could be detected. For metals, although there were localized elevated levels of arsenic and lead in several biota samples and in the sediment adjacent to the munitions, the origin of those metals could not be definitively linked to the munitions since comparison of sediment between the clean reference site and the disposal site showed relatively little difference. This was especially the case for a comparison with samples for ocean disposed dredge spoils sites (locations where material taken from the dredging of harbors on Oahu was disposed). At individual sampling sites adjacent to munitions, the concentrations of metals were not significantly higher as compared to the background at control sites and not significant in comparison to typical deep-sea marine sediments (Briggs et al., 2016). Observations and data collected also did not indicate any adverse effect to the localized ecology due to the presence of munitions degrading for over 75 years when compared to control sites. When specifically looking at marine organisms around the munitions (Kelley et al., 2016; Koide et al., 2016), the analysis indicated that in soft bottom habitats the expended items were providing hard substrate similar to other disposed objects or “artificial reefs” that attracted “hard substrate species” that would not have otherwise colonized the area and that there was no bioaccumulation of munitions-related chemicals for the species sampled (Koide et al., 2016).

On a broader scale, the island of Farallon de Medinilla (in the Mariana Islands) has been used as a target area since 1971. Between 1997 and 2012, there were 14 underwater scientific survey investigations around the island providing a long-term look at potential effects on the marine life from training and testing involving the use of munitions (Smith & Marx, 2016). Munitions use has included explosive rounds from gunfire, high explosive bombs by Navy aircraft and U.S. Air Force B-52s, in addition to the expenditure of inert rounds and non-explosive practice bombs. Marine life assessed during these surveys included algae, corals, benthic invertebrates, sharks, rays, bony fishes, and sea turtles. The investigators found no evidence over the 16-year period, that the condition of the biological resources had been adversely affected to a significant degree by the training activities (Smith & Marx, 2016). Furthermore, they found that the health, abundance, and biomass of fishes, corals, and other marine resources were comparable to or superior to those in similar habitats at other locations within the Mariana Archipelago.

The concentrations of metals from munitions, expended materials, and devices in any one location in the Study Area would be a small fraction of that from a World War II era munitions disposal site, or a target island used for 45 years, or a water range in a river used for almost 100 years. Based on findings from much more intensively used locations, the water quality effects from the use of munitions, expended materials, and other devices resulting from any of the proposed training and testing activities would be negligible by comparison.

### C.2.4 Other Materials

Under the Proposed Action, other materials include marine markers and flares, chaff, towed and stationary targets, and miscellaneous components of other expended objects (e.g., concrete blocks used as anchors) (see Appendix F, Military Expended Materials and Direct Strike Analysis, for details). These materials and components are either made mainly of non-reactive or slowly reactive materials (e.g., glass, carbon fibers, and plastics) or break down or decompose into benign byproducts (e.g., rubber, steel, iron, and concrete). Most of these objects would settle to the seafloor where they would (1) be exposed to seawater, (2) become lodged in or covered by seafloor sediments, (3) become encrusted by oxidation products such as rust, (4) dissolve slowly, or (5) be covered by marine organisms such as coral. Plastics may float or descend to the bottom, depending upon their buoyancy. Marine markers and flares are largely consumed during use.

Towed and stationary targets include floating steel drums; towed aerial targets; the trimaran; and inflatable, floating targets. The trimaran is a three-hulled boat with a 4 ft. square sail that is towed as a moving target. Large, inflatable, plastic targets can be towed or left stationary. Towed aerial targets are either (1) rectangular pieces of nylon fabric 7.5 ft. by 40 ft. that reflect radar or lasers; or (2) aluminum cylinders with a fiberglass nose cone, aluminum corner reflectors (fins), and a short plastic tail section. This second target is about 10 ft. long and weighs about 75 lb. These four targets are recovered after use and will not be considered further.

Marine markers are pyrotechnic devices that are dropped on the water's surface during training exercises to mark a position, to support search and rescue activities, or as a bomb target. The MK 58 marker is a tin tube that weighs about 12 lb. Markers release smoke at the water surface for 40 to 60 minutes. After the pyrotechnics are consumed, the marine marker fills with seawater and sinks. Iron and aluminum constitute 35 percent of the marker by weight. To produce the lengthy smoke effect, approximately 40 percent of the marker by weight is made up of pyrotechnic materials. The propellant, explosive, and pyrotechnic constituents of MK 58 include red phosphorus (2.19 lb.) and manganese (IV) dioxide (1.40 lb.). Other constituents include magnesium powder (0.29 lb.), zinc oxide (0.12 lb.), nitrocellulose (0.000017 lb.), nitroglycerin (0.000014 lb.), and potassium nitrate (0.2 lb.). The failure rate of marine markers is approximately 5 percent (U.S. Department of the Navy, 2010c).

Flares are used to signal, to illuminate surface areas at night in search and attack operations, and to assist with search and rescue activities. They range in weight from 5 to 14 kg. The major constituents of flares include magnesium granules and sodium nitrate. Containers are constructed of aluminum, and the entire assembly is usually consumed during flight. Flares may also contain a primer such as TNT, propellant (ammonium perchlorate), and other explosives. These materials are present in small quantities (e.g., $1.0 \times 10^{-4}$ ounces [oz.] of ammonium perchlorate and $1.0 \times 10^{-7}$ oz. of explosives). Small amounts of metals are used to give flares and other pyrotechnic materials bright and distinctive colors. Combustion products from flares include magnesium oxide, sodium carbonate, carbon dioxide, and water. Illuminating flares and marine markers are usually entirely consumed during use; neither is intended to be recovered.

Table C-5 summarizes the components of markers and flares (U.S. Department of the Air Force, 1997).

**Table C-5: Summary of Components of Marine Markers and Flares**

| Flare or Marker | Constituents | Composition (%) |
|---|---|---|
| LUU-2 Paraflare | Magnesium granules, sodium nitrate, aluminum, iron, trinitrotoluene (TNT), royal demolition explosive, ammonium perchlorate, potassium nitrate, lead, chromium, magnesium, manganese, nickel | Magnesium (54), sodium nitrate (26), aluminum (14), iron (5) |
| MK45 Paraflare | Aluminum, sodium nitrate, magnesium powder, nitrocellulose, TNT, copper, lead, zinc, chromium, manganese, potassium nitrate, pentaerythritol-tetranitrate, nickel, potassium perchlorate | Magnesium (45), sodium nitrate (30), aluminum (22) |
| MK58 Marine Marker | Aluminum, chromium, copper, lead, lead dioxide, manganese dioxide, manganese, nitroglycerin, red phosphorus, potassium nitrate, silver, zinc, zinc oxide | Iron (60), aluminum (35) |

Sources: (U.S. Department of the Air Force, 1997; U.S. Department of the Navy, 2006a, 2010c)

Most of the pyrotechnic components of marine markers are consumed and byproducts are released into the air. Thereafter, the aluminum and steel canister sink to the bottom. Combustion of red phosphorus produces phosphorus oxides, which have a low toxicity to aquatic organisms. The amount of flare residue is negligible. Phosphorus contained in the marker settles to the seafloor, where it reacts with the water to produce phosphoric acid until all phosphorus is consumed by the reaction. Phosphoric acid is a variable, but normal, component of seawater (U.S. Department of the Navy, 2006a). The aluminum and iron canisters are expected to be covered by sand and sediment over time, to become encrusted by chemical corrosion, or to be covered by marine plants and animals. Elemental aluminum in seawater tends to be converted by hydrolysis to aluminum hydroxide, which is relatively insoluble, adheres to particulates, and is transported to the bottom sediments (Monterey Bay Research Institute, 2010).

Red phosphorus, the primary pyrotechnic ingredient, constitutes 18 percent of the marine marker by weight. Toxicological studies of red phosphorus revealed an aquatic toxicity in the range of 10–100 milligrams per liter (10–100 ppm) for fish, *Daphnia* (a small aquatic crustacean), and algae (European Flame Retardants Association, 2002). Red phosphorus slowly degrades by chemical reactions to phosphine and phosphorus acids. Phosphine is very reactive and usually undergoes rapid oxidation. The final products, phosphates, are harmless (U.S. Department of the Navy, 2010a, 2010c). A study by the U.S. Department of the Air Force (1997) found that, in salt water, the degradation products of flares that do not function properly include magnesium and barium.

Chaff is an electronic countermeasure designed to confuse enemy radar by deflecting radar waves and thereby obscuring aircraft, ships, and other equipment from radar tracking sources. Chaff consists of small, thin glass fibers coated in aluminum that are light enough to remain in the air anywhere from 10 minutes to 10 hours (Farrell & Siciliano, 2004). Chaff is typically packaged in cylinders and contain a few million fibers. Chaff may be deployed from an aircraft or may be launched from a surface vessel.

The major components of the chaff glass fibers and the aluminum coating are provided in Table C-6.

Factors influencing chaff dispersion include the altitude and location where it is released, prevailing winds, and meteorological conditions (Spargo, 2007; U.S. Department of the Navy, 1999). Doppler radar has tracked chaff plumes containing approximately 900 grams of chaff drifting 200 miles from the point of release, with the plume covering a volume of greater than 400 cubic miles (Arfsten et al., 2002). Based on the dispersion characteristics of chaff, large areas of open water would be exposed to chaff, but the chaff concentrations would be low.

**Table C-6: Major Components of Chaff**

| Component | Percent by Weight |
|---|---|
| **Glass Fiber** | |
| Silicon dioxide | 52–56 |
| Alumina | 12–16 |
| Calcium oxide, magnesium oxide | 16–25 |
| Boron oxide | 8–13 |
| Sodium oxide, potassium oxide | 1–4 |
| Iron oxide | ≤ 1 |
| **Aluminum Coating** | |
| Aluminum | 99.45 (min.) |
| Silicon and Iron | 0.55 (max.) |
| Copper | 0.05 |
| Manganese | 0.05 |
| Zinc | 0.05 |
| Vanadium | 0.05 |
| Titanium | 0.05 |
| Others | 0.05 |
| Sources: Arfsten et al., 2002; Farrell & Siciliano, 2004; U.S. Department of the Air Force, 1997; U.S. Department of the Navy, 1999) | |

Chaff is generally resistant to chemical weathering and likely remains in the environment for long periods. However, all the components of chaff's aluminum coating are present in seawater in trace amounts, except magnesium, which is present at 0.1 percent (Nozaki, 1997). Aluminum is the most common metal in the Earth's crust and also occurs naturally in trace amounts in the

aquatic environment. Aluminum oxide and silicon dioxide are the two most common minerals in the earth's crust, and ocean waters are constantly exposed to both minerals, so the addition of small amounts of chaff would not affect water quality or sediment composition (U.S. Department of the Navy, 1999).

The dissolved concentration of aluminum in seawater ranges from 1 to 10 micrograms per liter (1 to 10 parts per billion). For comparison, the concentration in rivers is 50 micrograms per liter (50 parts per billion). In the ocean, aluminum concentrations tend to be higher on the surface, lower at middle depths, and higher again at the bottom (Li et al., 2008). Aluminum is a very reactive element and is seldom found as a free metal in nature except under highly acidic (low pH) or alkaline (high pH) conditions. It is found combined with other elements, most commonly with oxygen, silicon, and fluorine. These chemical compounds are commonly found in soil, minerals, rocks, and clays (Agency for Toxic Substances and Disease Registry, 2008; U.S. Department of the Air Force, 1994). Elemental aluminum in seawater tends to be converted by hydrolysis to aluminum hydroxide, which is relatively insoluble, and is scavenged by particulates and transported to bottom sediments (Monterey Bay Research Institute, 2010).

Because of their light weight, chaff fibers tend to float on the water surface for a short period. The fibers are quickly dispersed by waves and currents. They may be accidentally or intentionally ingested by marine life, but the fibers are non-toxic. Chemicals leached from the chaff would be diluted by the surrounding seawater, reducing the potential for chemical concentrations to reach levels that can affect sediment quality or benthic habitats.

Schiff (1977) placed chaff samples in Chesapeake Bay water for 13 days. No increases in concentration of greater than 1 ppm of aluminum, cadmium, copper, iron, or zinc were detected. Accumulation and concentration of chaff constituents is not likely under natural conditions. A U.S. Air Force study of chaff analyzed nine elements under various pH conditions: silicon, aluminum, magnesium, boron, copper, manganese, zinc, vanadium, and titanium. Only four elements were detected above the 0.02 milligrams per liter detection limit (0.02 ppm): magnesium, aluminum, zinc, and boron (U.S. Department of the Air Force, 1994). Tests of marine organisms detected no effects of chaff exposure at levels above those expected in the Study Area (Farrell & Siciliano, 2004).

## C.3 Vegetation

### C.3.1 Acoustic Stressors

Acoustic stressors are not applicable to vegetation and are therefore not analyzed further in this section.

### C.3.2 Explosive Stressors

Single-celled algae may overlap with underwater and sea surface explosion locations. If single-celled algae are in the immediate vicinity of an explosion, only a small number of individuals are likely to be affected relative to their total population level. Additionally, the extremely fast growth rate and ubiquitous distribution of phytoplankton (Caceres et al., 2013; Levinton, 2013) suggest no meaningful effect on the resource. The low number of explosions relative to the amount of single-celled algae in the Study Area also decreases the potential for effects on these

vegetation types. Based on these factors, the effect on these types of vegetation would not be detectable and they are not discussed further in this section.

Macroalgae and marine vascular plants that are attached to the seafloor may occur in locations where explosions are conducted and may be adversely affected for different reasons. Much of the attached macroalgae grows on live hard bottom that would be mostly protected in accordance with Navy mitigation measures. Activity-based mitigation occurs for explosive activities to observe for floating vegetation prior to commencing firing or an explosive detonation until the floating vegetation is clear from the mitigation zone. For mitigation, the term "floating vegetation" refers specifically to floating concentrations of detached kelp paddies and Sargassum. Many of these activities will not occur in seafloor resource mitigation areas, which would benefit vegetation that occurs there.

Attached macroalgae grow quickly and are resilient through high levels of wave action (Mach et al., 2007), which may aid in their ability to withstand underwater explosions that occur near them. Attached macroalgae typically need hard or artificial substrate in order to grow. The potential distribution of attached macroalgae can be inferred by the presence of hard or artificial substrate that occurs at depths of less than 200 m throughout the Study Area. See Section 3.1 (Sediments and Water Quality) for information regarding the distribution of hard substrate in the Study Area. If attached macroalgae are in the immediate vicinity of an explosion, only a small number of them are likely to be affected relative to their total population level. Only explosions occurring on or at shallow depth beneath the surface have the potential to affect floating macroalgae. Sea surface or underwater explosions could uproot or damage marine vascular plants if activities overlap with areas where they are rooted.

The potential for marine vascular plants (seagrass and eelgrass) to be affected by underwater and surface explosions is unlikely as seagrass and eelgrass may have very limited overlap with explosives training areas. Eelgrass are much less resilient to disturbance than marine algae; regrowth after uprooting can take up to 10 years (Dawes et al., 1997). Explosions may also temporarily increase the turbidity (sediment suspended in the water) of nearby waters, but the sediment would settle to pre-explosion conditions within a number of days. Sustained high levels of turbidity may reduce the amount of light that reaches vegetation. This scenario is not likely because seagrass and eelgrass do not overlap with explosives training areas.

### C.3.3 Energy Stressors

Energy stressors are not applicable to vegetation and are therefore not analyzed further in this section.

### C.3.4 Physical Disturbance and Strike Stressors

#### C.3.4.1 Effects from Vessels and In-Water Devices

Several different types of vessels (ships, submarines, boats, amphibious vehicles) and in-water devices (e.g., towed devices, unmanned underwater vehicles) are used during military readiness activities throughout the Study Area, as described in Chapter 2 (Description of Proposed Action and Alternatives). Vessel and in water device movements occur intermittently, are variable in duration (ranging from a few hours to a few weeks) and are dispersed

throughout the Study Area. Events involving large vessels are widely spread over offshore areas, while smaller vessels are more active in nearshore areas.

The potential effects from Navy vessels and in-water devices used during military readiness activities on vegetation are based on the vertical distribution of the vegetation. Vessels and in-water devices may affect vegetation by striking or disturbing vegetation on the sea surface or seafloor (Spalding et al., 2003). In the open ocean, marine algae on the sea surface have a patchy distribution. Marine algae could be temporarily disturbed if struck by moving vessels or by the propeller action of transiting vessels. These strikes could also injure the organisms that inhabit marine algal mats, such as sea turtles, seabirds, marine invertebrates, and fish. Marine algae are resilient to winds, waves, and severe weather that could sink the mat or break it into pieces. Effects on marine algae by strikes may collapse the pneumatocysts (air sacs) that keep the mats afloat. Evidence suggests that some floating marine algae will continue to float even when up to 80 percent of the pneumatocysts are removed (Zaitsev, 1971).

Vegetation on the seafloor, such as marine vascular plants and macroalgae, may be disturbed by amphibious combat vehicles, and manned and unmanned underwater vehicles. Seagrasses are resilient to the lower levels of wave action that occur in sheltered estuarine shorelines, but are susceptible to vessel propeller scarring (Sargent et al., 1995). Seagrasses could take up to 10 years to fully regrow and recover from propeller scars (Dawes et al., 1997). Seafloor macroalgae may be present in locations where these vessels occur, but the effects would be minimal because of their resilience, distribution, and biomass. Because seafloor macroalgae in coastal areas are adapted to natural disturbances, such as storms and wave action that can exceed 32.8 ft. (10 meters [m]) per second (Mach et al., 2007), macroalgae will quickly recover from vessel movements. Macroalgae that is floating in the area may be disturbed by amphibious combat vehicle activities, but the effect would not be detectable because of the small amount of macroalgae in areas where these activities occur and will not be considered further in this section.

Towed in-water devices include towed targets that are used during activities such as missile exercises and gun exercises. These devices are operated at low speeds either on the sea surface or below it. The analysis of in-water devices will focus on towed surface targets because of the potential for effects on marine algae.

Unmanned underwater vehicles and autonomous underwater vehicles are used in training and testing activities in the Study Area. They are typically propeller driven and operate within the water column or crawl along the seafloor. The propellers of these devices are typically encased, eliminating the potential for seagrass propeller scarring. Although algae on the seafloor could be disturbed by these devices, unmanned underwater vehicles are not expected to compromise the health or condition of algae for the same reasons given for vessel disturbance.

Estimates of relative vessel and in-water device use and location for each alternative are provided in Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]). These estimates are based on the number of activities predicted for each alternative. While these estimates provide a prediction of use, actual Navy vessel use depends upon military training requirements, deployment schedules, annual budgets, and

other unpredictable factors. Testing and training concentrations are most dependent upon locations of Navy shore installations and established testing and training areas.

Because of the quantity of vessel traffic in nearshore waters off Guam since the 1940s, it is thought that the existing vegetation community has shifted to dominance of species which are adapted to disturbance (Coles et al., 1997). In Apra Harbor, there are anticipated to be movements of Navy small boats, divers, and swimmers over marine vegetation, but seagrass beds, if present, would be avoided to the maximum extent practicable.

In open ocean areas, vessel strikes of vegetation would be limited to floating marine algae. Vessel and in-water device movements may disperse or injure floating algal mats. Because algal distribution is patchy, mats may re-form, and events would be on a small spatial scale, Navy military readiness activities involving vessel movement would not affect the general health of marine algae. Navy mitigation measures would ensure that vessels avoid large algal mats, such Sargassum, or other sensitive vegetation that other marine life depend on for food or habitat; these measures would safeguard this vegetation type from vessel strikes. This Standard Operating Procedure for vessels is "Watch personnel monitor their assigned sectors for any indication of danger to the ship and the personnel on board, such as a floating or partially submerged object or piece of debris, periscope, surfaced submarine, wisp of smoke, flash of light, or surface disturbance." In addition, as a standard collision avoidance procedure, prior to deploying a towed in-water device from a manned platform, the Navy searches the intended path of the device for any floating debris, objects, or animals (e.g., driftwood, concentrations of floating vegetation, marine mammals) that have the potential to obstruct or damage the device. This standard operating procedure benefits marine mammals, sea turtles, and vegetation through a reduction in the potential for physical disturbance and strike by a towed in-water device.

### C.3.4.2 Effects from Military Expended Materials

Military expended materials can potentially affect marine vascular plants on the seafloor by disturbing, crushing, or shading, which may interfere with photosynthesis. If a marine vascular plant is not able to photosynthesize, its ability to produce energy is compromised. However, the intersection of marine vascular plants and military expended materials is limited. Marine vascular plants generally grow in waters that are sheltered from wave action such as estuaries, lagoons, and bays (Phillips & Meñez, 1988). Locations for most Navy military readiness activities where materials are expended do not provide this type of habitat. The potential for detectable effects on marine vascular plants from expended materials would be based on their size or low density (e.g., small projectiles, small decelerators/parachutes, endcaps, and pistons) of most of the materials that could be used in or drift into these areas from offshore. Larger, denser materials, such as non-explosive practice munitions and sonobuoys would be used farther offshore and are likely to sink rapidly where they land. Falling materials could cause bottom sediments to be suspended. Resuspension of the sediment could affect water quality and decrease light exposure, but since it would be short-term (hours), stressors from military expended materials would not likely affect the general health of marine vascular plants.

**Small-, Medium-, and Large-Caliber Projectiles**. Small-, medium-, and large-caliber non-explosive practice munitions, or fragments of high-explosive projectiles, expended during

training and testing activities rapidly sink to the seafloor. Most of these projectiles would be expended in the open ocean areas of the Study Area. Because of the small sizes of the projectiles and their casings, damage to marine vegetation is unlikely. Large-caliber projectiles are primarily used in offshore areas at depths greater than 85 ft., while small- and medium-caliber projectiles may be expended in both offshore and coastal areas (at depths mostly less than 85 ft.). Marine algae could occur where these materials are expended, but seagrasses generally do not because these activities do not normally occur in water that is shallow enough for seagrass to grow.

**Bombs, Missiles, and Rockets**. Bombs, missiles, and rockets, or their fragments (if high explosive) are expended offshore (at depths mostly greater than 85 ft.) during training and testing activities, and rapidly sink to the seafloor. Marine algae could occur where these materials are expended. However, marine vascular plants generally would not occur where these materials are expended because these activities do not normally occur in water that is shallow enough for marine vascular plants to grow.

**Decelerators/Parachutes**. Decelerators/parachutes of varying sizes are used during training and testing activities. Marine algae and other marine vascular plants could occur where these materials are expended.

**Targets**. Many training and testing activities use targets. Targets that are hit by munitions could break into fragments. Target fragments vary in size and type, but most fragments are expected to sink. Pieces of targets that are designed to float are recovered when practical. Target fragments would be spread out over large areas. Marine algae could occur where these materials are expended.

**Countermeasures**. Defensive countermeasures (e.g., chaff, flares, and acoustic devices) are used to protect against incoming weapons (e.g., missiles). Chaff is made of aluminum-coated glass fibers, and flares are pyrotechnic devices. Chaff, chaff canisters, and flare end caps are expended materials. Chaff and flares are dispensed from aircraft or fired from ships. Floating marine algal mats could occur in any of the locations where these materials are expended.

### C.3.4.3 Effects from Seafloor Devices

Seafloor devices use sandy substrates, devoid of marine vegetation, to the greatest extent practicable. Marine plant species found within the relatively shallow waters of the Study Area are adapted to natural disturbance and recover quickly from storms, as well as from wave and surge action. Installation of seafloor devices may affect vegetation in benthic habitats, but the effects would be temporary and would be followed by rapid (i.e., within a few weeks) recovery.

Installation and maintenance of mine warfare training areas and installation of other training areas involve seafloor disturbance where those activities would take place. Installation of mine warfare equipment would occur on soft, typically sandy, sediments and would not occur near shallow water coral reefs. Refer to the description of the Range Modernization and Sustainment activity in Section 2.3.4 of Chapter 2 (Description of Proposed Action and Alternatives) and Section A.3 of Appendix A (Military Readiness Activities Descriptions).

### C.3.5 Entanglement Stressors

Entanglement stressors are not applicable to vegetation and are therefore not analyzed further in this section.

### C.3.6 Ingestion Stressors

Ingestion stressors are not applicable to vegetation and are therefore not analyzed further in this section.

### C.3.7 Secondary Stressors

This section analyzes potential effects on marine vegetation exposed to stressors indirectly through effects on habitat and prey availability.

#### C.3.7.1 Effects on Habitat

Section 3.1 (Sediments and Water Quality) and Section 3.3 (Marine Habitats) consider the effects on marine sediments and water quality and abiotic habitats from explosives and explosion byproducts, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). One example from the sediment and water quality analysis of a local effect on water quality could be an increase in cyanobacteria associated with munitions deposits in marine sediments. Cyanobacteria may proliferate when iron is introduced to the marine environment, and this proliferation can affect adjacent habitats by releasing toxins and can create hypoxic conditions. Introducing iron into the marine environment from munitions or infrastructure is not known to cause toxic red tide events; rather, these harmful events are more associated with natural causes (e.g., upwelling) and the effects of other human activities (e.g., agricultural runoff and other coastal pollution) (Hayes et al., 2007). High-order explosions consume most of the explosive material, leaving only small or residual amounts of explosives and combustion products. Many combustion products are common seawater constituents. All combustion products are rapidly diluted by ocean currents and circulation. Explosives byproducts from high-order detonations present no indirect stressors to marine vegetation through sediment or water.

The analysis included in Section 3.1 (Sediments and Water Quality) determined that neither state nor federal standards or guidelines for sediments or water quality would be violated by the No Action Alternative, Alternative 1, or Alternative 2. Because standards for sediment and water quality would not be violated, population-level effects on marine vegetation are not likely to be detectable and are therefore inconsequential. Therefore, because these standards and guidelines are structured to protect human health and the environment, and the proposed activities do not violate them, no indirect effects are anticipated on vegetation from the training and testing activities proposed by the No Action Alternative, Alternative 1, or Alternative 2.

Other materials that are re-mobilized after their initial contact with the seafloor (e.g., by waves or currents) may continue to strike or abrade marine vegetation. Secondary physical strike and disturbances are relatively unlikely because most expended materials are denser than the surrounding sediments (e.g., metal) and are likely to remain in place as the surrounding

sediment moves. Potential secondary physical strike and disturbance effects may cease when (1) the military expended material is too massive to be mobilized by typical oceanographic processes, (2) the military expended material becomes encrusted by natural processes and incorporated into the seafloor, or (3) the military expended material becomes permanently buried. Although individual organisms could be affected by secondary physical strikes, the viability of populations or species would not be affected.

### C.3.7.2 Effects on Prey Availability

Prey availability as a stressor is not applicable to vegetation and will not be analyzed further in this section.

## C.4 Invertebrates

### C.4.1 Acoustic Stressors

#### C.4.1.1 Background

A summary of available information related to each type of effect is presented in the following sections. Some researchers discuss effects in terms of the acoustic near field and far field. The near field is an area near a sound source where considerable interference between sound waves emerging from different parts of the source is present. Amplitude may vary widely at different points within this acoustically complex zone, and sound pressure and particle velocity are generally out of phase. The far field is the distance beyond which sound pressure and particle velocity are in phase, all sound waves appear to originate from a single point, and pressure levels decrease predictably with distance. The boundary between the near and far field is frequency-dependent, with the near field extending farther at lower frequencies. It has been estimated that the near field for a sound of 500 Hertz (Hz) (intensity not specified) would extend about 3 m from the source (Myrberg, 2001).

##### C.4.1.1.1 Injury

Injury refers to the direct effects on the tissues or organs of an animal due to exposure to pressure waves or particle motion. Available information on injury to invertebrates resulting from acoustic sources pertains mostly to damage to the statocyst, an organ sensitive to water particle motion and responsible for balance and orientation in some invertebrates. A few studies have also investigated effects to appendages and other organs, and one study investigated zooplankton mortality in response to air gun firing.

Researchers have investigated the effects of noise on American lobsters exposed to air gun firings in an aquarium and in the field (Payne et al., 2007). Lobsters in the aquarium were placed about 3.5 m from the air guns and exposed to sound levels of about 200 dB (peak-to-peak). Caged lobsters in the field were located 2 m from the air guns and exposed to higher-intensity sound levels (about 230 dB peak-to-peak). No physical damage to appendages and no effects on balance or orientation (indicating no damage to statocysts) were observed in any lobsters. No visible evidence of damage to hepatopancreata (digestive glands) or ovaries were found. Caged snow crabs (*Chionoecetes opilio*) were exposed to repeated air gun firings in the field (Christian et al., 2003). Crabs exposed to a single air gun were placed at depths of 2–15 m, while crabs exposed to air gun arrays were placed at depths of

4 m. Air guns were fired during multiple sessions, with each session consisting of a firing every 10 seconds for 33 minutes. Peak received levels were up to 207 dB re 1 µPa and 187 decibels referenced to 1 squared micropascal (dB re 1 $\mu Pa^2$) (single gun), and 237 dB re 1 µPa and 175 dB re 1 $\mu Pa^2$ (array). Post-experimental examination showed no physical damage to statocysts, hepatopancreata, heart muscle or surrounding tissue, carapace, or appendages. As a comparison, air guns operated at full capacity during Navy activities would produce an SPL of approximately 206 dB re 1 µPa root mean squared (rms) and a sound exposure level (SEL) of 185–196 decibels referenced to 1 micropascal squared per second (dB re 1 $\mu Pa^2$-s) at a distance 1 m from the air gun. Air guns are also operated at less than full capacity, resulting in reduced sound levels.

In three instances, seismic air gun use has been hypothesized as the cause of giant squid strandings. This was based on the proximity in time and space of the squid and operating seismic vessels and, in two of the events, to physical injuries considered consistent with exposure to impulsive acoustic waves (Guerra & Gonzales, 2006; Guerra et al., 2004; Leite et al., 2016). However, because the animals were not observed at the time of potential effect, the cause(s) of the injuries and strandings cannot be determined conclusively.

Zooplankton abundance and mortality was investigated in the context of exposure to air gun firings in an open ocean environment (McCauley et al., 2017). Net tows and sonar surveys were conducted after transects involving air gun firings were completed. The results indicated decreased zooplankton abundance and increased mortality as a result of exposure. The most abundant organisms (copepods and cladocerans [water fleas]) showed a 50 percent decrease in abundance at distances of about 500 to 700 m from the source. Received noise level at this distance was about 156 dB re 1 $\mu Pa^2$-s SEL and 183 dB re 1 µPa peak-to-peak. There was no effect on the abundance of these specific taxa at distances of about 1 kilometer (km) from the source (153 dB re 1 $\mu Pa^2$-s SEL and 178 dB re 1 µPa peak-to-peak). However, an overall decrease in zooplankton abundance was reported at distances to about 1.2 km from the source. The authors speculated that the effects could have been caused by damage to external sensory hairs on the organisms.

Physiological studies of wild captured cephalopods found progressive damage to statocysts in squid and octopus species after exposure to two hours of low-frequency (50–400 Hz) sweeps (100 percent duty cycle) at SPL of 157 to 175 dB re 1 µPa (André et al., 2011; Solé et al., 2013). It is noted that the animals were in the near field (distance was not specified in the report, but animals were likely within a few to several feet of the sound source based on the experiment description), where there is significant particle motion. In a similar experiment designed to control for possible confounding effects of experimental tank walls, common cuttlefish (*Sepia officinalis*) were exposed to two hours of low-frequency sweeps (100 to 400 Hz; 100 percent duty cycle with a 1-second sweep period) in an offshore environment (Solé et al., 2017). Sounds were produced by a transducer located near the surface, and caged experimental animals were placed at depths between 7 and 17 m. Received sound levels ranged from 139 to 142 dB re 1 $\mu Pa^2$. Maximum particle motion of 0.7 meter per squared second was recorded at the cage nearest the transducer (7.1 m between source and cage). Progressive damage to sensory hair cells of the statocysts were found immediately after and 48 hours after sound exposure, with

the severity of effects being proportional to distance from the transducer. The authors suggest that whole-body vibrations resulting from particle motion were transmitted to the statocysts, causing damage to the structures. Statocyst damage was also found in captive individuals of two jellyfish species (Mediterranean jellyfish [*Cotylorhiza tuberculata*] and barrel jellyfish [*Rhizostoma pulmo*]) under the same exposure parameters (50–400 Hz sweeps; two-hour exposure time; 100 percent duty cycle with a one-second sweep period; approximately 157 to 175 dB re 1 µPa received SPL) (Sole et al., 2016). In the context of overall invertebrate population numbers, most individuals exposed to acoustic stressors would be in the far field where particle motion would not occur and, therefore, the types of damage described above would not be expected. In addition, exposure duration would be substantially less than two hours.

This limited information suggests that the potential for statocyst damage may differ according to the type of sound (impulsive or continuous) or among invertebrate taxa (e.g., crustaceans and cephalopods). Therefore, a definitive conclusion regarding potential effects on invertebrates in general is unsupported. Although invertebrate occurrence varies based on location, depth, season, and time of day (for example, the rising of the deep scattering layer, which consists of numerous invertebrate taxa), individuals could be present in the vicinity of impulsive or non-impulsive sounds produced by Navy activities. Estimation of invertebrate abundance at any particular location would generally not be feasible, but there is a general pattern of higher abundances in relatively productive estuarine and nearshore waters compared to abundances in offshore portions of the Study Area. The number of individuals affected would be influenced by sound sensing capabilities. As discussed in Section C.4.1 (Acoustic Stressors), invertebrate acoustic sensing is probably limited to the particle motion component of sound. Water particle motion is most detectable near a sound source and at lower frequencies, which likely limits the range at which invertebrates can detect sound.

#### C.4.1.1.2 Physiological Stress

A stress response consists of one or more physiological changes (e.g., production of certain hormones) that help an organism cope with a stressor. However, if the magnitude or duration of the stress response is too great or too prolonged, there can be negative consequences to the organism. Physiological stress is typically evaluated by measuring the levels of relevant biochemicals in the subject organisms.

The results of two investigations of physiological stress in adult invertebrates caused by impulsive noise varied by species. Some biochemical stress markers and changes in osmoregulation were observed in American lobsters exposed to air gun firings at distances of approximately 2–4 m from the source (Payne et al., 2007). Increased deposits of carbohydrates, suggesting a possible stress response, were noted in digestive gland cells four months after exposure. Conversely, repeated air gun exposures caused no changes in biochemical stress markers in snow crabs located from 2 to 170 m from the source (Christian et al., 2003).

Several investigations of physiological reactions of captive adult invertebrates exposed to boat noise playback and other continuous noise have been conducted. Continuous exposure to boat noise playback resulted in changes to some biochemical levels indicating stress in common prawns (*Palaemon serratus*) (30-minute exposure to sound levels of 100 to 140 dB re 1 µPa

rms) and European spiny lobsters (30-minute exposure to sound levels up to 125 dB re 1 µPa rms) (Celi et al., 2015; Filiciotto et al., 2016; Filiciotto et al., 2014). Increased oxygen consumption, potentially indicating stress, was found in shore crabs exposed to ship-noise playback of 148 to 155 dB re 1 µPa for 15 minutes (Wale et al., 2013b). Red swamp crayfish (*Procambarus clarkii*) exposed to 30-minute continuous acoustic sweeps (frequency range of 0.1 to 25 kilohertz (kHz), peak amplitude of 148 dB rms at 12 kHz) showed changes in some biochemical levels indicating stress (Celi et al., 2013). Captive sand shrimp (*Crangon crangon*) exposed to low-frequency noise (30 to 40 dB above ambient) continuously for three months demonstrated decreases in growth rate and reproductive rate (Lagardère, 1982). Mediterranean mussels (*Mytilus galloprovincialis*) exposed to 30-minute continuous acoustic sweeps (frequency range of 0.1 to 60 kHz, maximum SPL of 150 dB rms re 1 µPa), although exhibiting no behavioral changes at any tested frequency, showed statistically significant increases in some biochemical stress indicators (e.g., glucose and heat shock protein) in the low-frequency exposure category (0.1 to 5 kHz) (Vazzana et al., 2016). Changes in glucose levels were found in blue crabs (*Callinectes sapidus*) exposed to low-frequency sound (broadband noise with a significant component of 60 Hz at approximately 170 dB re 1 µPa SPL) and mid-frequency pulsed tones and chirps (1.7 to 4 kHz at approximately 180 dB re 1 µPa SPL) (Dossot et al., 2017).

In addition to experiments on adult invertebrates, some studies have investigated the effects of impulsive and non-impulsive noise (air guns, boat noise, turbine noise) on invertebrate eggs and larvae. Data on similar effects resulting from sonar are currently unavailable. Developmental delays and body malformations were reported in New Zealand scallop (*Pecten novaezelandiae*) larvae exposed to seismic air gun playbacks at frequencies of 20 Hz to 22 kHz with SPL of 160–164 dB re 1 µPa (Aguilar de Soto et al., 2013). Although uncertain, the authors suggested physiological stress as the cause of the effects. Larvae in the relatively small (2 m diameter) experimental tank were considered close enough to the acoustic source to experience particle motion, which would be unlikely at the same pressure levels in the far field. Playbacks occurred once every three seconds and the larvae were periodically examined over the course of 90 hours. Snow crab (*Chionoecetes opilio*) eggs located in 2 m water depth and exposed to repeated firings of a seismic air gun (peak received SPL was 201 dB re 1 µPa) had slightly increased mortality and apparent delayed development (Christian et al., 2003). However, Dungeness crab (*Metacarcinus magister*) zoeae were not affected by repeated exposures to an air gun array (maximum distance of about 62 ft. slant distance) (Pearson et al., 1994), and exposure of southern rock lobster (*Jasus edwardsii*) eggs to air gun SELs of up to 182 dB re 1 $\mu Pa^2$-s did not result in embryonic developmental effects (Day et al., 2016). An investigation of the effects of boat noise playback on the sea hare (*Stylocheilus striatus*) found reduced embryo development and increased larvae mortality, but no effect on the rate of embryo development (Nedelec et al., 2014). Specimens were exposed to boat-noise playback for 45 seconds every five minutes over a 12-hour period. Continuous playback of simulated underwater tidal and wind turbine sounds resulted in delayed metamorphosis in estuarine crab larvae (*Austrohelice crassa* and *Hemigrapsus crenulatus*) that were observed for up to about 200 hours (Pine et al., 2016).

Overall, the results of these studies indicate the potential for physiological effects in some, but not all, adult invertebrates exposed to air guns near the source (about 2–4 m) and to boat and other continuous noise for durations of 15–30 minutes or longer. Larvae and egg development effects were reported for impulsive (distance from source of about 2 m) and non-impulsive noise exposures of extended duration (intermittently or continuously for several to many hours) and for air gun playback and field exposure, although air gun noise had no effect in one study. In general, exposure to continuous noise such as vessel operation during Navy military readiness events would occur over a shorter duration and sound sources would be more distant than those associated with most of the studies. Adverse effects resulting from short exposure times have not been shown experimentally. A range to effects was not systematically investigated for air gun use. Experiments using playback of air gun and boat noise were conducted in relatively small tanks where particle motion, which decreases rapidly with distance, could have been significant. Marine invertebrate egg and larval abundances are high relative to the number of adults, and eggs and larvae are typically subject to high natural mortality rates. These factors decrease the likelihood of population-level effects resulting from effects on eggs and larvae from physiological stress associated with Navy training and testing events.

#### C.4.1.1.3 Masking

Masking occurs when one sound interferes with the detection or recognition of another sound. Masking can limit the distance over which an organism can communicate or detect biologically relevant sounds. Masking can also potentially lead to behavioral changes.

Little is known about how marine invertebrates use sound in their environment. Some studies show that crab, lobster, oyster, and coral larvae and post-larvae may use nearby reef sounds when in their settlement phase. Orientation and movement toward reef sounds was found in larvae located at 60–80 m from a sound source in open water, and in experimental tanks (distance from the sound source was about 150 cm in one laboratory study) (Radford et al., 2007; Stanley et al., 2010; Vermeij et al., 2010). The component of reef sound used is generally unknown, but an investigation found that low-frequency sounds (200–1,000 Hz) produced by fish at dawn and dusk on a coral reef were the most likely sounds to be detectable a short distance from the reef (Kaplan & Mooney, 2016). Similarly, lobed star coral larvae were found to have increased settlement on reef areas with elevated sound levels, particularly in the frequency range of 25–1,000 Hz (Lillis et al., 2016). Mountainous star coral (*Orbicella faveolata*) larvae in their settlement phase were found to orient toward playbacks of reef sounds in an experimental setup, where received sound levels were about 145–149 dB re 1 µPa and particle velocity was about $9 \times 10^{-8}$ meters per second (Vermeij et al., 2010). Marine invertebrates may also use sound to communicate and avoid predators (Popper et al., 2001). Crabs (*Panopeus* species) exposed to playback of predatory fish vocalizations reduced foraging activity, presumably to avoid predation risk (Hughes et al., 2014). The authors suggest that, due to lack of sensitivity to sound pressure, crabs are most likely to detect fish sounds when the fish are nearby. Anthropogenic sounds could mask important acoustic cues such as detection of settlement cues or predators, and potentially affect larval settlement patterns or survivability in highly modified acoustic environments (Simpson et al., 2011). Low-frequency sounds could

interfere with perception of low-frequency rasps or rumbles among crustaceans, particularly when conspecific sounds are produced at the far end of the hearing radius. Navy activities occurring relatively far from shore would produce transient sounds potentially resulting in only intermittent, short-term masking, and would be unlikely to affect the same individuals within a short time. Training and testing activities would generally not occur at known reef sites within the probable reef detection range of larvae. Effects could be more likely in locations where anthropogenic noise occurs frequently within the perceptive range of invertebrates (e.g., pierside locations in estuaries). There are likely many other non-Navy noise sources present in such areas, and potential effects on invertebrates would be associated with all anthropogenic sources.

#### C.4.1.1.4 Behavioral Reactions

Behavioral reactions refer to alterations of natural behaviors due to exposure to sound. Most investigations involving invertebrate behavioral reactions have been conducted in relation to air gun use and vessel noise. Studies of air gun effects on marine invertebrates (crustaceans and cephalopods) have typically been conducted with equipment used for seismic exploration, and the limited results suggest responses may vary among taxa. Snow crabs placed 48 m below a seismic air gun array did not react behaviorally to repeated firings (peak received SPL was 201 dB re 1 µPa) (Christian et al., 2003). Studies of commercial catch of rock lobsters (*Panulirus cygnus*) and multiple shrimp species in the vicinity of seismic prospecting showed no long-term adverse effects to catch yields, implying no detectable long-term effects on abundance from intermittent anthropogenic sound exposure over long periods (Andriguetto-Filho et al., 2005; Parry & Gason, 2006). Conversely, squid have exhibited various behavioral reactions when exposed to impulsive noise such as air gun firing (McCauley et al., 2000). Some squid showed strong startle responses, including inking, when exposed to the first shot of broadband sound from a nearby seismic air gun (received SEL of 174 dB re 1 µPa rms) Strong startle response was not seen when sounds were gradually increased, but the squid exhibited alarm responses at levels above 156 dB re 1 µPa rms (McCauley et al., 2000). Southern reef squids (*Sepioteuthis australis*) exposed to air gun noise displayed alarm responses at levels above 147 dB re 1 $\mu Pa^2$-s (Fewtrell & McCauley, 2012).

Common prawns and European spiny lobsters exposed to 30 minutes of boat noise playback in frequencies of 200 Hz to 3 kHz (sound levels of approximately 100 to 140 dB SPL [prawns] and 75 to 125 dB SPL [lobsters]) showed behavioral responses including changes in movement velocity, and distance moved, as well as time spent inside a shelter (Filiciotto et al., 2016; Filiciotto et al., 2014). Common cuttlefish exposed to playback of underwater ferry engine noise for 3.5 minutes (maximum sound level of about 140 dB re 1 µPa SPL) changed color more frequently, swam more, and raised their tentacles more often than control specimens or individuals exposed to playback of wave sounds (Kunc et al., 2014). Shore crabs (*Carcinus maenas*) exposed to ship noise playback did not exhibit changes in the ability or time required to find food, but feeding was often suspended during the playback (Wale et al., 2013a). Japanese carpet shell clams and Norway lobsters exposed to playback of ship noise for seven days at received levels of 135–140 dB re 1 µPa exhibited reactions such as reduced activity, movement, and valve closing (Solan et al., 2016). Brittlestars (*A. filiformis*) included in

the study showed no overall statistically detectable behavioral changes, although individual animals were affected. Antarctic krill (*Euphausia superba*) did not respond to a research vessel approaching at 2.7 knots (source level below 150 dB re 1 µPa) (Brierley et al., 2003). Decreased activity levels were found in blue crabs exposed to low-frequency broadband sound with a significant component of 60 Hz (approximately 170 dB re 1 µPa SPL) and mid-frequency pulsed tones and chirps (1.7 –4 kHz at approximately 180 dB re 1 µPa SPL) (Dossot et al., 2017). Exposure to low-frequency sounds resulted in more pronounced effects than exposure to mid-frequency sounds. American lobsters appeared to be less affected than crabs (Dossot et al., 2017).

A limited number of studies have investigated behavioral reactions to non-impulsive noise other than that produced by vessels. Red swamp crayfish (*Procambarus clarkii*) exposed to 30-minute continuous acoustic sweeps (frequency range of 0.1–25 kHz, peak amplitude of 148 dB rms at 12 kHz) exhibited changes in social behaviors (Celi et al., 2013). Caribbean hermit crabs (*Coenobita clypeatus*) delayed reaction to an approaching visual threat when exposed to continuous noise (Chan et al., 2010a; Chan et al., 2010b). The delay potentially put them at increased risk of predation, although the studies did not address possible simultaneous distraction of predators. Razor clams (*Sinonovacula constricta*) exposed to white noise and sine waves of 500 and 1,000 Hz responded by digging at a sound level of about 100 dB re 1 µPa (presumably as a defense reaction) but did not respond to sound levels of 80 dB re 1 µPa (Peng et al., 2016). Mediterranean mussels exposed to 30-minute continuous acoustic sweeps (frequency range of 0.1 to 60 kHz, maximum SPL of 150 dB rms re 1 µPa) showed no statistically significant behavioral changes compared to control organisms (Vazzana et al., 2016).

The results of these studies indicate that at least some invertebrate taxa would respond behaviorally to various levels of sound and substrate vibration produced within their detection capability. Comprehensive investigations of the range to effects of different sound and vibration sources and levels are not available. However, sound source levels for Navy pile diving and air gun use are within the range of received levels that have caused behavioral effects in some species (Solan et al., 2016). The low-frequency component of vessel noise would likely be detected by some invertebrates, although the number of individuals affected would be limited to those near enough to a source to experience particle motion.

### C.4.1.2 Effects from Sonar and Other Transducers

Many non-impulsive sounds associated with training and testing activities are produced by sonar. Other transducers include items such as acoustic projectors and countermeasure devices. Most marine invertebrates do not have the capability to sense sound pressure; however, some are sensitive to nearby low-frequency sounds, such as could be approximated by some low-frequency sonars. As described in Section C.4.1 (Acoustic Stressors), invertebrate species detect sound through particle motion, which diminishes rapidly with distance from the sound source. Therefore, the distance at which they may detect a sound is probably limited. Most activities using sonar or other transducers would be conducted in deep-water, offshore portions of the Study Area and are not likely to affect most benthic invertebrate species (including ESA-listed abalone species), although invertebrates in the water column could be affected. However, portions of the range complexes overlap nearshore waters of the

continental shelf, and it is possible that sonar and other transducers could be used and affect benthic invertebrates in these areas. Sonar is also used in shallow water during pierside testing and maintenance testing.

Invertebrate species generally have their greatest sensitivity to sound below 1 to 3 kHz (Kunc et al., 2016) and would therefore not be capable of detecting mid- or high-frequency sounds, including the majority of sonars, or distant sounds in the Study Area. Studies of the effects of continuous noise such as boat noise, acoustic sweeps, and tidal/wind turbine sound (information specific to sonar use was not available) on invertebrates have found statocyst damage, elevated levels of biochemicals indicative of stress, changes in larval development, masking, and behavioral reactions under experimental conditions (see Section 3.4.2.1, Affected Environment). Noise exposure in the studies generally lasted from a few minutes to 30 minutes. The direct applicability of these results is uncertain because the duration of sound exposure in many of the studies is greater than that expected to occur during Navy activities, and factors such as environmental conditions (captive versus wild conditions) may affect individual responses (Celi et al., 2013). Individuals of species potentially susceptible to statocyst damage (e.g., some cephalopods) could be physically affected by nearby noise. Available research has shown statocyst damage to occur after relatively long-duration exposures (two hours), which would be unlikely to occur to individual invertebrates due to transiting sources and potential invertebrate movement. An exception is pierside sonar testing and maintenance testing, where invertebrates (particularly sessile or slow-moving taxa such as bivalve molluscs, hydroids, and marine worms) could be exposed to sound for longer time periods compared to at-sea activities. Some studies also indicate the potential for effects on invertebrate larval development resulting from exposure to non-impulsive noise (continuous or intermittent exposures over time periods of 12 to 200 hours) although, similar to stress effects, sonar has not been studied specifically. Masking could affect behaviors such as larvae settlement, communication, predator avoidance, and foraging in mollusc, crustacean, and coral species.

### C.4.1.3 Effects from Air Guns

Air guns produce shock waves that are somewhat similar to those produced by explosives (see Section 3.4.3.3, Explosives Stressors) but of lower intensity and slower rise times. An impulsive sound is generated when pressurized air is released into the surrounding water. Some studies of air gun effects on marine invertebrates have involved the use of an array of multiple seismic air guns, although arrays are not used during Navy training and testing activities. The volume capacity of air guns used for Navy testing (60 cubic inches at full capacity) is generally within the volume range of single air guns used in seismic exploration (typically 20–800 cubic inches). However, seismic air guns are used in arrays with a total volume of several thousands of cubic inches, which is far more than would be associated with any Navy activities. Generated impulses would have short durations, typically a few hundred milliseconds. The root-mean-squared SPL and SEL at a distance of 1 m from the air gun would be approximately 200 to 210 dB re 1 µPa and 185 to 195 dB re 1 $\mu Pa^2$-s, respectively.

The results of studies of the effects of seismic air guns on marine invertebrates, described in detail in Section 3.4.3.2 (Acoustic Stressors), suggest possible differences between taxonomic groups and life stages. Physical injury has been reported in relatively few crustaceans (crabs,

shrimp, and lobsters) exposed to seismic air guns at received levels comparable to the source level of Navy air guns operated at full capacity, but one study reported injury and mortality for zooplankton at exposures below Navy source levels. Evidence of physiological stress was not found in crabs exposed to sound levels up to 187 dB re 1 $\mu Pa^2$. However, stress response was reported for lobsters located about 3.5 m from the source, where particle motion was likely detectable. While behavioral reaction to air guns has not been documented for crustaceans, squid have exhibited startle and alarm responses at various sound levels. Squid have shown startle response at received levels of 156–174 dB re 1 µPa rms (distance from sound source is unclear but presumed to be 30 m based on experimental description), although the reactions were less intense when ramp-up procedures (beginning with lower-intensity sound and progressing to higher levels) were used. In one study, onset of alarm response occurred at 147 dB re 1 $\mu Pa^2$-s; distance from the source was not provided. Developmental effects to crab eggs and scallop larvae were found at received levels of 210 and 164 dB 1 µPa SPL (about 7 ft. from the source). Conversely, crab zoeae located 62 ft. from an air gun source showed no developmental effects. Air gun use could also result in substrate vibration, which could cause behavioral effects in nearby benthic invertebrates.

### C.4.1.4 Effects from Vessel Noise

Physiological effects included biochemical changes indicative of stress in crustacean species, decreased growth and reproduction in shrimp, and changes in sea hare embryo development. It is also possible that vessel noise may contribute to masking of relevant environmental sounds, such as predator detection or reef sounds. Low-frequency reef sounds are used as a settlement cue by the larvae of some invertebrate species. Behavioral effects resulting from boat noise playback have been observed in various crustacean, cephalopod, and bivalve species and include shell closing and changes in feeding, coloration, swimming, and other movements. Exposure to other types of non-impulsive noise (and therefore potentially relevant to vessel noise effects), including continuous sweeps and underwater turbine noise playback, has resulted in statocyst damage (squid and octopus), physiological stress, effects to larval development, and behavioral reactions. Noise exposure in several of the studies using boat and other continuous noise sources occurred over a duration of 3.5–30 minutes to captive individuals unable to escape the stimulus. In other studies, noise playback ranged from hours to days (and up to three months in one investigation) of continuous or intermittent exposure. Given the duration of exposure, direct applicability of the results to Navy training and testing activities is uncertain for mobile species. However, it is possible that invertebrates in the Study Area that are exposed to vessel noise could exhibit similar reactions.

While commercial vessel traffic and associated noise is relatively steady over time, Navy traffic is episodic in the ocean. Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours to a few weeks. Vessels engaged in training and testing may consist of a single vessel involved in unit-level activity for a few hours or multiple vessels involved in a major training exercise that could last a few days within a given area. In the West Coast Exclusive Economic Zone, Navy ships are estimated to contribute roughly 10 percent of the total large vessel broadband energy noise (Mintz, 2012).

### C.4.1.5 Effects from Weapons Noise

Underwater sound produced by weapons firing, launch, and impact of non-explosive practice munitions would be greatest near the surface and would attenuate with depth. However, the potential for in-air weapons noise to affect invertebrates would be small. Much of the energy produced by muzzle blasts and flying projectiles is reflected off the water surface. As discussed in Section 3.0.4.1.2 (Explosive Stressors), sound generally enters the water only in a cone beneath the blast or projectile trajectory (within 13 to 14 degrees of vertical for muzzle blast noise, and 65 degrees behind the projectile in the direction of fire for projectile shock waves). An SEL of 180 to 185 dB re 1 $\mu Pa^2$-s was measured at water depth of 5 ft. directly below the muzzle blast of the largest gun analyzed, at the firing position closest to the water. Different weapons and angles of fire would produce less sound in the water. Bow waves from supersonic projectiles produce a brief "crack" noise at the surface, but transmission of sound into the water is minimal. Launch noise fades rapidly as the missile or target moves downrange and the booster burns out. Hull vibration from large-caliber gunfire produces only a small level of underwater noise. For example, analysis of 5-in. gun firing found that energy transmitted into the water by hull vibration is only 6 percent of that produced by the muzzle blast. Compared to weapons firing, launches, and hull vibration, impulsive sound resulting from non-explosive practice munition strikes on the water surface could affect a somewhat larger area, though far less than an explosive blast. Underwater sound would generally be associated only with relatively large munitions impacting at high speed.

Based on the discussion above, invertebrates would likely only be affected by noise produced by muzzle blasts and impact of large non-explosive practice munitions. Effects would likely be limited to pelagic invertebrates, such as squid, jellyfish, and zooplankton, located near the surface. Injury and physiological stress has not been found in limited studies of invertebrates exposed to impulsive sound levels comparable to those produced beneath the muzzle blast of a 5-in. gun. Behavioral reactions have not been found in crustaceans, but have been observed for squid. While squid could display short-term startle response, behavioral reactions in response to sound is not known for jellyfish or zooplankton. Zooplankton may include gametes, eggs, and larval forms of various invertebrate species, including corals. Although prolonged exposure to repeated playback of nearby impulsive sound (air guns) has resulted in developmental effects to larvae and eggs of some invertebrate species, brief exposure to a single or limited number of muzzle blasts or munition impacts would be unlikely to affect development. Other factors would limit the number and types of invertebrates potentially affected. Most squid are active near the surface at night, when weapons firing and launch occur infrequently. Weapons firing and launch typically occurs greater than 12 NM from shore, which because of the water depths would substantially limit the sound level reaching the bottom. Therefore, effects on benthic invertebrates (e.g., bivalve molluscs, worms, and crabs) are unlikely.

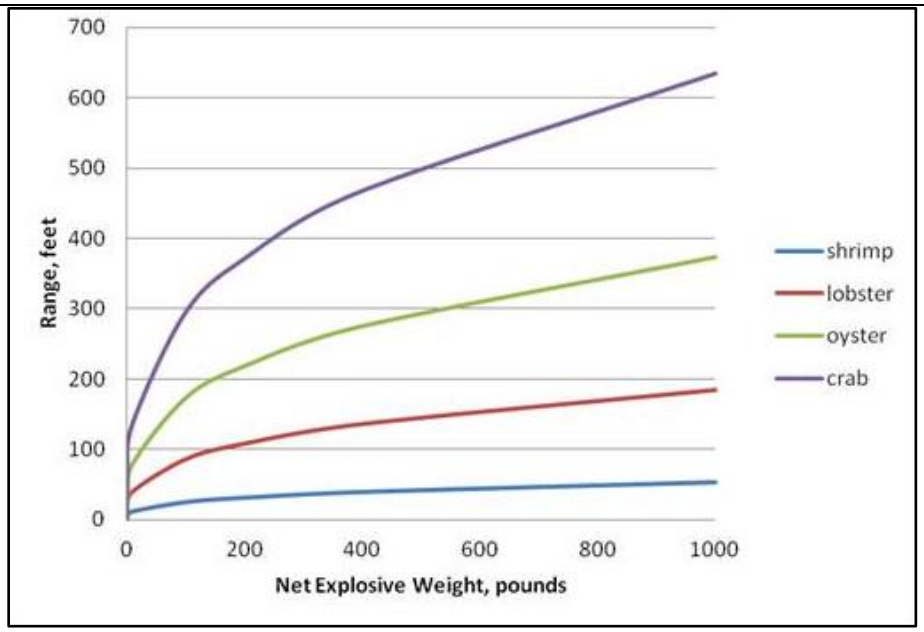
## C.4.2 Explosive Stressors

### C.4.2.1 Background

Explosions may affect invertebrates at the water surface, in the water column, or on the bottom. The potential for effects is influenced by typical detonation scenarios and invertebrate distribution. The majority of explosions would occur in the air or at the surface, with relatively

few at the bottom (Appendix A, Military Readiness Activities Descriptions), which would decrease the potential for effects on benthic invertebrate species. Surface explosions typically occur during the day at offshore locations more than 12 NM from shore. There is a general pattern of lower invertebrate abundance in offshore portions of the Study Area compared to relatively productive estuarine and nearshore waters. Therefore, the typical offshore location of detonations would result in fewer invertebrates potentially exposed to detonation effects. In addition, invertebrate abundances in offshore surface waters tend to be lower during the day, when surface explosions typically occur, than at night.

In general, an explosion may result in direct trauma and mortality due to the associated rapid pressure changes. For example, gas-containing organs such as the swim bladder in many fish species and the lungs of marine mammals are subject to rapid contraction and overextension (potentially causing rupture) when exposed to explosive shock waves. Most marine invertebrates lack air cavities and are therefore comparatively less vulnerable to damaging effects of pressure waves. A report summarizing the results of all known historical experiments (from 1907 to the 1980s) involving invertebrates and detonations concluded that marine invertebrates are generally insensitive to pressure-related damage from underwater explosions (Keevin & Hempen, 1997). Limited studies of crustaceans have examined mortality rates at various distances from detonations in shallow water (Aplin, 1947; Chesapeake Biological Laboratory, 1948; Gaspin et al., 1976). Similar studies of molluscs have shown them to be more resistant than crustaceans to explosive effects (Chesapeake Biological Laboratory, 1948; Gaspin et al., 1976). Other invertebrates, such as sea anemones, polychaete worms, isopods, and amphipods, were observed to be undamaged in areas near detonations (Gaspin et al., 1976). Data from these experiments were used to develop curves that estimate the distance from an explosion beyond which at least 90 percent of certain adult benthic marine invertebrates would survive, depending on the weight of the explosive (Young, 1991) (Figure C-3). For example, 90 percent of crabs would survive a 200-lb. explosion if they are greater than about 350 ft. from the source, and shrimp, lobster, and oysters are less sensitive (i.e., greater survivability) to underwater explosions than crabs. Similar information on the effects of explosions to planktonic invertebrates and invertebrate larvae is not available.




Source: Young (1991)

**Figure C-3: Prediction of Distance to 90 Percent Survivability of Marine Invertebrates Exposed to an Underwater Explosion**

Charges detonated in shallow water or near the bottom, including explosive munitions disposal charges and some explosions associated with mine warfare, could kill and injure marine invertebrates on or near the bottom, depending on the species and the distance from the explosion. Taxonomic groups typically associated with the bottom, such as sponges, marine worms, crustaceans, echinoderms, corals, and molluscs, could be affected. Net explosive weight (NEW) for activities involving detonations on or near the bottom is relatively low. Most detonations occurring on or near the bottom would have a NEW of 60 lb. or less, although some explosives would be up to 1,000 lb. NEW. Based on the estimates shown in Figure C-3, most benthic marine invertebrates beyond approximately 275 ft. from a 60 lb. blast would survive. The potential mortality zone for some taxa (e.g., shrimp, lobsters, worms, amphipods) would be substantially smaller. A blast near the bottom could disturb sessile invertebrates such as mussels and hard substrate suitable for their colonization. A blast in the vicinity of hard corals could cause direct effects on coral polyps or early life-stages of pre-settlement corals, or fragmentation and siltation of the corals. For example, in one study, moderate to substantial recovery from a single small blast directly on a reef was observed within five years, but reef areas damaged by multiple blasts showed no evidence of recovery during the six-year observation period (Fox & Caldwell, 2006). In another study, modeling results indicated that deep-water corals off Alaska damaged by trawling activities could require over 30 years to recover 80 percent of the original biomass (Rooper et al., 2011). The extent of trawling damage is potentially greater than that associated with detonations due to the small footprints of detonations compared to the larger surface area typically affected by trawling, as well as the avoidance of known shallow-water coral reefs and live hard bottom habitat during activities involving detonations. While the effects of trawling activities and underwater detonations are

not directly comparable, the trawling model results illustrate the extended recovery time that may be required for deep-water coral regrowth following physical disturbance.

Effects on benthic invertebrates in deeper water would be infrequent because most offshore detonations occur in the air or at the surface. Benthic invertebrates in the abyssal zone (generally considered to be deeper than about 6,000 ft.) seaward of the coastal large marine ecosystems are sparsely distributed and tend to be concentrated around hydrothermal vents and cold seeps. These topographic features are typically associated with steep or high-relief areas of the continental shelf break (e.g., canyons, outcrops) or open ocean (e.g., seamounts).

Underwater surveys of a Navy bombing range in the Pacific Ocean (Farallon De Medinilla) were conducted annually from 1999 to 2012 (Smith & Marx, 2016). Although Farallon De Medinilla is a land range, bombs and other munitions occasionally strike the water. A limited number of observations of explosion-related effects were reported, and the results are summarized here to provide general information on the types of effects that may occur. However, the effects are not presumed to be broadly applicable to Navy training and testing activities. During the 2010 survey, it was determined that a blast of unknown size (and therefore of unknown applicability to proposed training and testing activities) along the waterline of a cliff ledge caused mortality to small oysters near the impact point. Corals occurring within 3 m of the affected substrate were apparently healthy. A blast crater on the bottom that was 5 m in diameter and 50 cm deep, presumably resulting from a surface detonation, was observed during one survey in water depth of 12 m. Although it may be presumed that corals or other invertebrates located within the crater footprint would have been damaged or displaced, evidence of such effects was not detected. The blast occurred in an area of sparse coral coverage and it is therefore unknown whether coral was present in the crater area prior to the blast.

The applicability of the mortality distance estimates to invertebrates located in the water column is unknown. However, detonations that occur near the surface release a portion of the explosive energy into the air rather than the water, reducing effects on invertebrates in the water column. In addition to effects caused by a shock wave, organisms in an area of cavitation that forms near the surface above a large underwater detonation could be killed or injured. Cavitation is where the reflected shock wave creates a region of negative pressure followed by a collapse, or water hammer (see the *Acoustic and Explosives Concepts Technical Report*). The number of organisms affected by explosions at the surface or in the water column would depend on the size of the explosive, the distance of organisms from the explosion, and the specific geographic location within the Study Area. As discussed previously, many invertebrates that occur near the surface at night (e.g., squid and zooplankton) typically move down in the water column during the day, making them less vulnerable to explosions when most Navy activities involving detonations occur.

Marine invertebrates beyond the range of mortality or injurious effects may detect the impulsive sound produced by an explosion. At some distance, impulses lose their high pressure peak and take on characteristics of non-impulsive acoustic waves. Invertebrates that detect impulsive or non-impulsive sounds may experience stress or exhibit behavioral reactions in response to the sound. Repetitive impulses during multiple explosions, such as during a surface firing exercise, may be more likely to cause avoidance reactions. However, the distance to

which invertebrates are likely to detect sounds is limited due to their sensitivity to water particle motion caused by nearby low-frequency sources. Sounds produced in water during training and testing activities, including activities that involve multiple impulses, occur over a limited duration. Any auditory masking, in which the sound of an impulse could prevent detection of other biologically relevant sounds, would be very brief.

## C.4.3 Energy Stressors

### C.4.3.1 Effects from In-Water Electromagnetic Devices

Several different types of electromagnetic devices are used during training and testing activities. Information on the types of activities that use in-water electromagnetic devices is provided in Appendix B (Activity Stressor Matrices).

Little information is available regarding marine invertebrates' susceptibility to electromagnetic fields. Magnetic fields are not known to control spawning or larval settlement in any invertebrate species. Existing information suggests sensitivity to electric and magnetic fields in at least three marine invertebrate phyla: Mollusca, Arthropoda, and Echinodermata (Bureau of Ocean Energy Management, 2011; Lohmann & Lohmann, 2006; Lohmann et al., 1995). A possible magnetic sense has been suggested in jellyfish as well, although this has not been demonstrated experimentally (Fossette et al., 2015). Much of the available information on magnetic field sensitivity of marine invertebrates pertains to crustaceans. For example, a magnetic compass sense has been demonstrated in the spiny lobster (*Panulirus argus*) (Lohmann & Lohmann, 2006; Lohmann et al., 1995), and researchers suggest subtle behavioral response to magnetic fields of about 1 millitesla (1,000 microtesla) in the Dungeness crab and American lobster (Woodruff et al., 2013). A review of potential effects of undersea power cables on marine species provides a summary of numerous studies of the sensitivity of various invertebrate species to electric and magnetic fields (Bureau of Ocean Energy Management, 2011). Electric field sensitivity is reported in the summary for only two freshwater crayfish species, while magnetic field sensitivity is reported for multiple marine invertebrate species, including molluscs, crustaceans, and echinoderms. Sensitivity thresholds range from 300 to 30,000 microtesla, depending on the species. Most responses consisted of behavioral changes, although non-lethal physiological effects were noted in two sea urchin species in a 30,000 microtesla field (embryo development) and a marine mussel exposed to 300 to 700 microtesla field strength (cellular processes). Marine invertebrate community structure was not affected by placement of energized underwater power cables with field strengths of 73 to 100 microtesla (Love et al., 2016). Effects to eggs of the sea urchin *Paracentrotus lividus* and to brine shrimp (*Artemia* spp.) cysts have been reported at relatively high magnetic field strengths (750 to 25,000 microtesla) (Ravera et al., 2006; Shckorbatov et al., 2010). The magnetic field generated by the Organic Airborne and Surface Influence Sweep (a typical electromagnetic device used in Navy training and testing) is about 2,300 microtesla at the source. Field strength drops quickly with distance from the source, decreasing to 50 microtesla at 4 m, 5 microtesla at 24 m, and 0.2 microtesla at 200 m from the source. Therefore, temporary disruption of navigation and directional orientation is the primary effect considered in association with magnetic fields.

Studies of the effects of low-voltage direct electrical currents in proximity to marine invertebrates suggest a beneficial effect on at least some species at appropriate current strength. American oysters (*Crassostrea virginica*) and various stony and soft corals occurring on substrates exposed to low-voltage currents (between approximately 10 and 1,000 microamperes) showed increased growth rates and survival (Arifin et al., 2012; Goreau, 2014; Jompa et al., 2012; Shorr et al., 2012). It is theorized that the benefits may result from a combination of more efficient uptake of calcium and other structure-building minerals from the surrounding seawater, increased cellular energy production, and increased pH near the electrical currents. The beneficial effects were noted in a specific range of current strength; higher or lower currents resulted in either no observable effects or adverse effects. The moderate voltage and current associated with the Organic Airborne and Surface Influence Sweep are not expected to result in adverse effects to invertebrates. In addition, due to the short-term, transient nature of electromagnetic device use, there would be no beneficial effects associated with small induced electrical currents in structures colonized by invertebrates.

### C.4.4 Physical Disturbance and Strike Stressors

Most marine invertebrate populations extend across wide areas containing hundreds or thousands of discrete patches of suitable habitat. Sessile invertebrate populations may be connected by complex currents that carry adults and young from place to place. Effects on such widespread populations are difficult to quantitatively evaluate in terms of Navy military readiness activities that occur intermittently and in relatively small patches in the Study Area. Invertebrate habitats generally cover enormous areas (Section 3.1, Sediments and Water Quality) and, in this context, a physical strike or disturbance would affect individual organisms directly or indirectly, but not to the extent that viability of populations of common species would be affected. While the potential for overlap between Navy activities and invertebrates is reduced for those species living in rare habitats, if overlap does occur, any potential effects would be amplified for those invertebrate species or taxa with limited spatial extent. Examples of such organisms include stony corals, and sponges, which are mostly restricted to hard bottom habitat or artificial habitat. Shallow-water coral reefs, live hard bottom, and other areas of hard substrate such as artificial reefs are protected to the extent, they are included in current mitigation measures.

With few exceptions, activities involving vessels and in-water devices are not intended to contact the bottom due to potential damage to equipment and the resulting safety risks for vessel personnel. The potential for strike impact and disturbance of benthic or habitat-forming marine invertebrates would result from amphibious activities, bottom-crawling unmanned underwater vehicles, military expended materials and seafloor devices. For environmental and safety reasons, amphibious landings and other nearshore activities would avoid areas where corals are known to occur.

With the exception of habitat-forming benthic taxa (e.g., corals, sea pens, and sponges), most small invertebrate populations recover quickly from non-extractive disturbance. Many large invertebrates, such as crabs, shrimps, and clams, undergo massive disturbance during commercial and recreational harvests, storms, or beach restoration activities.

Biogenic habitats such as shallow coral reefs, deep-water coral, and sponge communities may take decades to regrow following a strike or disturbance (Jennings & Kaiser, 1998; Precht et al., 2001). However, bottom-disturbing activities are not conducted on mapped coral reefs or live hard bottom. In soft bottom areas, recovery of benthic invertebrate populations after substantial human disturbance depends on factors such as size of the area disturbed, bottom topography, hydrodynamics of the affected area, seasonality of the disturbance, and the size and typical growth rate of affected species. Most studies of the effects of beach sand nourishment projects (which is a proxy for effects due to amphibious landings) have reported initial declines in benthic invertebrate populations due to burial and increased turbidity (which may affect filter-feeding capability), but subsequent recovery over time scales of weeks to years (Posey & Alphin, 2002; U.S. Army Corps of Engineers, 2001, 2012; Wilber et al., 2009). Recovery is typically greatest at nourishment sites when there is a close match in grain size between the existing and supplied sediment. However, species composition may be altered in the recolonized area, and overall invertebrate biomass may not recover for many years. Similarly, repeated and intense bottom fishing disturbance can result in a shift from communities dominated by relatively high-biomass individuals towards dominance by high abundance of small-sized organisms (Kaiser et al., 2002). If activities are repeated at the same site, the benthic invertebrate community composition could be altered over time (years), especially for sessile invertebrates (e.g., coral). Some bottom-disturbing activities, such as mine countermeasures and neutralization training and testing and precision anchoring may occur in the same locations or near the same locations yearly.

### C.4.4.1 Effects from Vessels and In-Water Devices

#### Vessels

Most of the military readiness activities under all the alternatives involve vessels. For a discussion of the types of activities that use vessels and where they are used, refer to Appendix B (Activity Stressor Matrices). See Table 3.0-8 for a representative list of Navy vessel types, lengths, and speeds.

Vessels could affect adults and other life stages of marine invertebrates by directly striking organisms, or by disturbing the water column or sediments (Bishop, 2008). Species that occur at or near the surface (e.g., jellyfish, squid) would potentially be exposed to direct vessel strikes. Exposure to propeller-generated turbulence was found to result in mortality in a zooplankton species (the copepod *Acartia tonsa*) located near the surface (Bickel et al., 2011). However, many pelagic invertebrates such as squid and zooplankton move away from the surface during the day, reducing potential exposures during daytime vessel operations. Many vessel hulls have a hydrodynamic shape, and pelagic marine invertebrates are therefore generally disturbed, rather than struck, as the water flows around a vessel. Zooplankton are ubiquitous in the water column and typically experience high mortality rates.

In addition, vessel hull strikes and propeller cavitation and turbulence could displace, damage, injure, or kill invertebrate eggs and larvae in the upper portion of the water column throughout the Study Area. For example, turbulent water was found to decrease successful fertilization and resulted in abnormal development and low survival in eggs of the broadcast spawning purple sea urchin (*Strongylocentrotus purpuratus*) (Mead & Denny, 1995). In some areas of the Study

Area, vessels could transit through water containing coral gametes, eggs, embryonic stages, or planula larvae of broadcast spawning species. Eggs of cluster coral (*Acropora millepora*) were found to disintegrate into irregular groups or individual blastomeres when subjected to even very light shearing forces and turbulence (Heyward & Negri, 2012). Such dissociation can be beneficial through creation of more juveniles but may also cause mortality. Early embryonic development of broadcast spawning coral species has reportedly been affected by handling of captive-reared embryos (Guest et al., 2010). Although the available information indicates that developmental stages of numerous invertebrate species could be physically affected, broadcast-spawning invertebrates produce very large numbers of eggs and planktonic larvae that typically experience high mortality rates under normal conditions (Nybakken, 1993). Any effects resulting from Navy vessel operation would be biologically insignificant by comparison.

Propeller wash (water displaced by propellers used for propulsion) of even the deepest draft vessels operated over the continental shelf is likely indistinguishable from the water motion associated with periodic storm events, and vessel operation in deeper waters beyond the shelf break would not affect the bottom. Therefore, the potential for vessels to disturb invertebrates on or near the bottom would occur mostly during nearshore and inshore training or testing activities, and along dredged navigation channels. Invertebrates on or near the bottom in such relatively shallow areas could be affected by sediment disturbance or direct strike during amphibious landings. Few sources of information are available on the effect of non-lethal chronic vessel disturbance to marine invertebrates. One study of seagrass-associated marine invertebrates, such as amphipods and polychaetes, found that chronic disturbance from vessel wakes resulted in the long-term displacement of some marine invertebrates from the affected shallow-water area (Bishop, 2008). However, invertebrates that typically occur in areas associated with nearshore or inshore activities, such as shorelines, are highly resilient to vessel disturbance. They are regularly disturbed by natural processes such as high-energy waves and longshore currents, and generally recover quickly. Potential exceptions include sessile or encrusting invertebrates that may occur along sheltered shorelines that are subject to a high frequency of boat propeller- or wake-induced erosion (Grizzle et al., 2002; Zabawa & Ostrom, 1980). Increased erosion of shoreline banks or suspension of bottom sediments may cause turbidity that affects filter-feeding invertebrates. The results of a small number of studies suggest that the wave energy resulting from boat wakes produced in relatively narrow water bodies may affect oyster occurrence, and studies of shallow freshwater areas found that waves generated from small boats caused about 10 percent of benthic invertebrates (e.g., amphipods) to become suspended in the water column where they presumably would be more vulnerable to predation (Bilkovic et al., 2017).

Non-amphibious vessels avoid contact with the bottom to prevent damage to the vessels and benthic habitat that supports encrusting organisms. The encrusting organisms (e.g., hard corals) living on hard substrate in the ocean are exposed to strong currents under natural conditions and would not likely be affected by propeller wash. Many activities occur in offshore areas and, therefore, would be unlikely to affect benthic invertebrates, although small-caliber gunnery exercises, blank firing, and smoke grenade use may occur in areas closer to shore. Many Navy vessel movements in nearshore waters are concentrated in established channels and ports or predictable transit corridors from Guam to the Hawaiian Islands or westward to Asia, and

shallow-water vessels typically operate in defined boat lanes with sufficient depths to avoid propeller or hull strikes on the bottom.

Invertebrates that occur on the bottom, including shallow-water corals, organisms associated with hard bottom, and deep-water corals, are not likely to be exposed to vessel strikes. Propeller movement has the potential to disrupt sediments that could affect shallow-water corals and hard bottom communities.

### In-Water Devices

Some of the military readiness activities under both action alternatives involve the use of in-water devices, including remotely operated vehicles, unmanned surface vehicles, unmanned underwater vehicles, motorized autonomous targets, and towed devices. For a discussion of the types of activities that use in-water devices, see Appendix B (Activity Stressor Matrices). See Section 3.0 (Introduction) for the types, sizes, and speeds of representative Navy in-water devices used in the Study Area.

In-water devices can operate from the water's surface to the benthic zone. The devices could potentially affect marine invertebrates by directly striking organisms or by disturbing the water column. As discussed for vessel use, most invertebrates in the water column would be disturbed, rather than struck, as water flows around a device due to the hydrodynamic shape. In addition, in-water devices are smaller than most Navy vessels, decreasing the surface area in which invertebrates could be struck. The potential for direct strike is reduced for some types of devices because they are operated at relatively low speeds (e.g., unmanned underwater vehicles, which are typically operated at speeds of 1 to 15 knots). Unmanned surface vehicles are operated at the greatest speeds (up to 50 knots or more) and therefore have greater potential to strike invertebrates. However, relatively few invertebrates occur at the surface and consist mostly of squid, jellyfish, and zooplankton. Squid and many zooplankton species move away from the surface during the day (Nybakken, 1993), when unmanned surface vehicles are typically operated. In-water devices do not normally collide with invertebrates on the bottom because the devices are operated in relatively deep water and contact with the bottom is avoided. Devices operated very near the bottom could potentially disturb sediments and associated invertebrates through propeller wash. However, such disturbance would be infrequent and would affect a small area, and disturbed areas would be quickly reoccupied by benthic invertebrates.

As discussed for vessels, zooplankton and invertebrate eggs and larva could be displaced, damaged, injured, or killed by propeller wash or turbulence resulting from water flow around in-water devices. Effects due to turbulence would generally increase with increasing speed of the device. Many zooplankton species migrate away from the surface during the day, when Navy training and testing typically are conducted, decreasing the potential for effects in the upper portions of the water column. The number of individuals affected would be small in comparison to overall populations, and the affected species generally exhibit rapid growth and recovery rates.

### C.4.4.2 Effects from Military Expended Materials

Military expended materials are deposited throughout the Study Area. However, most military expended materials are deposited within established range complexes and testing ranges. These areas of higher military expended materials deposition are generally located away from the coastline on the continental shelf and slope and beyond (e.g., abyssal plain). Physical disturbance or strikes by military expended materials on marine invertebrates is possible at the water's surface, through the water column, and on the bottom. However, disturbance or strike effects on marine invertebrates by military expended materials falling through the water column are not very likely because military expended materials do not generally sink rapidly enough to cause strike injury. Exposed invertebrates would likely experience only temporary displacement as the object passes by. Therefore, the discussion of military expended materials disturbance and strikes will focus on items at the water's surface and on the bottom.

Potential effects on invertebrates generally consist of physical trauma, stress or behavioral responses, abrasion, and shading. Military expended materials may injure or kill invertebrates by directly striking individuals, causing breakage (particularly for species with exoskeletons or that build structures), crushing, or other physical trauma. Direct strike may result from the initial impact or may occur after items fall through the water column and settle onto invertebrates or are moved along the bottom by water currents or gravity. Expended items may also bury or smother organisms although, depending on the size of the expended item relative to the animal, some mobile invertebrates may be able to move or dig out from underneath an item. In addition to physical strike, military expended materials may disturb individuals and cause them to change locations, behaviors, or activities. Disturbance could therefore result in effects such as briefly increased energy expenditure, decreased feeding, and increased susceptibility to predation. Expended items could also cause increased turbidity that could affect filter-feeding species, although such effects are likely to be localized and temporary. Expended items that come to rest on or near corals could cause abrasion or shading (in the case of corals that host symbiotic algae) that reduces photosynthesis in the algae, although these effects are unlikely based on the mitigation measures in place for shallow-water coral reefs where symbiotic algae are present. Abrasion refers to scraping or wearing down of a supporting structure or hard body part (e.g., coral skeleton, shell) through repeated impact on the same individual or structure. Abrasion would generally be associated with military expended materials such as flexible materials (e.g., wires or cords) that become fixed in a location for some time but that are moved repeatedly over sessile invertebrates by water currents.

Military expended materials that impact the water surface could directly strike zooplankton, the gametes, embryos, and larvae of various invertebrate species and a small number of adult invertebrates (e.g., squid, jellyfish, swimming crabs). However, many zooplankton and squid are absent from the surface water column during the day when most training and testing activities occur. Inert military expended materials also have the potential to impact the water and produce a large impulse which could disturb nearby invertebrates. Potential effects on invertebrates resulting from impulsive sound and shock waves are discussed in Section 3.8.2.1 (Acoustic Stressors) and Section 3.8.2.2 (Explosive Stressors). In addition to direct strike of invertebrates and production of impulsive sound, surface water impacts could affect physical

properties of the surrounding water (e.g., slight heating or increased dissolved gas concentrations due to turbulent mixing with the atmosphere), potentially affecting the suitability of the affected water mass as habitat for some invertebrate species. However, physical changes to the water column would be localized and temporary, persisting for only a few minutes.

Compared to surface waters and offshore areas, a greater number of macroinvertebrates typically occurs on the bottom and closer to shore. Benthic invertebrate taxa, including sponges, cnidarians, worms, bryozoans, molluscs, arthropods, and echinoderms, may occur in areas affected by military expended materials. However, some of the most sensitive benthic species (e.g., corals) are more likely to occur on hard bottom, reefs, and other hard substrates. Shallow-water coral reefs are protected by mitigation measures from most activities that generate military expended materials. Military expended materials that impact the bottom may affect invertebrates by strike (including injury or mortality), disturbance, burial, abrasion, or shading within the footprint of the item (the area of substrate physically covered by the item). Military expended materials may also cause physiological or behavioral reactions to individual invertebrates outside the footprint of the items. After items come to rest on the bottom, continued impacts are possible if the items are mobilized by currents or waves and damage benthic invertebrates as they move. Turbidity may also occur as water flows around deposited items. However, these impacts would generally cease when the military expended materials are incorporated into the seafloor by natural encrustation or burial processes or become otherwise immobilized.

Sessile marine invertebrates and infauna (organisms attached to the bottom or living in the sediments) are generally more susceptible to military expended material disturbance and strike than benthic species with the ability to move relatively quickly over the bottom. Some susceptible species (e.g., hydroids, sponges, soft corals) have fragile structures and sensitive body parts that could be damaged or covered by military expended materials. Military expended materials could also break hard structures such as coral skeletons and mussel beds. Shallow- and deep-water corals that build complex or fragile structures could be particularly susceptible to breakage or abrasion. Such structures are resistant to physical forces typical of ambient conditions (e.g., water currents), but not as resilient to other types of physical disturbance involving greater force. Decelerators/parachutes would be unlikely to be carried by currents onto reef structures due to the typical offshore locations of use and the sink rate of the items. Expended items may provide new colonization sites for benthic invertebrates. Researchers found that military expended materials in a bombing range became covered by sedentary reef invertebrates over time (Smith & Marx, 2016). However, invertebrate species composition on artificial substrates may differ from that of the surrounding natural community.

Potential effects on shallow-water corals, invertebrates associated with hard bottom habitat, or deep-water corals present the greatest risk of long-term damage compared with other bottom communities because: (1) many corals and hard bottom invertebrates are sessile, fragile, and particularly vulnerable; (2) many of these organisms grow slowly and could require decades to recover; and (3) military expended materials are likely to remain exposed on hard bottom communities whereas shifting sediment patterns would tend to bury military expended

materials in soft bottom communities. The probability of striking deep-water corals or invertebrates located on hard bottom habitat is low, given their low percent cover on suitable habitat (see Section 3.3, Marine Habitats, for a discussion of bottom habitat).

A few investigations have been conducted to determine the presence and, in some cases, possible effects of military expended materials on the bottom. The results of multi-year underwater surveys at a military bombing range in the Mariana Archipelago (Pacific Ocean) provide an example of potential effects resulting from expended munitions. Water areas were not targeted at this range; bottom effects occurred only when the target land mass was missed, or the munition bounced off the land into the water. The surveys found no overall long-term adverse effects on corals or other invertebrates due to expended items, despite several decades of use (Smith & Marx, 2016). Numerous intact bombs and fragments were observed on the bottom. Inert 500 lb. bombs were found to disturb a bottom area of 17 square meter each, although specific damage to invertebrates, if any, was not described. It may be presumed that invertebrates within this footprint could have been killed, injured, damaged, or displaced. Expended items, once settled in place, appeared to become encrusted with marine growth and pose no substantial long-term threat to invertebrates. The condition of corals indicated a healthy environment, with no apparent change in species composition, distribution, size, or stress indicators. However, the results of several other studies indicate that sessile invertebrate communities growing on artificial substrate such as the expended munitions are often different than those growing on natural substrate (Burt et al., 2009; Macreadie et al., 2011; Perkol-Finkel et al., 2006; Steimle & Zetlin, 2000). A remotely operated vehicle survey of deep portions of the Jacksonville Range Complex reported only two exposed items of military expended materials in about 37,800 m of survey line distance (U.S. Department of the Navy, 2010a, 2011). However, it is important to note that the survey was not designed to document military expended materials, and these were only the items photographed using still frames. Another extensive remotely operated vehicle survey along the continental shelf break and canyons in the northeast and mid-Atlantic region found marine debris in 81 percent of individual dives, but the items did not include any visible military expended materials (Quattrini et al., 2015). Underwater surveys of bottom areas off the Gulf coast of Florida with a presumably high potential for military expended materials (based on reported obstructions by fishermen) found no items of military origin, suggesting that expended materials may be widely distributed or may become covered by sediments (U.S. Department of the Navy, 2013b). In a deep-sea trawl survey of the northern Gulf of Mexico, items of military origin were found (artillery shells and a missile), but were among the least-frequently encountered types of debris (Wei et al., 2012).

**Military Expended Materials**

Military expended materials that are munitions and associated with training activities include small-, medium-, and large-caliber projectiles, bombs, missiles, rockets, and grenades. Fragments of exploded munitions are also included because they can result in effects on invertebrates that are similar to those associated with smaller intact munitions. Military expended materials associated with testing activities are the same except that there are no grenades. Navy training and testing activities in the Study Area include firing a variety of weapons and using a variety of non-explosive training and testing rounds, including small-,

medium-, and large-caliber projectiles. Large-caliber projectiles are primarily used in the open ocean beyond 20 NM from shore. Direct strike from bombs, missiles, and rockets would result in types of effects similar to those of projectiles. However, they are larger than most projectiles and are likely to produce a greater number of fragments. Bombs, missiles, and rockets are designed to explode within about 3 ft. of the sea surface, where marine invertebrates larger than zooplankton are relatively infrequent.

Military expended materials other than munitions associated with training and testing activities include a large number of items such as aerial countermeasures, targets (surface and aerial), mine shapes, ship hulk, decelerators/parachutes, acoustic countermeasures, sonobuoys, and other materials such as torpedo accessories, concrete slugs, marine markers, bathythermographs, endcaps, and pistons. Some expended materials used during training and testing activities, including some types of torpedoes and targets, non-explosive mine shapes, and bottom-placed instruments, are recovered.

Chaff, which consists of aluminum-coated glass fibers, may be transported great distances by the wind, beyond the areas where they are deployed, before contacting the sea surface. These materials contact the sea surface and bottom with very little kinetic energy, and their low buoyant weight makes them an inconsequential strike and abrasion risk. Therefore, chaff is not considered to be a potential strike and disturbance stressor.

During a sinking exercise, aircraft, ship, and submarine crews deliver munitions on a surface target, which is a clean, deactivated ship that is deliberately sunk using multiple weapon systems. Sinking exercises occur in specific open ocean areas, outside of the coastal range complexes. Habitat-forming invertebrates are likely absent where sinking exercises are planned because the activity occurs in depths greater than the range for shallow-water and many deep-water coral species (approximately 3,000 m) and away from typical locations for hydrothermal vent or cold seep communities (e.g., seamounts) (Cairns, 2007). It is unlikely that deep-sea hard corals would be affected by a sinking ship hulk or fragments of a hulk due to their lack of occurrence below depths of about 3,000 m (the depth of the aragonite saturation boundary).

Decelerators/parachutes of varying sizes are used during training and testing activities and may be deployed from aircraft or vessels. Similar to other marine debris such as derelict fishing gear, decelerators/parachutes may kill or injure sessile benthic invertebrates due to covering/shading or abrasion. Activities that expend sonobuoy and air-launched torpedo decelerators/parachutes generally occur in relatively deep water away from the shore; however, there is some potential for near shore effects from testing events using sonobuoys to conduct mine detection in nearshore environments. Decelerators/parachutes expended over deep offshore areas may affect deep-water invertebrates (particularly sessile species) by disturbance, strikes, burial, smothering, or abrasion. For example, a decelerator/parachute could cover a sponge or deep-water coral and impair feeding.

Proportional affect analysis determined that the total bottom area affected by all military expended materials in all training areas would be about 145 acres annually, ranging from less than 1 acre to about 120.5 acres in specific range complexes and substrate types. This represents much less than 1 percent of available bottom habitat in any range complex. In addition to expended items, recovered materials would temporarily disturb approximately 10

acres of bottom habitat in all training areas combined. The substrate types and associated invertebrate assemblages within the potentially disturbed areas are difficult to predict, as discussed in Appendix F (Military Expended Materials and Direct Strike Analysis). Activities conducted throughout the Study Area have the potential to affect hard bottom communities as well as invertebrates within all other habitat types. Activities occurring at depths of less than about 3,000 m may affect deep-water corals. Consequences could include damage, injury, or mortality because of projectiles, munitions, or other items. Decelerators/parachutes, wires, and cables could also affect benthic communities if they are mobilized by water currents, although it is expected that most such materials would become buried, encrusted, or otherwise immobilized over time and would not continue to affect individual invertebrates or invertebrate assemblages. Effects would be most pronounced if all the materials expended within the applicable depth range were deposited on areas of hard substrate supporting long-lived, sessile organisms such as deep-water corals, because it may be assumed that many of the benthic invertebrates present in the impact area footprint would be killed, injured, displaced, or disturbed by the expended materials. In addition, some previously undisturbed bottom area would be affected by activities in subsequent years. Conversely, effects would be less if the materials were deposited on soft bottom areas containing invertebrate communities that recover relatively quickly from disturbance. Although hard substrate potentially supporting deep-water corals and other invertebrate communities is present in at least some areas in water depths less than 3,000 m, a scenario of all expended materials being deposited on such substrate is unrealistic. Deep-water stony corals are relatively rare in the Study Area, and most species are solitary. Hard and mixed bottom types, which support the occurrence of deep-water corals other than sea pens account for about 10 percent of the substrate from the shelf to depths of 3,000 m (Clarke et al., 2015). These habitat types are often associated with seamounts, banks, and canyons. Based on the results of limited investigation, a low percentage of available hard substrate may be inhabited by deep-water corals or other invertebrate species (Harter et al., 2009; U.S. Department of the Navy, 2010c). It is expected that most of the bottom type affected would be soft substrate (Appendix F, Military Expended Materials and Direct Strike Analysis). Therefore, although it is possible for a portion of expended items to affect hard substrate and associated sensitive invertebrate communities, the number of exposed individuals would not likely affect the overall viability of populations or species. While the potential for overlap between Navy activities and invertebrates is reduced for those species living in rare habitats, if overlap does occur, any potential effects would be amplified for those invertebrate species or taxa with limited spatial extent. With the exception of some shallow-water corals, detailed distribution and habitat utilization information sufficient to support species-specific analysis is generally unavailable.

### C.4.4.3 Effects from Seafloor Devices

For a discussion of the types of activities that use seafloor devices, where they are used, and how many activities would occur under each alternative, see Appendix B (Activity Stressor Matrices). Seafloor devices include items that are placed on, dropped on, or moved along the substrate for a specific purpose, and include mine shapes, anchor blocks, anchors, bottom-placed instruments, bottom-crawling unmanned underwater vehicles, and bottom placed targets that are recovered (not expended). Placement or deployment of seafloor devices would

cause disturbance, injury, or mortality to marine invertebrates within the footprint of the device. These items could potentially break hard substrate and associated biogenic habitats (e.g., hard coral skeletons). Objects placed on the bottom may attract invertebrates or provide temporary attachment points for invertebrates. Some invertebrates attached to the devices would be removed from the water when the devices are recovered. A shallow depression may remain for some time in the soft bottom sediment where an anchor was dropped, potentially altering the suitability of the affected substrate for benthic invertebrates temporarily (possibly months).

Seafloor devices may also disturb marine invertebrates outside the footprint of the device and would cause temporary (possibly hours to days) local increases in turbidity and sedimentation near the bottom, along with some changes in scouring/deposition patterns in higher current areas with soft bottom. Sedimentation can smother sessile invertebrates, while turbidity may affect respiratory organs or impair the ability of filter-feeding invertebrates to obtain food (e.g., by clogging their feeding structures or diluting the amount of food in the surrounding volume of water). However, the brief episodes of minor turbidity associated with Navy seafloor devices would be localized and the effects do not change the substrate type. Compared to overall populations, relatively few individuals would be affected.

Precision anchoring, and the associated potential effects, is qualitatively different than other seafloor devices because the activity involves repeated disturbance to the same soft bottom areas. Precision anchoring may result in temporary and localized disturbances to water column and bottom habitats. For example, an anchor may shift due to changing currents or vessel movement and the mooring chain may drag across the bottom, causing abrasion and effects on benthic species (Davis et al., 2016). Anchor impacts on the bottom would likely crush a small number of benthic invertebrates. Bottom disturbance would result in localized sedimentation and turbidity, which could smother invertebrates or affect respiration or feeding. Turbidity would quickly dissipate (i.e., minutes to hours) following the exercise, and many soft bottom invertebrates are burrowing organisms that would be unaffected by shallow burial. Although precision anchoring occurs in soft-bottom areas, where invertebrate populations are generally resilient to disturbance, invertebrates in designated anchorage areas may be prevented from fully recovering due to long-term use, and benthic composition may be changed compared to historical conditions.

### C.4.5 Entanglement Stressors

This section analyzes the potential entanglement effects of the various types of expended materials used by the Navy during training and testing activities within the Study Area. Included are potential effects from wires and cables, and decelerators/parachutes. In this section, only potential effects of these items as entanglement stressors are discussed. Abrasion and covering/shading effects on sessile benthic invertebrates are discussed with physical effects in Section 3.8.2.4 (Entanglement Stressors).

Marine invertebrates are likely less susceptible than vertebrates to entanglement, as illustrated by the fact that fishing nets which are designed to take pelagic marine invertebrates operate by enclosing or entrapping rather than entangling (Chuenpagdee et al., 2003). However, entanglement may be possible for some species and some expended items. A survey of marine

debris entanglements found that marine invertebrates accounted for 16 percent of all animal entanglements (Ocean Conservancy, 2010). The same survey cites potential entanglement in military items only in the context of waste-handling aboard ships, and not for military expended materials. A summary of the effects of litter on various marine species identified potential effects on some invertebrate taxa, particularly mobile benthic species such as crabs and seastars, that may become entangled in debris (e.g., nets) after attempting to move through the items (National Oceanic and Atmospheric Administration Marine Debris Program, 2014a). The potential for a marine invertebrate to become entangled in wires, cables, or decelerators/parachutes is considered remote. The materials generally do not have the characteristics required to entangle marine species. Wires and cables are essentially rigid lines. Sonobuoy components may include plastic mesh and a float unit. Although mesh items have increased potential for entangling marine animals in general, and invertebrates can become entangled in nets (Ocean Conservancy, 2010), invertebrates are not particularly susceptible to entanglement in these items. Decelerators/parachutes have large openings between the cords separating the decelerator/parachute fabric from the release mechanism. There is no plausible scenario in which decelerator/parachute cords would tighten around and hold a mobile invertebrate. Decelerators/parachutes sink slowly through the water column, although many have weights attached to their lines to speed their sinking. Invertebrates in the water column with limited mobility (e.g., jellyfish, zooplankton) could be trapped in decelerator/parachute fabric as it sinks.

### C.4.5.1 Effects from Wires and Cables

Fiber-optic cables, torpedo guidance wires, sonobuoy wires, and expendable bathythermograph wires would be expended during training and testing activities. For a discussion of the types of activities that use wires and cables, see Appendix B (Activity Stressor Matrices).

A marine invertebrate could become temporarily entangled and escape unharmed, it could be held tightly enough that it could be injured during its struggle to escape, it could be preyed upon while entangled, or it could starve while entangled. The probability of these outcomes cannot be predicted because interactions between invertebrate species and entanglement hazards are not well known. However, it is unlikely that an invertebrate would become entangled in wires or cables. The items would be essentially linear after deployment, as they sink through the water column. Once the items reach the bottom, they could be moved into different shapes or loop around objects due to water currents, but the items are not expected to form tight coils, and the possibility of an invertebrate being ensnared is remote. The wires and cables would eventually become buried in sediment or encrusted by marine growth, which would eliminate or further reduce the entanglement potential. The small number of items expended across the Study Area results in an extremely low rate of potential encounter for marine invertebrates.

## C.4.6 Ingestion Stressors

This section analyzes the potential ingestion effects of the various types of military expended materials used by the Navy during training and testing activities within the Study Area, which may be broadly categorized as munitions and materials other than munitions. Aspects of

ingestion stressors that are applicable to marine organisms in general are presented above in Section C.1.5. The Navy expends the following types of materials that could become ingestion stressors during training and testing in the Study Area: non-explosive practice munitions (small- and medium-caliber), fragments from high-explosives, fragments from targets, chaff and flares, chaff and flare accessories (including end caps, compression pads or pistons, and o-rings), and small decelerators/parachutes. Very few invertebrates are large enough to ingest intact small- and medium-caliber munitions and casings; potential effect resulting from these items would be limited to a few taxa such as squid and octopus. Other military expended materials such as targets, large-caliber projectiles, intact training and testing bombs, guidance wires, sonobuoy tubes, and marine markers are too large for any marine invertebrate to consume and are eliminated from further discussion.

Expended materials could be ingested by marine invertebrates in all large marine ecosystems and open ocean areas. Ingestion could occur at the surface, in the water column, or at the bottom, depending on the size and buoyancy of the expended object and the feeding behavior of the animal. Floating material is more likely to be eaten by animals that may feed at or near the water surface (e.g., jellyfish, squid), while materials that sink to the bottom present a higher risk to both filter-feeding sessile (e.g., sponges) and bottom-feeding animals (e.g., crabs). Most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates, and relatively large predatory or scavenging individuals are unlikely to consume an item that does not visually or chemically resemble food (Koehl et al., 2001; Polese et al., 2015). Many arthropods such as blue crab (*Callinectes sapidus*) and spiny lobster are known to discriminate between palatable and unpalatable food items inside the mouth, so in a strict sense, only items that are passed into the interior digestive tract should be considered to be ingested (Aggio et al., 2012). If expended material is ingested by marine invertebrates, the primary risk is blockage in the digestive tract. Most military expended materials are relatively inert in the marine environment and are not likely to cause injury or mortality via chemical effects. However, pollutants (e.g., heavy metals and PCBs) may accumulate on the plastic components of some military expended materials. Plastic debris pieces collected at various locations in the North Pacific Ocean had polycyclic aromatic hydrocarbons and pesticides associated with them (Rios et al., 2007). Relatively large plastic pieces could be ingested by some species. However, filter- or deposit-feeding invertebrates have the greatest potential to ingest small plastic items, and any associated pollutants could harm the individual animal or subsequently be incorporated into the food chain.

The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments over months to decades. Intact munitions, fragments of munitions, and other items could degrade into metal and plastic pieces small enough to be consumed by indiscriminate feeders, such as some marine worms. Deposit-feeding, detritus-feeding, and filter-feeding invertebrates such as amphipods, polychaete worms, zooplankton, and mussels have been found to consume microscale plastic particles (microplastics) that result from the breakdown of larger plastic items (National Oceanic and Atmospheric Administration Marine Debris Program, 2014b; Wright et al., 2013). Ingestion by these types of organisms is the most likely pathway for degraded military expended materials to enter the marine food web. Transfer of microplastic particles to higher trophic levels was

demonstrated in one experiment (Setala et al., 2014). Ingestion of microplastics may result in physical effects such as internal abrasion and gut blockage, toxicity due to leaching of chemicals, and exposure to attached pollutants. Potentially harmful bacteria may also grow on microplastic particles (Kirstein et al., 2016). In addition, consumption of microplastics may result in decreased consumption of natural foods such as algae (Cole et al., 2013). Microplastic ingestion by marine worms was shown in one study to result in lower energy reserves (Wright et al., 2013). Microplastic ingestion has been documented in numerous marine invertebrates (e.g., mussels, worms, mysid shrimp, bivalve molluscs, zooplankton, and scleractinian corals (Cole et al., 2013; Hall et al., 2015; Setala et al., 2016; Wright et al., 2013). In an experiment involving pelagic and benthic marine invertebrates with different feeding methods, all species exposed to microplastic particles ingested some of the items (Setala et al., 2016). Deposit-feeding worms and an amphipod species ingested the fewest particles, while bivalves and free-swimming crustaceans ingested higher amounts. Ingestion of plastic particles may result in negative physical and chemical effects to invertebrates, although invertebrates are generally able to discharge these particles from the body. Overall population-level effects across a broad range of species are currently uncertain (Kaposi et al., 2014; Wright et al., 2013).

The most abundant military expended material of ingestible size is chaff. The materials in chaff are generally nontoxic in the marine environment except in quantities substantially larger than those any marine invertebrate would likely encounter because of Navy training and testing activities. Chaff fibers are composed of an aluminum alloy coating on glass fibers of silicon dioxide (Section 3.0.4.1.3, Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]). Chaff is similar in form to fine human hair, and is somewhat analogous to the spicules of sponges or the siliceous cases of diatoms (U.S. Department of the Navy, 1999). Many invertebrates ingest sponges, including the spicules, without suffering harm (U.S. Department of the Navy, 1999). Marine invertebrates may occasionally encounter chaff fibers in the marine environment and may incidentally ingest chaff when they ingest prey or water. Literature reviews and controlled experiments suggest that chaff poses little environmental risk to marine organisms at concentrations that could reasonably occur from military training and testing (Arfsten et al., 2002; U.S. Department of the Navy, 1999). Studies were conducted to determine the effects of chaff ingestion on various estuarine invertebrates occurring near a site of frequent chaff testing in Chesapeake Bay (Schiff, 1977). American oysters (various life stages), blue crabs (*Callinectes sapidus*), blue mussels (*Mytilus edulis*), and the polychaete worm *Nereis succinea* were force fed a chaff-and-food mixture daily for a few weeks at concentrations 10–100 times the predicted exposure level in the Bay. Although some mortality occurred in embryonic oyster larvae from 0 to 48 hours, the authors suggest confounding factors other than chaff (e.g., contaminated experimental water) as the cause. The authors reported no statistically significant mortality or effects on growth rate for any species. Because many invertebrates (e.g., crabs, shrimp) actively distinguish between food and non-food particles, the experimental design represents an unrealistic scenario with respect to the amount of chaff consumed. An investigation of sediments in portions of Chesapeake Bay exposed to aluminized chaff release for approximately 25 years found no significant increase in concentration compared to samples collected 3.7 km from the release area (Wilson et al., 2002).

As described in Section 3.8.1 (Affected Environment), many thousands of marine invertebrate species inhabit the Study Area. Most available literature regarding the effects of debris ingestion on marine invertebrates pertains to microplastics (Goldstein & Goodwin, 2013; National Oceanic and Atmospheric Administration Marine Debris Program, 2014b; Wright et al., 2013). Discussion of potential consumption of larger items is typically focused on fishes, sea turtles, marine mammals, and seabirds. Consequently, it is not possible to speculate in detail on which invertebrates in which locations might ingest all types of military expended materials. Despite the potential effects, it is reasonable to conclude that relatively large military expended materials would not be intentionally consumed by actively foraging invertebrates unless they are attracted by other cues (e.g., visual cues such as flashing metal bits that squid might attack). Passively-feeding invertebrates (e.g., shellfish, jellyfish) may accidentally ingest small particles by filtration or incidental adhesion to sticky mucus. The potential for effects on invertebrates from ingestion of military expended materials is also related to the locations of Navy training and testing activities relative to invertebrate population densities. Increased invertebrate densities are associated with the highest densities of microscopic plant food, which are typically located in nearshore waters in closer proximity to nutrient sources or in areas where upwelling tends to occur. Conversely, activities that generate military expended materials occur mostly seaward of nearshore water. Small deposit-feeding, detritus-feeding, and filter-feeding invertebrates would be most likely to ingest small items such as degraded plastic particles, although lobsters reportedly may also ingest microplastics (National Oceanic and Atmospheric Administration Marine Debris Program, 2014b). Though ingestion is possible in some circumstances, due to the overall size and composition of military expended materials, effects on populations would likely not be detectable.

### C.4.6.1 Effects from Military Expended Materials – Munitions

Ingestion of intact military expended materials that are munitions is not likely for most types of expended items because they are too large to be ingested by most marine invertebrates. Though ingestion of intact munitions or large fragments is conceivable in some circumstances (e.g., a relatively large invertebrate such as an octopus or lobster ingesting a small-caliber projectile), such a scenario is unlikely due to the animal's ability to discriminate between food and non-food items. Indiscriminate deposit- and detritus-feeding invertebrates such as some marine worms could potentially ingest munitions fragments that have degraded to sediment size. Metal particles in the water column may be taken up by suspension feeders (e.g., copepods, mussels) (Chiarelli & Roccheri, 2014; Griscom & Fisher, 2004), although metal concentrations in the water are typically much lower than concentrations in sediments (Bazzi, 2014; Brix et al., 2012).

## C.4.7 Secondary Stressors

This section analyzes potential effects on marine invertebrates exposed to stressors indirectly through effects on their habitat (sediment or water quality) or prey. The assessment of potential water and sediment quality stressors refers to previous sections (Section 3.1, Sediments and Water Quality), and addresses specific activities in local environments that may affect invertebrate habitats. The terms "indirect" and "secondary" do not imply reduced severity of environmental consequences, but instead describe how the effect may occur in an

organism or its ecosystem. Stressors from Navy training and testing activities that could pose indirect effects on marine invertebrates via habitat or prey include: (1) explosives and explosive byproducts, (2) chemicals other than explosives, and (3) metals.

### Explosives and Explosive Byproducts

Secondary effects on invertebrates resulting from explosions at the surface, in the water column, or on the bottom would be associated with changes to habitat structure and effects to prey species. Most explosions on the bottom would occur in soft bottom habitat and would displace some amount of sediment, potentially resulting in cratering. However, water movement would redistribute the affected sediment over time. A small amount of sediment would be suspended in the water column temporarily but would resettle to the bottom. There would be no overall reduction in the surface area or volume of sediment available to benthic species that occur on the bottom or within the substrate. Activities that inadvertently result in explosions on or near hard bottom habitat or reefs could break hard structures and reduce the amount of colonizing surface available to encrusting organisms (e.g., corals, sponges).

Explosions in the water column or on the bottom could affect invertebrate prey species. Some species of most invertebrate taxa prey upon other invertebrate species, with prey items ranging in size from zooplankton to relatively large shrimps and crabs. Therefore, in a strict sense, mortality to invertebrate species resulting from an explosion may represent a reduction in prey to other invertebrate species. A few invertebrates such as squid and some jellyfish prey upon fish, although jellyfish capture fish passively rather than through active pursuit. Therefore, fish mortality resulting from an explosion would reduce the number of potential prey items for invertebrates that consume fish. In addition to mortality, fish located near a detonation would likely be startled and leave the area, temporarily reducing prey availability until the affected area is repopulated.

Some invertebrates (e.g., worms, crustaceans, sea stars) are scavengers that would feed on any vertebrate or invertebrate animal that is killed or significantly impaired by an explosion. Therefore, scavenging invertebrates that are not killed or injured themselves could benefit from physical effects on other animals resulting from explosions in the water column or on the bottom.

High-order explosions consume most of the explosive material, leaving only small or residual amounts of explosives and combustion products. Most of the combustion products of trinitrotoluene (i.e., TNT), such as carbon dioxide and nitrogen, are common seawater constituents, although other products such as carbon monoxide are also produced (Becker, 1995). Other explosive compounds may produce different combustion products. All combustion products are rapidly diluted by ocean currents and circulation. Therefore, explosives byproducts from high-order detonations would not degrade sediment or water quality or result in indirect stressors to marine invertebrates. Low-order detonations and unexploded munitions present an elevated potential for effects on marine invertebrates. Deposition of undetonated explosive materials into the marine environment can be reasonably estimated by the known failure and low-order detonation rates of high explosives. Explosive material not completely consumed during a detonation from munitions disposal and mine clearing training are collected after the

activities are completed; therefore, potential effects are likely inconsequential and not detectable for these activities.

Exposure to relatively high concentrations of various explosive materials in sediments and in the water may result in lethal and sub-lethal effects to invertebrates. The type and magnitude of effects appear to be different among various invertebrate species and are also influenced by the type of explosive material and physical characteristics of the affected water and sediment. For example, lethal toxicity has been reported in some invertebrate species (e.g., the amphipod *Eohaustorius estuarius*) exposed to trinitrotoluene (i.e., TNT), while mortality has not been found in other species (e.g., the polychaete worm *Neanthes arenaceodentata*), even when exposed to very high concentrations (Rosen & Lotufo, 2005). Exposure to water-borne explosive materials has been found to affect reproduction or larval development in bivalve, sea urchin, and polychaete worm species (Lotufo et al., 2013). Invertebrates on the bottom may be exposed to explosive materials by ingesting contaminated sediment particles, in addition to being exposed to materials in the overlying water column or in voids in the sediment (for burrowing invertebrates). However, toxicity and other sub-lethal effects have often been associated with exposure to higher concentrations of explosive materials than the concentrations expected to occur in marine or estuarine waters of the Study Area due to training and testing activities.

Indirect effects of explosives and unexploded munitions on marine invertebrates via sediment are possible near the munitions. Rosen and Lotufo (2010) exposed mussels and deposit-feeding amphipods and polychaete worms to levels of TNT and royal demolition explosive potentially associated with a breached munition or low-order detonation. The authors found concentrations in the sediment above toxicity levels within about 1 in. of the materials, although no statistical increase in mortality was observed for any species. Concentrations causing toxicity were not found in the water column. Explosive material in the marine environment is readily degraded via several biotic and abiotic pathways. The results of studies of explosive material deposition at munitions disposal sites and active military water ranges suggest that explosives and explosives residues pose little risk to fauna living in direct contact with munitions, and that sediment is not a significant sink for these materials (Kelley et al., 2016; Koide et al., 2016; Smith & Marx, 2016). Munitions constituents and degradation products would likely be detectable only within a few feet of a degrading munition, and the spatial range of toxic sediment conditions could be less (inches). It has been suggested that the risk of toxicity to invertebrates in realistic exposure scenarios is negligible (Lotufo et al., 2013). Indirect effects of explosives and unexploded munitions on marine invertebrates via water are likely to be inconsequential. Most explosives and explosive degradation products have relatively low solubility in seawater. This means that dissolution occurs extremely slowly, and harmful concentrations of explosives and degradation products are not likely to occur in the water column. Also, the low concentration of materials delivered slowly into the water column is readily diluted by ocean currents and would be unlikely to concentrate in toxic levels. Filter feeders such as sponges or some marine worms would be exposed to chemical byproducts only in the immediate vicinity of degrading explosives (inches or less) due to the low solubility and dilution by water currents. While marine invertebrates may be adversely affected by the indirect effects of degrading explosives via water, this is unlikely in realistic scenarios.

Effects on marine invertebrates, including zooplankton, eggs, and larvae, are likely only within a very small radius of the munition (potentially inches). These effects may continue as the munition degrades over decades. Because most munitions are deployed as projectiles, multiple unexploded or low-order detonations would not likely accumulate on spatial scales as small as feet to inches; therefore, potential effects are likely to remain local and widely separated. Explosives, explosives byproducts, and unexploded munitions would therefore generally not be present in these habitats.

**Chemicals Other Than Explosives**

Several Navy training and testing activities introduce potentially harmful chemicals into the marine environment, primarily propellants and combustion products, other fuels, PCBs in target vessels, other chemicals associated with munitions, and simulants. Ammonium perchlorate (a rocket and missile propellant) is the most common chemical used. Perchlorate is known to occur naturally in nitrate salts, such as those from Chile, and it may be formed by atmospheric processes such as lightning and reactions between ozone and sodium chloride in the air (associated with evaporated seawater) (Dasgupta et al., 2005; Sijimol & Mohan, 2014; U.S. Environmental Protection Agency, 2014c). Perchlorate may affect metabolic processes in plants and animals. Effects have been found in earthworms and aquatic (freshwater) insects (Smith, 2002; Srinivasan & Viraraghavan, 2009), although effects specific to marine invertebrates are unknown. Other chemicals with potential for adverse effects to invertebrates include some propellant combustion products, such as hydrogen cyanide and ammonia.

Rockets and missiles are highly efficient at consuming propellants (for example, over 99.9 percent of perchlorate is typically consumed) and, therefore, very little residual material would enter the water column. Additionally, perchlorate does not readily absorb into sediments, potentially reducing the risk to deposit- and detritus-feeding invertebrates. Torpedoes are expended in the water and, therefore, torpedo propellant (e.g., Otto Fuel II) combustion products would enter the marine environment. Overall, analysis concludes that effects on sediments and water quality would be minimal for several reasons. The size of the area affected is large and, therefore, chemicals would not be concentrated. Most propellant combustion byproducts are benign, and those of concern (e.g., hydrogen cyanide) would be quickly diluted. Most propellants are consumed during normal operations, and the failure rate of munitions using propellants and other combustible materials is low. Most byproducts of Otto Fuel II combustion occur naturally in seawater, and most torpedoes are recovered after use, limiting the potential for unconsumed fuel to enter the water. In addition, most constituents are readily degraded by biotic and abiotic processes. Concentrations of chemicals in sediment and water are not likely to cause injury or mortality to marine invertebrates, gametes, eggs, or larvae.

Target vessels are only used during sinking exercises, which occur infrequently. Polychlorinated biphenyls may be present in certain solid materials (e.g., insulation, wires, felts, and rubber gaskets) on target vessels. The vessels are selected from a list of Navy-approved vessels that have been cleaned in accordance with USEPA guidelines. Sinking exercises must be conducted at least 50 NM offshore and in water at least 6,000 ft. deep. USEPA estimates that as much as 100 lb. of PCBs remain onboard sunken target vessels. USEPA considers the contaminant levels released during the sinking of a target to be within the standards of the Marine Protection,

Research, and Sanctuaries Act (16 United States Code 1341, et seq.). Under a 2014 agreement with USEPA, the Navy will not likely use aircraft carriers or submarines as the targets for a sinking exercise. Based on these considerations, PCBs are not evaluated further as a secondary stressor to invertebrate habitats.

### Metals

Certain metals and metal-containing compounds (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) are harmful to marine invertebrates at various concentrations above background levels (Chan et al., 2012; Negri et al., 2002; Wang & Rainbow, 2008). For example, physiological effects in crabs, limpets, and mussels due to copper exposure were reported (Brown et al., 2004), although the effects were found at concentrations substantially higher than those likely to be encountered due to Navy expended materials. Metals are introduced into seawater and sediments as a result of training and testing activities involving vessel hulks, targets, munitions, and other military expended materials. Some effects due to metals result from the concentrating effects of bioaccumulation, which is not discussed in this section. Bioaccumulation issues are discussed in the *Ecosystem Technical Report for the Hawaii-Southern California Training and Testing (HSTT) Final Environmental Impact Statement/Overseas Environmental Impact Statement* (U.S. Department of the Navy, 2013c). While not specific to the MITT Study Area, the discussion on the potential for effects from bioaccumulation are applicable. Secondary effects may occur when marine invertebrates are exposed by contact with the metal, contact with trace amounts in the sediment or water (e.g., from leached metals), and ingestion of contaminated sediments.

Because metals tend to precipitate out of seawater and often concentrate in sediments, potential adverse indirect effects are much more likely via sediment than water (Zhao et al., 2012). However, studies have found the concentrations of metals in the sediments of military ranges (e.g., Navy training areas such as Vieques, Puerto Rico) or munitions disposal sites, where deposition of metals is very high, to rarely be above biological effects levels. For example, researchers sampled areas associated with Vieques in which live ammunition and weapons were used and found generally low concentrations of metals in the sediment (Kelley et al., 2016; Pait et al., 2010b). Comparison with guidelines suggested by the National Oceanic and Atmospheric Administration's National Status and Trends Program showed that average metal concentrations were below threshold effects levels for all constituents except copper and were below probable effects levels for all constituents. The concentration of munitions at Vieques is substantially greater than would occur in the Study Area. Evidence from a number of studies at military ranges and disposal sites indicates metal contamination is very localized (Briggs et al., 2016; Kelley et al., 2016; Koide et al., 2016). Effects on invertebrates, eggs, or larvae would likely be limited to exposure in the sediment within a few inches of the object.

Concentrations of metals in seawater affected by Navy training and testing activities are unlikely to be high enough to cause injury or mortality to marine invertebrates. Benthic invertebrates occurring very near (within a few inches of) Navy-derived materials on the seafloor could be affected by associated metal concentrations, but this is expected to affect relatively few individuals.

## C.5 Marine Habitats

### C.5.1 Acoustic Stressors

Acoustic Stressors are not applicable to marine habitats, due to the lack of hearing capabilities of abiotic habitats and are not analyzed further in this section.

### C.5.2 Explosive Stressors

In-water detonations are used during various mine warfare training activities, surface-to-surface gunnery exercises, air-to-surface gunnery, missile, and bombing exercises, as well as sinking exercises, in-water demolition, and other training activities. Likewise, air-to-surface gunnery, missile, and bombing tests, anti-submarine warfare tracking tests, mine warfare, detection, neutralization tests, and other testing activities also employ in-water explosives. The potential effects of in-water detonations on marine habitats are assessed according to size of charge (net explosive weight), charge radius, height above the bottom, substrate types in the area, and equations linking all these factors.

Most explosive detonations during training and testing involving the use of high-explosive munitions, including bombs, missiles, and projectile casings, would occur in the air or near the water's surface. Explosives associated with torpedoes, explosive sonobuoys, and explosive mines would occur in the water column; demolition charges could occur near the surface, in the water column, or the ocean bottom. Most surface and water column detonations would occur in waters greater than 3 NM from shore at water depths greater than 100 ft. and would not be expected to affect the bottom, although mine warfare and demolition detonations could occur in shallow water and typically in a few specific locations within the Study Area. This section only evaluates the effect of explosives placed on the bottom because the physical structure of the water column is not affected by explosions.

An explosive charge would produce percussive energy that would be absorbed and reflected by the bottom. Hard bottom would mostly reflect the energy (Berglind et al., 2009), whereas a crater would be formed in soft bottom (Gorodilov & Sukhotin, 1996). For a specific size of explosive charge, crater depths and widths would vary depending on depth of the charge and substrate type. There is a nonlinear relationship between crater size and depth of water, with relatively small crater sizes in the shallowest water, followed by a spike in size at some intermediate depth, and a decline to an average flat line (indicating similar crater size for all charge weights) at greater depth (Gorodilov & Sukhotin, 1996; O'Keeffe & Young, 1984). Radii of the craters reportedly vary little among unconsolidated substrate types (O'Keeffe & Young, 1984). On substrate types with nonadhesive particles (everything except clay), the effects should be temporary, whereas craters in clay may persist for years (O'Keeffe & Young, 1984). Soft substrate moves around with the tides and currents and depressions are only short-lived (days to weeks) unless they are maintained.

### C.5.3 Energy Stressors

Energy stressors are not applicable to habitats, since activities that include the use of energy-producing devices are typically conducted at or near the surface of the water and would not affect bottom habitats. Therefore, they are not analyzed further in this section.

## C.5.4 Physical Disturbance and Strike Stressors

### C.5.4.1 Effects from Vessels and In-Water Devices

Vessels conducting training and testing activities in the Study Area include large ocean-going ships and submarines typically operating in waters deeper than 100 m but also occasionally transiting inshore waters from ports and through the operating areas. Training and testing activities also include smaller vessels operating in inshore waters, typically at higher speeds (greater than 10 knots). Vessels used for training and testing activities range in size from small boats (less than 40 ft.) to nuclear aircraft carriers (greater than 980 ft.) Table 3.0-8 lists representative types of vessels, including amphibious warfare vessels, used during training and testing activities. Towed mine warfare and unmanned devices are much smaller than other Navy vessels, but would also disturb the water column near the device. Some activities involve vessels towing in-water devices used in mine warfare activities. The towed devices attached to a vessel by cables are smaller than most vessels, and are not towed at high speeds. Some vessels, such as amphibious vehicles, would intentionally contact the seafloor in the surf zone.

Vessels, in-water devices, and towed in-water devices could either directly or indirectly affect any of the habitat types discussed in this section, including soft and intertidal shores, soft and hard bottoms, and artificial substrates. In addition, a vessel or device could disturb the water column enough to stir up bottom sediments, temporarily increasing the local turbidity. The shore and nearshore environment is typically very dynamic because of its constant exposure to wave action and cycles of erosion and deposition. Along high-energy shorelines like ocean beaches, these areas would be reworked by waves and tides shortly after the disturbance. Along low-energy shoreline in sheltered inshore waters, the force of vessel wakes can result in elevated erosion and resuspension of fine sediment (Zabawa & Ostrom, 1980). In deeper waters where the tide or wave action has little influence, sediments suspended into the water column would eventually settle. Sediment settlement rates are highly dependent on grain size. Disturbance of deeper bottom habitat by vessels or in-water devices is possible where the propeller wash interacts with the bottom. However, most vessel transiting in shallow, nearshore waters is confined to navigation channels where bottom disturbance only occurs with the largest vessels. An exception would be for training and testing activities that occur in shallow, nearshore environments. Turbidity caused by vessel operation in shallow water, propeller scarring, and vessel grounding could affect habitats in shallow-water areas. In addition, physical contact with hard bottom areas can cause structural damage to the substrate. However, direct effects to the substrate are typically avoided because they could slow or damage the vessel or in-water device. These disturbances would not alter the overall nature of the sediments to a degree that would impair their function as habitat. The following alternatives analysis specifies where these effects could occur in terms of number of events with vessel movement or in-water devices training/testing in different habitat areas.

### C.5.4.2 Effects from Military Expended Materials

This section analyzes the potential for physical disturbance to marine substrates from the following categories of military expended materials: (1) non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than munitions, such as sonobuoys, expendable targets, and ship hulks. Note that expended materials do not

include materials that are recovered or categorized as in-water or seafloor devices. Areas expected to have the greatest amount of expended materials are the Study Area. Military expended materials have the potential to physically disturb marine substrates to the extent that they impair the substrate's ability to function as a habitat. These disturbances can result from several sources, including the effect of the expended material contacting the seafloor and moving around, the covering of the substrate by the expended material, or alteration of the substrate from one type to another.

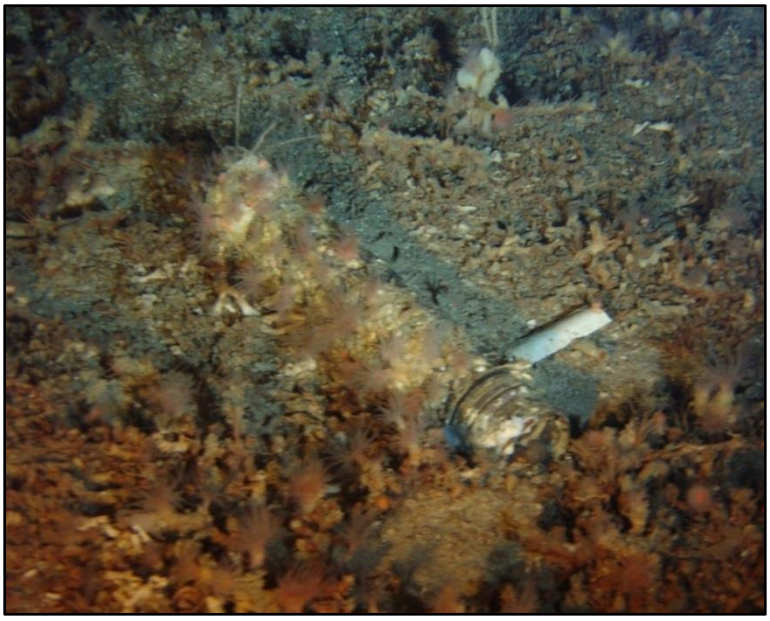
The potential for military expended materials to physically impact marine substrates as they come into contact with the seafloor depends on several factors. These factors include, but are not limited to, the size, shape, type, density, and speed of the material through the water column; the amount of the material expended; the frequency of training or testing; water depth, water currents, or other disturbances; and the type of substrate. Most of the kinetic energy of the expended material, however, is dissipated within the first few feet of the object entering the water causing it to slow considerably by the time it reaches the substrate. Because the damage caused by a strike is proportional to the force of the strike, slower speeds result in lesser impacts. Due to the water depth at which most training and testing events take place, a direct strike on either hard bottom or artificial structures (e.g., artificial reefs and shipwrecks) is unlikely to occur with sufficient force to damage the substrate. In softer substrates (e.g., sand, mud, silt, clay, and composites), the effect of the expended material coming into contact with the seafloor, if large enough and striking with sufficient momentum, may result in a depression and a localized redistribution of sediments as they are temporarily suspended in the water column. There may also be redistribution of unconsolidated sediment in areas with sufficient flow to move the sediment, creating a pattern of scouring on one side of the material and deposition on the other.

During Navy training and testing, countermeasures such as flares and chaff are introduced into marine habitats. These types of military expended materials are not expected to affect marine habitats as strike stressors, given their smaller size and low velocity compared to projectiles, bombs, and missiles.

Another potential physical disturbance that military expended materials could have on marine substrates would be to cover them or to alter the type of substrate and, therefore, its function as habitat. The majority of military expended materials that settle on hard bottoms or artificial substrates, while covering the seafloor, may serve a similar habitat function as the substrate it is covering by providing a hard surface on which organisms can attach (Figure C-4 and Figure C-5). Similarity in attached organisms over the long term depends on similarity in structural features (Perkol-Finkel et al., 2006; Ross et al., 2016), fine surface texture, and mineral content (Davis, 2009). Natural hard bottom and artificial structures of a similar shape will eventually have similar communities of attached organisms if they have similar fine texture and mineral content. However, the smooth surface texture of intact military expended materials and lack of mineral content suggests a difference in species composition and associated functions. An exception would be expended materials, like the decelerators/parachutes utilized to deploy sonobuoys, lightweight torpedoes, expendable mobile anti-submarine warfare training targets, and other devices from aircraft, which would not provide a hard surface for colonization. In

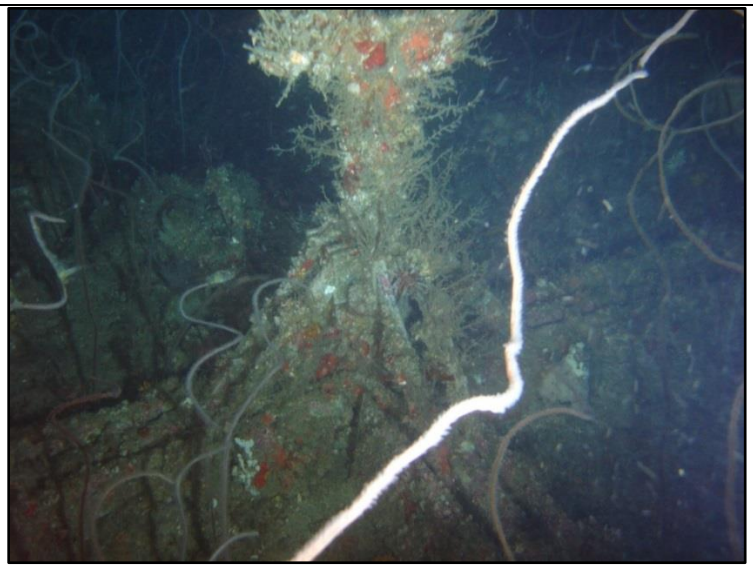
these cases, the hard bottom or artificial structure covered by the expended material would not be physically damaged, but would have an impaired ability to function as a habitat for colonizing or encrusting organisms. There is potential for these items to drift over shallow-water or deep-sea coral habitats.

Most military expended materials that settle on soft bottom habitats, while not damaging the actual substrate, would inhibit the substrate's ability to function as a soft-bottom habitat by covering it with a hard surface. This would effectively alter the substrate from a soft surface to a hard structure and, therefore, would alter the habitat to be more suitable for organisms more commonly found associated with hard bottom environments (U.S. Department of the Navy, 2010c, 2011). Expended materials that settle in the shallower, more dynamic environments of the continental shelf would likely be eventually covered over by sediments due to currents and other coastal processes or encrusted by organisms. Depending on the substrate properties and the hydrodynamic characteristics of the area, military expended materials may become buried rather quickly while in other areas they may persist on the surface of the seafloor for a more extended time. The offshore portion of the continental shelf experiences more sediment redistribution from oceanic boundary currents than distant surface waves. The effect of oceanic currents on sediment redistribution diminishes seaward of the continental shelf break: sediment along the continental slope experiences very little reworking from surface currents and waves. In the deeper waters of the continental slope and beyond where currents do not play as large of a role, expended materials may remain exposed on the surface of the substrate with minimal change for extended periods (Figure C-6).



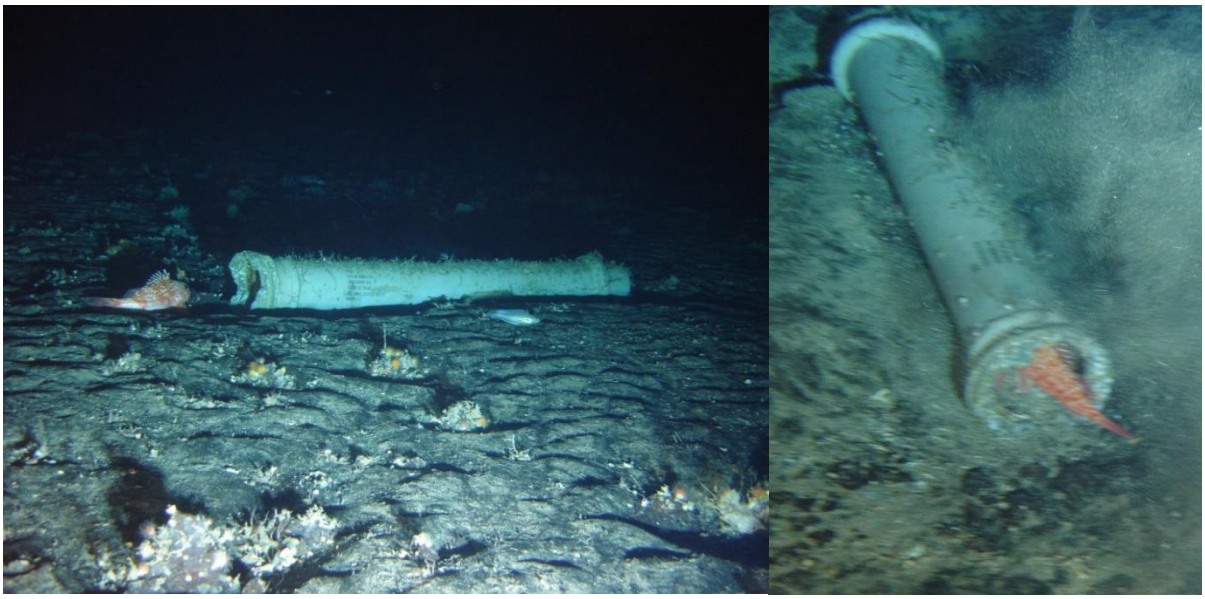
Note: Use of the smoke float as a colonizing substrate for a cluster of sea anemones (U.S. Department of the Navy, 2010c). Observed at approximately 350 meters in depth and 60 nautical miles east of Jacksonville, Florida.

**Figure C-4: A Marine Marker Observed in an Area Dominated by Coral Rubble on the Continental Slope**



Note: Encrusting organisms and benthic invertebrates readily colonize the artificial structure to a similar degree as the surrounding rock outcrop (U.S. Department of the Navy, 2010c). Observed on the ridge system that runs parallel to the shelf break at approximately 80 meters in depth and 55 nautical miles east of Jacksonville, Florida.

**Figure C-5: An Unidentified, Non-Military Structure on Hard Bottom**

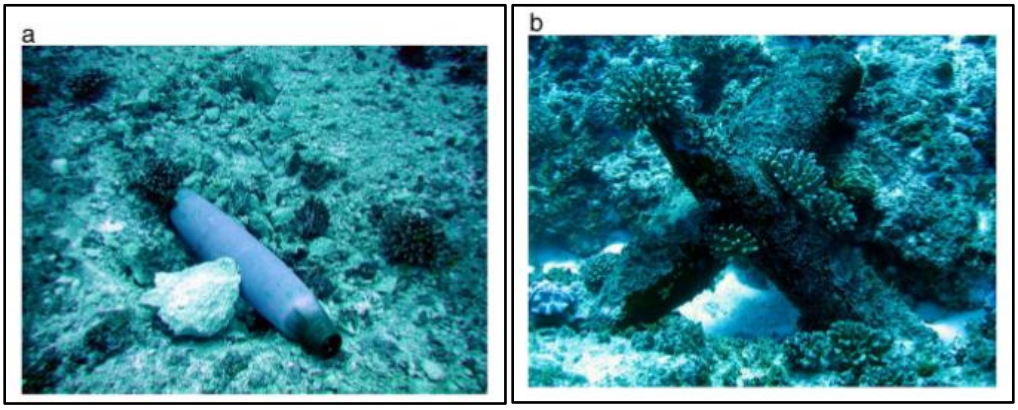


*Note: The casing was observed in a sandy area on the continental slope approximately 425 meters in depth and 70 nautical miles east of Jacksonville, Florida. The casing has not become covered by sediments or encrusting organisms due to the depth and the relatively calm, current-free environment. Source: U.S. Department of the Navy (2010a, 2011)*

**Figure C-6: A 76-millimeter Cartridge Casing on Soft Bottom and a Blackbelly Rosefish (*Helicolenus dactylopterus*) Using the Casing for Protection When Disturbed**

Whereas the effects will accumulate somewhat through successive years of training and testing, some portion of the expended material will sink below the surface of shifting soft bottom habitat or become incorporated into natural hard bottom before crumbling into inorganic particulates. This will be the fate of military expended materials with a density greater than or equal to that of the underlying substrate (e.g., metal, cement, sand). Constituents of military expended materials that are less dense than the underlying substrate (e.g., fabric, plastic) will likely remain on the surface substrate after sinking. In this case, the effect on substrate as a habitat is likely temporary and minor due to the mobility of such materials (refer to living resources sections for more information on the entanglement and ingestion risk posed by plastic and fabric constituents of military expended materials).

The effect of dense expendable materials on bottom substrate is prolonged in the portions of the study area that are seaward of the continental shelf. Between initial settlement and burial or complete degradation, these relatively stable objects will likely function as small artificial habitats for encrusting algae, attached macroalgae/seaweed, sedentary invertebrates as well as small motile organisms (Figure C-7).




***a.*** *MK 82 inert bomb (168 centimeters long) that directly affected the sea floor at a depth of 12 meters in Z3E on 5 or 6 September 2007; photographed on 13 September 2007. Area of destruction/ disturbance was approximately 17 square meters.*
***b.*** *MK 82 bombs with Pocilloporid corals, algae, etc.*
Source: Smith and Marx (2016)

**Figure C-7: Military Expended Materials Functioning as Habitat**

To determine the potential level of disturbance that military expended materials have on soft, intermediate, and hard bottom substrates, an analysis to determine the impact footprint was conducted for each range complex for each alternative. Three main assumptions were made that resulted in the impact footprints calculated being considered overestimates. First, within each category of expended items (e.g., bombs, missiles, rockets, large-caliber projectiles), the size of the largest item that would be expended was used to represent the sizes of all items in the category (see Appendix F, Military Expended Materials and Direct Strike Analysis). For example, the impact footprints of missiles used during training exercises range from 1.5 to 40 square feet. For the analyses, all missiles were assumed to be equivalent to the largest in size, or 40 square feet. Second, it was also assumed that the impact of the expended material on the seafloor was twice the size of its actual footprint. This assumption accounts for any displacement of sediments at the time of impact as well as any subsequent movement of the item on the seafloor due to currents or other forces. This should more accurately reflect the potential disturbance to soft bottom habitats, but would overestimate disturbance to hard bottom habitats since no displacement of the substrate would occur. Third, items with casings (e.g., small-, medium-, and large-caliber munitions; flares; sonobuoys) have their impact footprints doubled to account for both the item and its casing. Items and their casings were assumed to be the same size, even though, depending on the munitions, one of them is often smaller than the other.

Once the impact footprints were calculated, three analyses were performed for each range complex: (1) a conservative scenario in which potential effects to each habitat type (soft, intermediate, and hard bottom habitats) in that range complex if all expended materials settled in areas with that substrate type, (2) a proportional analysis in which potential effects to each habitat type expended materials settled proportionally across all habitat types in the area, (3) and a five-year scenario in which potential effect to the bottom habitats in that range complex over a five-year period if activities continued at anticipated levels and effects accumulated over that period Appendix F (Military Expended Materials and Direct Strike Analysis). During the analyses, the same dimensions were used for high-explosive munitions as were used for non-explosive practice munitions. The total area of the seafloor covered by the expended materials should be similar regardless of whether the item is intact or fragmented, despite the fact that high-explosive munitions will explode in the air, at the surface, or in the water column and only fragments would make it to the substrate.

According to surveys conducted at Farallon De Medinilla (a U.S. Department of Defense bombing range in the Mariana Archipelago) between 1997 and 2012, there was no evidence that the condition of the living resources assessed had changed or been adversely affected to a significant degree by the training activities being conducted there. It should also be noted that the intended munition target was on the nearby land area, and water impacts were due to inaccuracy. The health, abundance, and biomass of fishes, corals, and other marine resources are comparable to or superior to those in similar habitats at other locations within the Mariana Archipelago (Smith & Marx, 2016). However, the study noted that decline in some important reef fish during their latest surveys was likely due to increasing attention from fishermen. Also, this is expected to be an extreme case based on the proximity to shallow-water coral reefs and the increased movement of military expended materials due to the shallow margins of the

islands where wave impact is more severe. Effects to habitat from military expended materials in the Study Area would be expected to be less severe. See Appendix F (Military Expended Materials and Direct Strike Analysis) for detailed analyses of the effects associated with military expended materials from Navy training and testing activities.

A 2023 literature review (Naval Facilities Engineering Command Pacific, 2023) undertaken to consider effects of military training and testing on reef fish contaminant bioaccumulation, human, and ecological effects in the Mariana Islands resulted in several recommendations, including:

- A recommendation to include additional references and information in future Environmental Impact Statement documents.
- Future fate and transport studies should utilize a broader range of environmental conditions to facilitate a better understanding of explosive dynamics within the Mariana Islands Training and Testing Study Area.
- Use additional empirical research to reduce uncertainty in future analyses.
- Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) sections focusing on sediments, water quality, and aquatic organisms could be strengthened with additional literature and/or estimations of the concentrations of explosive compounds generated following planned activities.
- Recommend further studies adopting a similar approach and a wider variety of exposure scenarios, such as different explosive compositions and detonation scenarios, would be useful to minimize the uncertainty associated with applying data from munitions dumpsites to military testing and training risk assessments.

### C.5.4.3 Effects from Seafloor Devices

Mine shapes or other stationary targets and anchors are typically recovered within 7–30 days following the completion of the training or testing events. As a result of their temporary nature, recovered mine shapes do not permanently affect the substrate on which they are placed, but will temporarily impair the ability of the substrate to function as a habitat for as long as the mine shape and anchor is in place. The impairment is due to the temporary covering by artificial substrate along with changes in the bathymetry around the structures due to scouring and deposition patterns around objects on a soft bottom. Mine shapes, targets, or anchors that are not recovered would potentially have effects to abiotic habitat and, depending on the type of bottom substrate, could alter the ability to function as habitat but ultimately would likely become buried (on soft bottom) or become encrusted by similar types of organisms (on hard, intermediate, or artificial surfaces).

Potential effects of precision anchoring are qualitatively different from other seafloor devices because the activity involves repeated disturbance to the same area of seafloor. Precision anchoring training exercises involve releasing of anchors in designated locations. The intent of these training exercises is to practice anchoring the vessel within 300 ft. of the planned anchorage location. These training activities typically occur within predetermined shallow water anchorage locations near ports with seafloors consisting of soft bottom substrate. The level of effect to the soft sediments would depend on the size of the anchor used, which would vary

according to vessel type. As most of these activities occur in areas along navigation channels subject to strong currents and shifting sediment, disturbed areas would quickly return to pre-disturbance conditions The Navy will implement mitigation that includes not conducting precision anchoring (except in designated anchorages) within the anchor swing circle of shallow-water coral reefs, live hard bottom, artificial reefs, and shipwrecks to avoid potential effects from seafloor devices on habitats in mitigation areas throughout the Study Area. Mitigation for seafloor resources was not included in the quantitative assessment of habitat effects; however, it will help the Navy further avoid the potential for effects on habitats from precision anchoring activities.

Crawlers are fully autonomous, battery-powered amphibious vehicles used for functions such as reconnaissance missions in territorial waters. These devices are used to classify and map underwater mines in shallow water areas. The crawler can travel 2 ft. per second along the seafloor and can avoid obstacles. The crawlers are equipped with various sonar sensors and communication equipment that enable these devices to locate and classify underwater objects and mines while rejecting miscellaneous clutter that would not pose a threat.

Crawlers move over the surface of the seafloor and would not harm or alter any hard substrates encountered; therefore, hard bottom habitat would not be impaired. However, fragile abiotic or biogenic structures could be harmed by the crawlers moving over the substrate (refer to living resources sections for analysis). In soft substrates, crawlers may leave a trackline of depressed sediments approximately 2 ft. wide (the width of the device) in their wake. However, since these crawlers operate in shallow water, any disturbed sediments would be redistributed by wave and tidal action shortly (days to weeks) following the disturbance. Therefore, disturbance would not impair the ability of soft sediment to function as a habitat.

### C.5.5 Entanglement Stressors

Entanglement stressors are not applicable to habitats due to the lack of mobility capabilities of habitats and are not analyzed further in this section.

### C.5.6 Ingestion Stressors

Ingestion stressors are not applicable to habitats due to the lack of ingestion capabilities of habitats and are not analyzed further in this section.

### C.5.7 Secondary Stressors

Secondary stressors are not applicable to habitats as they are not susceptible to effects from secondary stressors and are not analyzed further in this section.

## C.6 Fishes

### C.6.1 Acoustic Stressors

Background information supporting the analysis of acoustic stressors is presented in the *Acoustic and Explosives Concepts Technical Report*.

### C.6.2 Explosive Stressors

Background information supporting the analysis of explosive stressors is presented in the *Acoustic and Explosives Concepts Technical Report*.

### C.6.3 Energy Stressors

#### C.6.3.1 Effects from In-Water Electromagnetic Devices

Several different in-water electromagnetic devices are used during training and testing activities. A discussion of the characteristics of energy introduced into the water through naval training and testing activities and the relative magnitude and location of these activities is presented in Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]), while Table B-1 and Table B-2 (Appendix B, Activity Stressor Matrices) lists the activities in each alternative that use the devices.

A comprehensive review of information regarding the sensitivity of marine organisms to electric and magnetic impulses is presented in Bureau of Ocean Energy Management (2011). The synthesis of available data and information contained in this report suggests that while many fish species (particularly elasmobranchs) are sensitive to electromagnetic fields (Hore, 2012), further investigation is necessary to understand the physiological response and magnitude of the potential effects. Most examinations of electromagnetic fields on marine fishes have focused on buried undersea cables associated with offshore wind farms in European waters (Boehlert & Gill, 2010; Gill, 2005; Ohman et al., 2007).

Many fish groups, including lampreys, elasmobranchs, eels, and stargazers, have an acute sensitivity to electrical fields, known as electroreception (Bullock et al., 1983; Helfman et al., 2009). Fishes likely use the same sensory organs (e.g., lateral line system particularly around the head) for electroreception and also for detecting sounds. Some species of sharks, such as the scalloped hammerhead, have small pores near the nostrils, around the head, and on the underside of the snout, or rostrum called ampullae of Lorenzini to detect the electromagnetic signature of their prey. Electroreceptors are thought to aid in navigation, orientation, and migration of sharks and rays (Kalmijn, 2000). In elasmobranchs, behavioral and physiological response to electromagnetic stimulus varies by species and age, and appears to be related to foraging behavior (Rigg et al., 2009). Many elasmobranchs respond physiologically to electric fields of 10 nanovolts per centimeter (cm) and behaviorally at 5 nanovolts per cm (Collin & Whitehead, 2004), while Kajiura & Holland (2002) showed juvenile scalloped hammerhead sharks detected and behaviorally responded to electric fields of less than 1 nanovolt per cm.

There are two general types of electroreceptor organs in fishes (Helfman et al., 2009). Ampullary receptors, located in recesses in the skin, are connected to the surface by a canal filled with a conductive gel and are sensitive to electric fields of low frequency (<0.1–25 Hz). Tuberous receptors are located in depressions of the epidermis, are covered with loosely packed epithelial cells, and detect higher frequency electric fields (50 Hz to > 2 kHz). They are typically found in fishes that use electric organs to produce their own electric fields. The distribution of electroreceptors on the head of these fishes, especially around the mouth, suggests that these sensory organs may be used in foraging. Additionally, some researchers hypothesize that the electroreceptors aid in social communication (Collin & Whitehead, 2004).

While elasmobranchs and other fishes can sense the level of the earth's electromagnetic field, the potential effects on fishes resulting from changes in the strength or orientation of the background field are not well understood. When the electromagnetic field is enhanced or altered, sensitive fishes may experience an interruption or disturbance in normal sensory perception. Research on the electrosensitivity of sharks indicates that some species respond to electrical impulses with an apparent avoidance reaction (Helfman et al., 2009; Kalmijn, 2000). This avoidance response has been exploited as a shark deterrent, to repel sharks from areas of overlap with human activity (Marcotte & Lowe, 2008). A recent study on cat sharks (*Scyliorhinus canicula*) demonstrated that sharks may show habituation to electrical fields over short-term exposures (Kimber et al., 2014). Other studies suggest that sharks are attracted to electromagnetic sources when conditions in the water hinder their other senses, such as sight and hearing. This attraction to electromagnetic sources helps sharks to find prey when in these low sensory conditions (Fields, 2007).

The mechanism for direct sensing of magnetic fields is unknown; however, the presence of magnetite (a magnetic mineral) in the tissues of some fishes such as tunas or other sensory systems such as the inner ear and the lateral line system, may be responsible for electromagnetic reception (Helfman et al., 2009). Magnetite of biogenic origins has been documented in the lateral line of the European eel (*Anguilla anguilla*) (Moore & Riley, 2009). Some species of tuna and stargazers have likewise been shown to respond to magnetic fields and may also contain magnetite in their tissues (Helfman et al., 2009).

Experiments with electromagnetic pulses can provide indirect evidence of the range of sensitivity of fishes to similar stimuli. Two studies reported that exposure to electromagnetic pulses do not have any effect on fishes (Hartwell et al., 1991; Nemeth & Hocutt, 1990). The observed 48-hour mortality of small estuarine fishes (e.g., sheepshead minnow, mummichog, Atlantic menhaden, striped bass, Atlantic silverside, fourspine stickleback, and rainwater killifish) exposed to electromagnetic pulses of 100–200 kilovolts per m (10 nanoseconds per pulse) from distances greater than 50 m was not statistically different than the control group (Hartwell et al., 1991; Nemeth & Hocutt, 1990). During a study of Atlantic menhaden, there were no statistical differences in swimming speed and direction (toward or away from the electromagnetic pulse source) between a group of individuals exposed to electromagnetic pulses and the control group (Hartwell et al., 1991; Nemeth & Hocutt, 1990).

Electromagnetic sensitivity in some marine fishes (e.g., salmonids) is already well developed at early life stages (Ohman et al., 2007); however, most of the limited research that has occurred focuses on adults. A laboratory study on Atlantic salmon showed no behavioral changes for adults and post-smolts passing through an area with a 50 Hz magnetic field activated (Armstrong et al., 2015). Some species appear to be attracted to undersea cables, while others show avoidance (Ohman et al., 2007). Under controlled laboratory conditions, the scalloped hammerhead (*Sphyrna lewini*) and sandbar shark (*Carcharhinus plumbeus*) exhibited altered swimming and feeding behaviors in response to very weak electric fields (less than 1 nanovolt per cm) (Kajiura & Holland, 2002). In a test of sensitivity to fixed magnets, five Pacific sharks were shown to react to magnetic field strengths of 2,500–234,000 microtesla at distances ranging between 0.26 and 0.58 m and avoid the area (Rigg et al., 2009). A field trial in the

Florida Keys demonstrated that southern stingrays (*Dasyatis americana*) and nurse sharks (*Ginglymostoma cirratum*) detected and avoided a fixed magnetic field producing a flux of 95,000 microtesla (O'Connell et al., 2010). A field study on white sharks (*Carcharodon carcharias*) in South Africa suggested behavioral changes in the sharks when approaching a towed prey item with an active electromagnetic field (Huveneers et al., 2013). No change was noticed in the sharks' behavior towards a static prey item. The maximum electromagnetic fields typically generated during Navy training and testing activities is approximately 2,300 microtesla.

Potential effects of electromagnetic activity on adult fishes may not be relevant to early life stages (eggs, larvae, juveniles) due to ontogenic (life stage-based) shifts in habitat utilization (Botsford et al., 2009; Sabates et al., 2007). Some skates and rays produce egg cases that occur on the bottom, while many neonate and adult sharks occur in the water column or near the water surface. Exposure of eggs and larvae (ichthyoplankton) to electromagnetic fields would be low since their distributions are extremely patchy. Early life history stages of ESA-listed steelhead occur in freshwater or estuarine habitats outside of the Study Area. For many sharks, skates, rays, and livebearers, the fecundity and natural mortality rates are much lower, and the exposure of the larger neonates and juveniles to electromagnetic energy would be similar across life stages for these species.

Based on current literature, only the fish groups identified above are capable of detecting electromagnetic fields (primarily elasmobranchs, tuna, eels, and stargazers) and thus will be carried forward in this section. The remaining major fish groups will not be presented further. Aspects of electromagnetic stressors that are applicable to marine organisms in general are described in Section C.1.2 (Conceptual Framework for Assessing Effects from Energy-Producing Activities) of this appendix.

### C.6.4 Physical Disturbance and Strike Stressors

How a physical strike affects a fish depends on the relative size of the object potentially striking the fish and the location of the fish in the water column. Before being struck by an object, an individual fish would sense a pressure wave through the water (Hawkins & Johnstone, 1978) and have the ability to swim away from the oncoming object. The movement generated by a large object moving through the water would simply displace small fishes in open water. Some fish might have time to detect the approaching object and swim away; others could be struck before they become aware of the object. An open-ocean fish that is displaced a small distance by movements from an object falling into the water nearby would likely continue on its original path as if nothing had happened. However, a bottom-dwelling fish near a sinking object would likely be disturbed, and may exhibit a general stress response, as described above in Section C.1 of this appendix. As in all vertebrates, the function of the stress response in fishes is to rapidly alter blood chemistry levels or ratios to prepare the fish to flee or fight (Helfman et al., 2009). This generally adaptive physiological response can become a liability to the fish if the stressor persists and the fish is not able to return to its baseline physiological state. When stressors are chronic, the fish may experience reduced growth, health, or survival (Wedemeyer et al., 1990). If the object hits the fish, direct injury (in addition to stress) or death may result.

The potential responses to a physical strike are varied, but include behavioral changes such as avoidance, altered swimming speed and direction, physiological stress, and physical injury or mortality. Despite their ability to detect approaching vessels using a combination of sensory cues (e.g., sight, hearing, and lateral line), larger slow-moving fishes (e.g., whale sharks [*Rhincodon typus*], manta rays [*Mobula* spp.), and ocean sunfish) cannot avoid all collisions, with some collisions resulting in mortality (Braun et al., 2015; Couturier et al., 2012; Deakos et al., 2011; Foderaro, 2015; Germanov & Marshall, 2014; Graham et al., 2012; Miller & Klimovich, 2016; Ramirez-Macias et al., 2012; Rowat et al., 2007; Speed et al., 2008; Stevens, 2007). Many fishes respond by darting quickly away from the stimulus. Some other species may respond by freezing in place and adopting cryptic coloration, while still some other species may respond in an unpredictable manner. Regardless of the response, the individual must stop its current activity and divert its physiological and cognitive attention to responding to the stressor (Helfman et al., 2009). The energy costs of reacting to a stressor depend on the specific situation, but in all cases the caloric requirements of stress reactions reduce the amount of energy available to the fish for other functions, such as predator avoidance, reproduction, growth, and maintenance (Wedemeyer et al., 1990).

The ability of a fish to return to its previous activity following a physical strike (or near-miss resulting in a stress response) is a function of a variety of factors. Some fish species are more tolerant of stressors than others and become re-acclimated more easily. Within a species, the rate at which an individual recovers from a physical strike may be influenced by its age, sex, reproductive state, and general condition. A fish that has reacted to a sudden disturbance by swimming at burst speed would tire after only a few minutes; its blood hormone and sugar levels (cortisol and glucose) may not return to normal for up to, or longer than, 24 hours. During its recovery period, the fish would not be able to attain burst speeds and would be more vulnerable to predators (Wardle, 1986). If the individual were not able to regain a steady state following exposure to a physical stressor, it may suffer reduced immune function and even death (Wedemeyer et al., 1990).

Potential effects of physical disturbance or strike to adults may be different than for other life stages (e.g., eggs, larvae, juveniles) because these life stages do not necessarily occur together in the same location (Botsford et al., 2009; Sabates et al., 2007), and because they have different response capabilities. The numbers of eggs and larvae exposed to vessel movements would be low relative to total ichthyoplankton biomass (Able & Fahay, 1998); therefore, measurable effects on fish recruitment would not be expected. Also, the early life stages of most marine fishes (excluding sharks and other livebearers) already have extremely high natural mortality rates (10–85 percent per day) from predation on these life stages (Helfman et al., 2009), and therefore, most eggs and larvae are not expected to survive to the next life stage (Horst, 1977).

### C.6.4.1 Effects from Vessels and In-Water Devices

Vessels do not normally collide with adult fishes, most of which can detect and avoid them. One study on Barents Sea capelin (*Mallotus villosus*) behavioral responses to vessels showed that most adults exhibit avoidance responses to engine noise, sonar, depth finders, and fish finders (Jorgensen et al., 2004), reducing the potential for vessel strikes. Misund (1997) found that

fishes, such as polar cod (*Boreogadus saida*), haddock (*Melanogrammus aeglefinus*), jack mackerel (*Trachurus symmetricus*), sardine (*Sardina pilchardus*), herring, anchovy (*Engraulis ringens*), and capelin, that were ahead of a ship showed avoidance reactions and did so at ranges of 50–350 m. When the vessel passed over them, some fishes responded with sudden avoidance responses that included lateral avoidance or downward compression of the school. Conversely, Rostad, (2006) observed that some fishes are attracted to different types of vessels (e.g., research vessels, commercial vessels) of varying sizes, noise levels, and habitat locations. Fishes involved in that study included herring (*Clupea harengus*), sprat (*Sprattus sprattus*), and whitefish (*Merlangius merlangus*) (Rostad et al., 2006). Fish behavior in the vicinity of a vessel is therefore quite variable, depending on the type of fish, its life history stage, behavior, time of day, and the sound propagation characteristics of the water (Schwartz, 1985). Early life stages of most fishes could be displaced by vessels and not struck in the same manner as adults of larger species. However, a vessel's propeller movement or propeller wash could entrain early life stages. The low-frequency sounds of large vessels or accelerating small vessels caused avoidance responses among herring (Chapman & Hawkins, 1973), but avoidance ended within 10 seconds after the vessel departed.

There are a few notable exceptions to this assessment of potential vessel strike effects on fish groups. Large slow-moving fishes such as whale sharks (Ramirez-Macias et al., 2012; Rowat et al., 2007; Speed et al., 2008; Stevens, 2007) and manta rays (Braun et al., 2015; Couturier et al., 2012; Deakos et al., 2011; Germanov & Marshall, 2014; Graham et al., 2012; Miller & Klimovich, 2016) may occur near the surface in open-ocean and coastal areas, thus making them more susceptible to ship strikes which may result in blunt trauma, lacerations, fin damage, or mortality. Stevens (2007) noted that increases in the numbers and sizes of shipping vessels in the modern cargo fleets make it difficult to gather strike-related mortality data for whale sharks because personnel on large ships are often unaware of collisions; therefore, the occurrence of vessel strikes is likely much higher than has been documented by the few studies that have been conducted. This holds true not just for whale sharks, but also for any of the aforementioned fish species.

Based on the typical physiological responses described in SEIS/OEIS Section 3.9.2.4, vessel movements are not expected to compromise the general health or condition of individual fishes, except for large slow-moving fishes such as whale sharks, manta rays, and ocean sunfish (Foderaro, 2015; Rowat et al., 2007; Speed et al., 2008; Stevens, 2007).

In-water devices do not normally collide with adult fishes, as most can detect and avoid them. Fish responses to in-water devices would be similar to those discussed above for vessels. Fishes would likely show varying behavioral avoidance responses to in-water devices. Early life stages of most fishes could be displaced by in-water devices and not struck in the same manner as adults of larger species. Because in-water devices are continuously moving, most fishes are expected to move away from them or to follow behind them.

### C.6.4.2 Effects from Military Expended Materials

While disturbance or strike from any of these objects as they sink through the water column is possible, it is not very likely for most expended materials because the objects generally sink through the water slowly and can be avoided by most, if not all fishes. Therefore, with the

exception of sinking exercises, the discussion of military expended materials strikes focuses on strikes at the surface or in the upper water column from fragments (of high explosives) and projectiles because those items have a greater potential for a fish strike as they hit the water, before slowing down as they move through the water column.

#### C.6.4.2.1 Ship Hulk

During a sinking exercise, aircraft, ship, and submarine crews fire or drop munitions on a seaborne target, usually a clean deactivated ship (Section 3.1, Sediments and Water Quality), which is deliberately sunk using multiple weapon systems. A description of sinking exercises is presented in Appendix A (Military Readiness Activities Descriptions). Sinking exercises occur in specific open ocean areas, outside of the coastal range complexes, in waters exceeding 3,000 m (9,842.5 ft.) in depth. Direct munitions strikes from the various weapons used in these exercises are a source of potential effect. However, these effects are discussed for each of those weapon categories in this section and are not repeated in the respective sections. Therefore, the analysis of sinking exercises as a strike potential for benthic fishes is discussed in terms of the ship hulk landing on the seafloor.

#### C.6.4.2.2 Small-. Medium-, and Large-Caliber Projectiles

Various types of projectiles could cause a temporary (seconds), localized effect when they strike the surface of the water. Current Navy training and testing in the Study Area, such as gunnery exercises and testing events, include firing a variety of weapons and using a variety of non-explosive training and testing rounds, including 5-inch naval gun shells, and small-, medium-, and large-caliber projectiles. The larger-caliber projectiles are primarily used in the open ocean beyond 20 NM. Direct munitions strikes from firing weapons are potential stressors to fishes. There is a remote possibility that an individual fish at or near the surface may be struck directly if it is at the point of impact at the time of non-explosive munitions delivery. Expended rounds may strike the water surface with sufficient force to cause injury or mortality. However, limited fish species swim right at, or near, the surface of the water (e.g., with the exception of pelagic sharks, flyingfishes, jacks, tuna, mackerels, billfishes, ocean sunfishes, and other similar species).

Various projectiles would fall on soft or hard bottom habitats, where they could either become buried immediately in the sediments or sit on the bottom for an extended time period. Most munitions would sink through the water column and come to rest on the seafloor, stirring up sediment and possibly inducing an alarm response, displacing, or injuring nearby fishes in extremely rare cases. Particular effects on a given fish species would depend on the size and speed of the munitions, the water depth, the number of rounds delivered, the frequency of training and testing, and the sensitivity of the fish (U.S. Department of the Navy, 2013d).

#### C.6.4.2.3 Bombs, Missiles, and Rockets

Direct munitions strikes from bombs, missiles, and rockets are potential stressors to fishes. Some individual fish at or near the surface may be struck directly if they are at the point of impact at the time of non-explosive munitions delivery. However, most missiles hit their target or are disabled before hitting the water. Thus, most of these missiles hit the water as fragments, which quickly dissipates their kinetic energy within a short distance of the surface. A

limited number of fishes swim right at, or near, the surface of the water, as described for small-, medium-, and large-caliber projectiles.

Even though statistical modeling conducted for the Study Area (discussed in Appendix F, Military Expended Materials and Direct Strike Analysis) indicates that the probability of military expended materials striking marine mammals or sea turtles is extremely low, modeling could not be conducted to estimate the probability of military expended material strikes on an individual fish. This is primarily due to the lack of fish density data available at the scale of a range complex or testing range.

In lieu of strike probability modeling, the number, size, and area of potential impact (or "footprints") of each type of military expended material is presented in Appendix F (Military Expended Materials and Direct Strike Analysis). The application of this type of footprint analysis to fish follows the notion that a fish occupying the impact area could be susceptible to potential effects, either at the water surface (e.g., pelagic sharks, flyingfishes, jacks, tunas, mackerels, billfishes, and ocean sunfishes) or as military expended material falls through the water column and settles to the bottom (e.g., flounders, skates, and other benthic fishes). Furthermore, most of the projectiles fired during training and testing activities are fired at targets, and most projectiles hit those targets, so only a very small portion of those would hit the water with their maximum velocity and force. Of that small portion, a small number of fish at or near the surface (pelagic fishes) or near the bottom (benthic fishes) may be directly affected if they are in the target area and near the expended item that hits the water surface (or bottom).

Propelled fragments are produced by an exploding bomb. Close to the explosion, fishes could potentially sustain injury or death from propelled fragments (Stuhmiller et al., 1991). However, studies of underwater bomb blasts have shown that fragments are large and decelerate rapidly (O'Keeffe & Young, 1984; Swisdak & Montanaro, 1992), posing little risk to marine organisms.

Fish disturbance or strike could result from bomb fragments (after explosion) falling through the water column in very small areas compared to the vast expanse of the testing ranges, range complexes, or the remainder of the Study Area. The expected reaction of fishes exposed to military expended materials would be to immediately leave the area where bombing is occurring, thereby reducing the probability of a fish strike after the initial expended materials hit the water surface. When a disturbance of this type concludes, the area would be repopulated and the fish stock would rebound, with inconsequential effects on the resource (Lundquist et al., 2010).

### C.6.4.3 Effects from Seafloor Devices

The number and location of activities including seafloor devices is presented in SEIS/OEIS Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]). Additional information on stressors by testing and training activity is provided in Appendix B (Activity Stressor Matrices). Seafloor devices include items that are placed on, dropped on, or moved along the seafloor such as mine shapes, anchor blocks, anchors, bottom-placed instruments, bottom-crawling unmanned underwater vehicles, and bottom-placed targets that are not expended. As discussed in the military expended materials

strike section, objects falling through the water column would slow in velocity as they sink toward the bottom and could be avoided by most, if not all fish.

Aircraft deployed mine shapes, anchor blocks, anchors, and bottom-placed instruments, and targets all have the potential to strike fish upon deployment as they sink through the water column and settle on the seafloor. Unmanned underwater vehicles (e.g., bottom crawl vehicles) also have the potential to strike a fish. Some fishes are attracted to virtually any tethered object in the water column for food or refuge (Dempster & Taquet, 2004) and could be attracted to a non-explosive mine assembly. However, while a fish might be attracted to the object, its sensory abilities allow it to avoid colliding with fixed tethered objects in the water column (Bleckmann & Zelick, 2009), so the likelihood of a fish striking one of these objects is implausible. Therefore, strike hazards associated with collision into other seafloor devices such as deployed mine shapes or anchored devices are highly unlikely to pose any strike hazard to fishes and are not discussed further.

### C.6.5 Entanglement Stressors

This section evaluates potential entanglement effects of various types of expended materials used by the Navy during training and testing activities within the Study Area. The likelihood of fishes being affected by an entanglement stressor is a function of the physical properties, location, and buoyancy of the object and the behavior and physical features of the fish, as described in Section C.1.3. Two types of military expended materials are considered here: (1) wires and cables and (2) decelerators/parachutes.

Most entanglement observations involve abandoned or discarded nets, lines, and other materials that form loops or incorporate rings (Derraik, 2002; Keller et al., 2010; Laist, 1987; Macfadyen et al., 2009). A 25-year dataset assembled by the Ocean Conservancy reported that fishing line, rope, and fishing nets accounted for approximately 68 percent of fish entanglements, with the remainder due to encounters with various items such as bottles, cans, and plastic bags (Ocean Conservancy, 2010). No occurrences involving military expended materials were documented.

Fish entanglement occurs most frequently at or just below the surface or in the water column where objects are suspended. A smaller number involve objects on the seafloor, particularly abandoned fishing gear designed to catch bottom fishes or invertebrates (Ocean Conservancy, 2010). More fish species are entangled in coastal waters and the continental shelf than elsewhere in the marine environment because of higher concentrations of human activity (e.g., fishing, sources of entangling debris), higher fish abundances, and greater species diversity (Helfman et al., 2009; Macfadyen et al., 2009). The consequences of entanglement range from temporary and inconsequential to major physiological stress or mortality.

Some fishes are more susceptible to entanglement in derelict fishing gear and other marine debris, compared to other fish groups. Physical features, such as rigid or protruding snouts of some elasmobranchs (e.g., the wide heads of hammerhead sharks), increase the risk of entanglement compared to fishes with smoother, more streamlined bodies (e.g., lamprey and eels). Most fishes, except for jawless fishes and eels that are too smooth and slippery to

become entangled, are susceptible to entanglement gear specifically designed for that purpose (e.g., gillnets).

The overall effects of entanglement are highly variable, ranging from temporary disorientation to mortality due to predation or physical injury. The evaluation of a species' entanglement potential should consider the size, location, and buoyancy of an object as well as the size, physical characteristics, and behavior of the fish species.

The following sections seek to identify entanglement potential due to military expended material. Where appropriate, specific geographic areas (open ocean areas, range complexes, and bays and inland waters) of potential effect are identified.

### C.6.5.1 Effects from Wires and Cables

Cables, guidance wires, and sonobuoys (which contain a wire) are used during military readiness activities. The number and location of items expended under each alternative is presented in the SEIS/OEIS Section 3.0 (Introduction), with additional details provided in Appendix B (Activity Stressor Matrices).

Fish groups that could be susceptible to entanglement in expended cables and wires are those such as sawfishes, with elongated snouts lined with tooth-like structures that easily snag on other similar marine debris, such as derelict fishing gear (Macfadyen et al., 2009). Some elasmobranchs (including hammerhead sharks and manta rays) and billfishes occurring within the offshore and continental shelf portions of the range complexes and testing ranges (where the potential for entanglement would occur) could be susceptible to entanglement in cables and wires. Species occurring outside the specified areas within these range complexes would not be exposed to fiber optic cables, guidance wires, or sonobuoy wire.

Once a guidance wire is released, it is likely to sink immediately and remain on the seafloor. In some cases, the wire may snag on a hard structure near the bottom and remain partially or completely suspended. The types of fish that encounter any given wire would depend, in part, on its geographic location and vertical location in the water column. In any situation, the most likely mechanism for entanglement would involve fish swimming through loops in the wire that tighten around it; however, loops are unlikely to form in a guidance wire or sonobuoy wire because of its size and rigidity (Environmental Science Advisory Committee, 2005).

Because of their physical characteristics, guidance wires and cables pose a potential, though unlikely, entanglement risk to susceptible fishes. Analysis of potential entanglement for fishes is based on abandoned monofilament, nylon, and polypropylene lines used in commercial nets. Such derelict fishing gear is abundant in the ocean (Macfadyen et al., 2009) and pose a greater hazard to fishes than wires expended by the Navy. Fishing gear materials often have breaking strengths that can be up to orders of magnitude greater than that of guidance wire and fiber optic cables (Environmental Science Advisory Committee, 2005), and are far more prone to tangling, as discussed in SEIS/OEIS Section 3.0 (Introduction). Fiber optic cables do not easily form loops, are brittle, and break easily if bent, so they pose a negligible entanglement risk. Additionally, the encounter rate and probability of effect from guidance wires and fiber optic cables are low, as few are expended (see Chapter 2, Description of Proposed Action and Alternatives, for further information).

Sonobuoys consist of a surface antenna and float unit and a subsurface hydrophone assembly unit. The two units are attached through a thin gauge dual conductor and hard draw copper strand wire, which is then wrapped by a hollow rubber tubing or bungee in a spiral configuration. The tensile breaking strength of the wire is a maximum of 40 lb. (Swope & McDonald, 2013). The length of the cable is housed in a plastic canister dispenser, which remains attached upon deployment. The length of wire that extends out is no more than 1,500 ft. and is dependent on the water depth and type of sonobuoy. Attached to the wire is a kite-drogue and damper disk stabilizing system made of non-woven nylon fabric. The nylon fabric is very thin and can be broken by hand. The cable runs through the stabilizing system and leads to the hydrophone components. The hydrophone components may be covered by thin plastic netting depending on type of sonobuoy but pose no entanglement risk. Each sonobuoy has a saltwater-activated polyurethane float that inflates when the sonobuoy is submerged and keeps the sonobuoy components floating vertically in the water column below it. Sonobuoys remain suspended in the water column for no more than 30 hours, after which they sink to the seafloor.

The sonobuoy itself is not considered an entanglement hazard for upon deployment (Environmental Science Advisory Committee, 2005), but its components may pose an entanglement hazard once released into the ocean. Aerial-launched sonobuoys are deployed with a decelerator/parachute. Sonobuoys contain cords, electronic components, and plastic mesh that may entangle fish (Environmental Science Advisory Committee, 2005). Open-ocean filter feeding species, such as whale sharks, scalloped hammerhead sharks, oceanic whitetip sharks, and manta rays could become entangled in these items, whereas smaller species could become entangled in the plastic mesh in the same manner as a small gillnet. Since most sonobuoys are expended in offshore areas, many coastal fishes would not encounter or have any opportunity to become entangled in materials associated with sonobuoys.

### C.6.5.2 Effects from Decelerators/Parachutes

Decelerators/Parachutes of varying sizes are used during training and testing activities. Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]) describes the use and platforms where decelerators/parachutes would be released into the marine environment. Table 3.0-13 presents the size categories for decelerators/parachutes expended during training and testing activities that could present an entanglement risk to fishes. The types of activities that use decelerators/parachutes, physical characteristics and size of decelerators/parachutes, locations where decelerators/parachutes are used, and the number of decelerator/parachute activities proposed under each alternative are presented in Appendix B (Activity Stressor Matrices). Fishes face many potential entanglement scenarios in abandoned monofilament, nylon, polypropylene line, and other derelict fishing gear in the nearshore and offshore marine habitats of the Study Area (Macfadyen et al., 2009; Ocean Conservancy, 2010). Abandoned fishing gear is dangerous to fishes because it is abundant, essentially invisible, strong, and easily tangled. In contrast, decelerators/parachutes are rare, highly visible, and not designed to capture fishes. The weak entangling features reduce the risk to ESA-protected fishes.

Once a decelerator/parachute has been released to the water, it poses a potential entanglement risk to fishes. The Naval Ocean Systems Center identified the potential effects of torpedo air launch accessories, including decelerators/parachutes, on fish (U.S. Department of the Navy, 2001a). Unlike other materials in which fish become entangled (such as gill nets and nylon fishing line), the decelerator/parachute is relatively large and visible, reducing the chance that visually oriented fish would accidentally become entangled in it. No cases of fish entanglement have been reported for decelerators/parachutes (Ocean Conservancy, 2010; U.S. Department of the Navy, 2001a). Entanglement in a newly expended decelerator/parachute and its attachment lines while it is in the water column is unlikely because fish generally react to sound and motion at the surface with a behavioral reaction by swimming away from the source and would detect the oncoming decelerator/parachute in time to avoid contact. While the decelerator/parachute is sinking, fish would have ample opportunity to swim away from the large moving object. Even if the decelerator/parachute landed directly on a fish, it would likely be able to swim away faster than the decelerator/parachute would sink because the resistance of the water would slow the decelerator/parachute's downward motion.

Once the decelerator/parachute is on the bottom, however, it is feasible that a fish could become entangled in the decelerator/parachute or its attachment lines while diving and feeding, especially in deeper waters where it is dark. If the decelerator/parachute is dropped in an area of strong bottom currents, it could billow open and pose a short-term entanglement threat to large fish feeding on the bottom. Benthic fishes with elongated spines could become caught on the decelerator/parachute or lines. Most sharks and other smooth-bodied fishes are not expected to become entangled because their soft, streamlined bodies can more easily slip through potential snares. A fish with spines or protrusions (e.g., some sharks [including hammerheads], manta rays, and billfishes,) on its body that swam into the decelerator/parachute or a loop in the lines, and then struggled, could become bound tightly enough to prevent escape. Although this scenario is possible based on the structure of the materials and the shape and behavior of fishes, it is not considered a likely event.

### C.6.6 Ingestion Stressors

Aspects of ingestion stressors that are applicable to marine organisms in general are presented in Section C.1.5 (Conceptual Framework for Assessing Effects from Ingestion) of this appendix. Ingestion of expended materials by fishes could occur in coastal and open ocean areas, and can occur at or just below the surface, in the water column, or at the seafloor depending on the size and buoyancy of the expended object and the feeding behavior of the fish. Floating material is more likely to be eaten by fishes that feed at or near the water surface (e.g., ocean sunfish, manta rays, or flyingfishes), while materials that sink to the seafloor present a higher risk to bottom-feeding fishes (e.g., hammerhead sharks, rays, and flounder).

It is reasonable to assume that any item of a size that can be swallowed by a fish could be eaten at some time; this analysis focuses on ingestion of materials in two locations: (1) at the surface or water column and (2) at the seafloor. The potential for fish, including the ESA-listed fish species, to encounter and ingest expended materials is evaluated with respect to their feeding group and geographic range, which influence the probability that they would eat military expended materials.

The Navy expends the following types of materials during training and testing in the Study Area that could become ingestion stressors: non-explosive practice munitions (small- and medium-caliber), fragments from high-explosives, fragments from targets, chaff, flare casings (including plastic end caps and pistons), and small decelerators/parachutes. The location and number of activities that expend these items are detailed in Section 3.0 (Introduction) and in Appendix B (Activity Stressor Matrices). Metal items eaten by fish are generally small (such as fishhooks, bottle caps, and metal springs), suggesting that small- and medium-caliber projectiles, pistons, or end caps (from chaff canisters or flares) are more likely to be ingested. Both physical and toxicological effects could occur as a result of consuming metal or plastic materials (Dantas et al., 2012; Davison & Asch, 2011; Possatto et al., 2011). Ingestion of plastics has been shown to increase hazardous chemicals in fish leading to liver toxicity of fishes (Rochman et al., 2013). Items of concern are those of ingestible size that either drift at or just below the surface (or in the water column) for a time or sink immediately to the seafloor. The likelihood that expended items would cause a potential effect on a given fish species depends on the size and feeding habits of the fish and the rate at which the fish encounters the item and the composition of the item. In this analysis only small- and medium-caliber munitions (or small fragments from larger munitions), chaff, small decelerators/parachutes, and end caps and pistons from flares and chaff cartridges are of ingestible size for a fish. For many small fish species (e.g., anchovy, sardines), even these items (except for chaff) are often too large to be ingested, even though small pieces could sometimes be nibbled off by small fishes. Therefore, the discussion in this section focuses on those fish species large enough to potentially ingest these materials.

The analysis of ingestion effects on fishes is structured around the following feeding strategies:

#### C.6.6.1.1 Feeding at or Just Below the Surface or Within the Water Column

- **Open-Ocean Predators.** Large, migratory, open-ocean fishes, such as tunas, mahi mahi, sharks, and billfishes, feed on fast-swimming prey in the water column of the Study Area. These fishes range widely in search of unevenly distributed food patches. Smaller military expended materials could be mistaken for prey items and ingested purposefully or incidentally as the fish is swimming. A few of these predatory fishes (e.g., tiger sharks) are known to ingest any type of marine debris that they can swallow, even automobile tires. Some marine fishes, such as tunas, eat plastic fragments, strings, nylon lines, ropes, or even small light bulbs (Choy & Drazen, 2013; Rochman et al., 2015).
- **Open-Ocean Planktivores.** Plankton-eating fishes in the open-ocean portion of the Study Area include flyingfishes, ocean sunfish, manta rays, and whale sharks. These fishes feed by either filtering plankton from the water column or by selectively ingesting larger zooplankton. These planktivores could encounter and incidentally feed on smaller types of military expended materials (e.g., chaff, end caps, pistons) at the surface or in the water column. Giant manta rays are the only ESA-listed species in the Study Area that is an open ocean planktivore, while some species in this group of fishes (e.g., jacks) constitute a major prey base for many important predators, including tunas, sharks, marine mammals, and seabirds. While not a consumer of plankton, the ocean sunfish eats jellyfish and may consume a decelerator/parachute by accident at or just below the

surface in the open ocean. Larger filter feeders such as whale sharks and manta rays could also inadvertently ingest a decelerator/parachute.

Military expended materials that could potentially affect these types of fish at or just below the surface or in the water column include those items that float or are suspended in the water column for some period of time (e.g., decelerators/parachutes and end caps and pistons from chaff cartridges or flares).

#### C.6.6.1.2 Fishes Feeding at the Seafloor

- **Bottom Dwelling Predators.** Large predatory fishes near the seafloor are represented by groupers, which are typical seafloor predators in the Study Area. These species feed opportunistically on or near the bottom, taking fish and invertebrates from the water column and from the bottom (e.g., crabs, octopus). Bottom-dwelling fishes in the nearshore coasts may feed by seeking prey and by scavenging on dead fishes and invertebrates (e.g., skates, rays, flatfishes).
- **Bottom Dwelling Foragers and Scavengers**. Bottom dwelling fishes may feed by seeking prey and by scavenging on dead fishes and invertebrates. Flatfishes, rays, and some sharks in the Study Area feed along the bottom on small fish and invertebrate prey, which could increase the likelihood of incidental ingestion of marine debris.

Military expended materials that could be ingested by fishes at the seafloor include items that sink (e.g., small-caliber projectiles and casings, fragments from high-explosive munitions).

Potential effects of ingestion on some adult fishes are different than for other life stages (eggs, larvae, and juveniles) because early life stages for some species are too small to ingest any military expended materials except for chaff, which has been shown to have limited effects on fishes in the concentration levels that it is released at (Arfsten et al., 2002; U.S. Department of the Air Force, 1997; U.S. Department of the Navy, 1999). Therefore, with the exception of later stage larvae and juveniles that could ingest microplastics, no ingestion potential effects on early life stages are expected.

Within the context of fish location in the water column and feeding strategies, the analysis is divided into (1) munitions (small- and medium-caliber projectiles, and small fragments from larger munitions); and (2) military expended material other than munitions (chaff, chaff end caps, pistons, decelerators/parachutes, flares, and target fragments).

### C.6.6.2 Effects from Military Expended Materials

Different types of explosive and non-explosive practice munitions are expended at sea during training and testing activities. This section analyzes the potential for fishes to ingest non-explosive practice munitions and fragments from high explosive munitions.

Types of non-explosive practice munitions generally include projectiles, missiles, and bombs. Of these, only small- or medium-caliber projectiles would be small enough for a large fish to ingest. Small- and medium-caliber projectiles include all sizes up to and including 2.25 inches in diameter. These solid metal materials would quickly move through the water column and settle to the seafloor. Ingestion of non-explosive practice munitions in the water column is possible when shiny fragments of the munitions sink quickly and could be ingested by fast, mobile

predators that chase moving prey (e.g., tunas, jacks, billfishes, swordfishes, dolphinfishes, mackerel, wahoo, and barracudas). In addition, these fragments may also be accidentally ingested by fishes that forage on the bottom such as flatfishes, skates, and rays. Types of high explosive munitions that can result in fragments include demolition charges, projectiles, missiles, and bombs. Fragments would result from fractures in the munitions casing and would vary in size depending on the size of the net explosive weight and munitions type; however, typical sizes of fragments are unknown. These solid metal materials would quickly move through the water column and settle to the seafloor. Similar to non-explosive practice munitions described above, ingestion of high-explosive munition fragments by fast-moving mobile predators such tunas, jacks, billfishes, swordfishes, dolphinfishes, mackerel, wahoo, and barracudas in the water column is possible. In the unlikely event that explosive material, high-melting-point explosive (known as HMX), or royal demolition explosive (known as RDX) is exposed on the ocean floor, it would break down in a few hours (U.S. Department of the Navy, 2001b, 2001c). High-melting-point explosive or royal demolition explosive would not accumulate in the tissues of fish (Lotufo et al., 2010; Price et al., 1998). Fragments are primarily encountered by species that forage on the bottom.

It is possible that expended small-caliber projectiles on the seafloor could be colonized by seafloor organisms and mistaken for prey or that expended small-caliber projectiles could be accidentally or intentionally eaten during foraging. Over time, the metal may corrode or become covered by sediment in some habitats, reducing the likelihood of a fish encountering the small caliber, non-explosive practice munitions.

The potential effects of ingesting foreign objects on a given fish depend on the species and size of the fish. Fish that normally eat spiny, hard-bodied invertebrates may have tougher mouths and digestive systems than fish that normally feed on softer prey. Materials that are similar to the normal diet of a fish would be more likely to be ingested and more easily handled once ingested—for example, by fishes that feed on invertebrates with sharp appendages. These items could include fragments from high explosives that a fish could encounter on the seafloor. Relatively small or smooth objects, such as small caliber projectiles or their casings, might pass through the digestive tract without causing harm. A small sharp-edged item could cause a fish immediate physical distress by tearing or cutting the mouth, throat, or stomach. If the object is rigid and large (relative to the fish's mouth and throat), it may block the throat or obstruct the flow of waste through the digestive system. An object may be enclosed by a cyst in the gut lining (Danner et al., 2009; Hoss & Settle, 1990). Ingestion of large foreign objects could lead to disruption of a fish's normal feeding behavior, which could be sublethal or lethal.

Fishes feed throughout the water column and could mistake many types of marine debris for prey items. Ingesting nonfood items is common among a variety of marine fishes, particularly those that feed on the seafloor (Boerger et al., 2010; Hoss & Settle, 1990; Jackson et al., 2000). Many fishes are also known to accidentally ingest plastic materials, and the extent to which an individual fish might discriminate between a plastic item perceived as prey and an indistinct or less appealing shape is not clear. Once eaten, any type of plastic could cause digestive problems for the fish (Danner et al., 2009). Fishes have been reported to ingest a variety of materials or debris, such as plastic pellets, bags, rope, and line (Hoss & Settle, 1990; Jackson et al., 2000). As

discussed above in Section 3.9.2.6 (Ingestion Stressors), some fish species such as the ocean sunfish eat jellyfish and may consume a decelerator/parachute at or just below the surface in the open ocean by accident. Larger filter feeders such as whale sharks and manta rays could also inadvertently ingest a small or medium decelerator/parachute.

Chaff is used throughout the Study Area. It is composed of an aluminum alloy coating on glass fibers of silicon dioxide and is released or dispensed in cartridges or projectiles that contain millions of fibers. Based on the small size of chaff fibers, fish would likely not confuse the fibers with prey items or purposefully feed on them. However, some fishes could occasionally ingest low concentrations of chaff incidentally while feeding on prey items on the surface, in the water column, or the seafloor. Chaff fiber ingestion is not expected to affect fishes based on the low concentration that could reasonably be ingested and the small size of the chaff fibers. Therefore, exposure to chaff would cause no injury, mortality, or tissue damage to fishes. Potential effects of chaff ingestion by fish are not discussed further. Effects of ingestion of the end caps or pistons associated with chaff cartridges are analyzed together with effects of flares below.

Chaff end caps and pistons sink in saltwater (U.S. Department of the Navy, 1999). Fishes feeding on the where chaff canisters and flares are expended (e.g., range complexes would be more likely to encounter and ingest these items than in other locations. Ingested end caps or pistons could disrupt a fish's feeding behavior or digestive processes. If the item is particularly large relative to the fish ingesting it, the item could become permanently encapsulated by the stomach lining, and potentially lead to starvation and death (Danner et al., 2009; Hoss & Settle, 1990). The highest density of chaff and flare end caps/pistons would be expended in the MIRC. Based on the low environmental concentration (Section 3.1, Sediments and Water Quality), it is unlikely that a larger number of fishes would ingest an end cap or piston, much less a harmful quantity. Furthermore, a fish might expel the item before swallowing it. The number of fish potentially affected by ingestion of end caps or pistons would be low based on the low environmental concentration and population-level effects are not expected to occur.

As described above, surface-feeding fishes have little opportunity to ingest end caps or pistons before they sink. However, some of these items could become entangled in dense algal mats near the surface. Predatory open-ocean fishes, such as tunas, dolphinfishes, and billfishes, are attracted to the many small prey species associated with algal mats. While foraging near the floating mats, predatory fishes may incidentally ingest end caps and pistons. The density of these items in any given location would vary based on release points and dispersion by wind and water currents. The number of end caps and pistons that would remain at or just below the surface in algal mats and potentially available to fish is unknown. Unlike other plastic types of marine debris, end caps and pistons are heavier than water and not expected to float unless they are enmeshed in algal or other floating debris.

Most materials associated with airborne mine neutralization system activities are recovered, but pieces of fiber optic cable may be expended (U.S. Department of the Navy, 2001a). For a discussion of the physical characteristics of these expended materials, where they are used, and the number of activities in each alternative, please see Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]). Only small amounts of fiber

optic cable would be deposited onto the seafloor each year, and the small amount of fiber optic cable expended during training and testing would sink to the seafloor. Highly migratory pelagic predators (e.g., tunas, billfishes, pelagic sharks) would be unlikely to encounter the small, dispersed lengths of fiber optic cable unless they were in the immediate area when the cable was expended. The low number of fiber optic cables expended in the Study Area during this activity makes it unlikely that fishes would encounter any fiber optic cables. Potential effects of fiber optic cable ingestion by fishes are not discussed further.

## C.6.7 Secondary Stressors

### C.6.7.1 Explosions

Secondary effects on fishes resulting from explosions at the surface, in the water column, or on the bottom would be associated with changes to habitat structure and effects to prey species. Most explosions on the bottom would occur in soft bottom habitat and would displace some amount of sediment, potentially resulting in cratering. However, water movement would redistribute the affected sediment over time. A small amount of sediment would be suspended in the water column temporarily (turbidity) but would resettle to the bottom. Activities that inadvertently result in explosions on or near hard bottom habitat or reefs could break hard structures and reduce the amount of colonizing surface available to encrusting organisms (e.g., corals, sponges). Given the large spatial area of the range complexes compared to the small percentage covered by hard bottom habitat, it is unlikely that most of the small, medium, and large projectiles expended in the Study Area would fall onto this habitat type. Furthermore, these activities are distributed within discrete locations within the Study Area, and the overall footprint of these areas is quite small with respect to the spatial extent of biogenic habitat within the Study Area.

Sinking exercises could also provide secondary effects on deep sea populations. These activities occur in open-ocean areas, outside of the coastal range complexes, with potential direct disturbance or strike effects on deep-sea fishes, as covered in Section 3.9.2.4 (Physical Disturbance and Strike Stressors). Secondary effects on these fishes could occur after the ship hulks sink to the seafloor. Over time, the ship hulk would be colonized by marine organisms that attach to hard surfaces. For fishes that feed on these types of organisms, or whose abundances are limited by available hard structural habitat, the ships that are sunk during sinking exercises could provide an incidental beneficial effect on the fish community (Love & York, 2005; Macreadie et al., 2011).

The alternatives could result in localized and temporary changes to the benthic community during activities that affect fish habitat. Fish habitat could become degraded during activities that would strike the seafloor or introduce military expended materials, bombs, projectiles, missiles, rockets or fragments to the seafloor. During or following activities that affect benthic habitats, fish species may experience loss of available benthic prey at locations in the Study Area where these items might be expended. Additionally, plankton and zooplankton that are eaten by fishes may also be negatively affected by these same expended materials. The spatial area of habitat affected by the Proposed Action would be relatively small compared to the available habitat in the Study Area. However, there would still be vast expanses of habitat adjacent to the areas of habitat effect that would remain undisturbed by the Proposed Action.

Most of the physical and biological features required by steelhead are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, there would be no effects associated with secondary stressors.

### C.6.7.2 Explosion By-Products

Deposition of undetonated explosive materials into the marine environment can be reasonably well estimated by the known failure and low-order detonation rates of high explosives. Undetonated explosives associated with mine neutralization activities are collected after the activity is complete; therefore, potential effects are assumed to be inconsequential for these training and testing activities, but other activities could result in unexploded munitions and unconsumed explosives on the seafloor. Fishes may be exposed by contact with the explosive, contact with contaminants in the sediment or water, and ingestion of contaminated sediments.

High-order explosions consume most of the explosive material, creating typical combustion products. In the case of royal demolition explosive, 98 percent of the products are common seawater constituents, and the remainder is rapidly diluted below threshold effect level. Explosion byproducts associated with high order detonations present no indirect stressors to fishes through sediment or water. However, low order detonations and unexploded munitions present elevated likelihood of effects on fishes.

Indirect effects of explosives and unexploded munitions to fishes via sediment is possible in the immediate vicinity of the munitions. Degradation of explosives proceeds via several pathways discussed in Section 3.1 (Sediments and Water Quality). Degradation products of royal demolition explosive are not toxic to marine organisms at realistic exposure levels (Rosen & Lotufo, 2010). Trinitrotoluene (TNT) and its degradation products affect developmental processes in fishes and are acutely toxic to adults at concentrations similar to real-world exposures (Halpern et al., 2008; Rosen & Lotufo, 2010). Relatively low solubility of most explosives and their degradation products means that concentrations of these contaminants in the marine environment are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in marine sediment approximately 0.15–0.3 m away from degrading munitions, the concentrations of these compounds were not statistically distinguishable from background beyond 1–2 m from the degrading munitions (Section 3.1, Sediments and Water Quality). Taken together, it is likely that various life stages of fishes could be affected by the indirect effects of degrading explosives within a very small radius of the explosive (0.3–2 m).

If a high explosive munition does not explode, it would sink to the bottom. In the unlikely event that explosive material, high-melting-point explosive (known as HMX), or royal demolition explosive (known as RDX) is exposed on the ocean floor, it would break down in a few hours (U.S. Department of the Navy, 2001c). High-melting-point explosive or royal demolition explosive would not accumulate in the tissues of fishes (Lotufo et al., 2010; Price et al., 1998). Fish may take up TNT from the water when it is present at high concentrations but not from sediments (Lotufo et al., 2010). The rapid dispersal and dilution of TNT expected in the marine water column reduces the likelihood of a fish encountering high concentrations of TNT to near zero.

A series of research efforts focused on World War II underwater munitions disposal sites in Hawaii (Briggs et al., 2016; Edwards et al., 2016; Kelley et al., 2016; Koide et al., 2016; University of Hawaii, 2010) and an intensively used live fire range in the Mariana Islands (Smith & Marx, 2016) provide information in regard to the effects of undetonated materials and unexploded munitions on marine life. Findings from these studies indicate that there were no adverse effects on the local ecology from the presence of degrading munitions and there was no bioaccumulation of munitions-related chemicals in local marine species. Therefore, water quality effects from the use of munitions, expended material, or devices would be negligible, would have no long-term effect on water quality, and therefore would not constitute a secondary indirect stressor for fishes.

### C.6.7.3 Metals

Certain metals and metal-containing compounds at concentrations above background levels (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) can be toxic to fishes (Wang & Rainbow, 2008). Metals are introduced into seawater and sediments as a result of training and testing activities involving vessel hulks, targets, munitions, batteries, and other military expended materials (Section 3.1, Sediments and Water Quality). Some metals bioaccumulate, and physiological effects begin to occur only after several trophic transfers concentrate the toxic metals (U.S. Department of the Navy, 2012). Indirect effects of metals on fish via sediment and water involve concentrations several orders of magnitude lower than concentrations achieved via bioaccumulation. Fishes may be exposed by contact with the metal, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Concentrations of metals in seawater are orders of magnitude lower than concentrations in marine sediments. It is extremely unlikely that fishes would be indirectly affected by toxic metals via the water.

### C.6.7.4 Chemicals

Several Navy training and testing activities introduce potentially harmful chemicals into the marine environment, principally flares and propellants for rockets, missiles, and torpedoes. Polychlorinated biphenyls are discussed in Section 3.1 (Sediments and Water Quality), but there is no additional risk to fish because the Proposed Action does not introduce this chemical into the Study Area and the use of polychlorinated biphenyls has been nearly zero since 1979. Properly functioning flares, missiles, rockets, and torpedoes combust most of their propellants, leaving benign or readily diluted soluble combustion byproducts (e.g., hydrogen cyanide). Operational failures allow propellants and their degradation products to be released into the marine environment.

The greatest risk to fishes from flares, missiles, and rocket propellants is perchlorate, which is highly soluble in water, persistent, and affects metabolic processes in many plants and animals. Fishes may be exposed by contact with contaminated water or ingestion of re-suspended contaminated sediments. Since perchlorate is highly soluble, it does not readily adsorb to sediments. Therefore, missile and rocket fuels pose no risk of indirect effect on fishes via sediment. In contrast, the principal toxic components of torpedo fuel, propylene glycol dinitrate and nitrodiphenylamine, adsorbs to sediments, have relatively low toxicity, and are readily degraded by biological processes (Section 3.1, Sediments and Water Quality). It is conceivable

that various life stages of fishes could be indirectly affected by propellants via sediment in the immediate vicinity of the object (e.g., within a few inches), but these potential effects would diminish rapidly as the propellant degrades.

### C.6.7.5 Other Materials

Some military expended materials (e.g., decelerators/parachutes) could become remobilized after their initial contact with the seafloor (e.g., by waves or currents) and could pose an entanglement or ingestion hazard for fishes. For example, in some bottom types without strong currents, hard-packed sediments, and low biological productivity, items such as projectiles might remain intact for some time before becoming degraded or broken down by natural processes. These potential effects may cease only (1) when the military expended materials are too massive to be mobilized by typical oceanographic processes, (2) if the military expended materials become encrusted by natural processes and incorporated into the seafloor, or (3) when the military expended materials become permanently buried. In this scenario, a decelerator/parachute could initially sink to the seafloor, but then be transported laterally through the water column or along the seafloor, increasing the opportunity for entanglement. In the unlikely event that a fish would become entangled, injury or mortality could result. In contrast to large decelerators/parachutes, other devices with decelerators such as sonobuoys are typically used in deep open ocean areas. These areas are much lower in fish numbers and diversity, so entanglement hazards are greatly reduced for commercially and recreationally targeted species (ex. tuna, swordfish), as well as mesopelagic prey of other species. The entanglement stressor would eventually cease to pose an entanglement risk as it becomes encrusted or buried.

## C.7 Marine Mammals

### C.7.1 Acoustic Stressors

Background information supporting the analysis of acoustic stressors is presented in the *Acoustic and Explosives Concepts Technical Report*.

### C.7.2 Explosive Stressors

Background information supporting the analysis of explosive stressors is presented in the *Acoustic and Explosives Concepts Technical Report*.

### C.7.3 Energy Stressors

#### C.7.3.1 Effects from In-Water Electromagnetic Devices

There has been renewed interest in this topic of inquiry given the potential for electromagnetic fields generated by undersea power cables to possibly affect geo-navigation in migrating marine mammals (Gill et al., 2014; Kremers et al., 2016b; Kremers et al., 2014; Zellar et al., 2017). Horton et al. (2017) have indicated that future experiments involving empirical observation of free-ranging animals are still required for there to be sufficient evidence demonstrating causal relations between marine mammal movement decisions and environmental cues such as Earth's magnetic field.

Most of the early research investigated the possible correlations of where live-stranding locations occurred to determine if there was an associated local variation in Earth's magnetic field (Kirschvink, 1990; Klinowska, 1985; Walker et al., 1992). Species included long-finned and short-finned pilot whales, striped dolphin, Atlantic spotted dolphin, Atlantic white-sided dolphin, fin whale, common dolphin, harbor porpoise, sperm whale, and pygmy sperm whale, which had live stranding locations that correlated with areas where the earth's magnetic field was locally weaker than surrounding areas (Kirschvink, 1990). These statistical associations for locally weaker areas represented a total intensity variation of less than 0.05 microtesla in the magnetic field (Kirschvink et al., 1986). While this correlation seemed to have also been demonstrated for bottlenose dolphins in the Atlantic (Kirschvink et al., 1986), there was no correlation found in the Pacific (Kirschvink, 1990). Subsequent research regarding fin whale sightings over the continental shelf off the northeastern United States was consistent with the findings involving stranded fin whales (Kirschvink, 1990), supporting the hypothesis that fin whales possess a magnetic sense and that they use it to migrate (Walker et al., 1992). Bureau of Ocean Energy Management (2011) reviewed available information on electromagnetic and magnetic field sensitivity of marine organisms (including marine mammals) for effect assessment of offshore wind farms for the U.S. Department of the Interior and concluded there was behavioral, anatomical, and theoretical evidence indicating that cetaceans sense magnetic fields.

Anatomical evidence suggests the presence of magnetic material in the brain (Pacific common dolphin, Dall's porpoise, bottlenose dolphin, goose-beaked whale, and the humpback whale) and in the tongue and lower jawbones (harbor porpoise) (Bauer et al., 1985; Kirschvink, 1990). Zoeger et al. (1981) found what appeared to be nerve fibers associated with the magnetic material in a Pacific common dolphin and proposed that it may be used as a magnetic field receptor. Electrosensitivity was found in the Guiana dolphin (Czech-Damal et al., 2011). Kuzhetsov (1999) conducted experiments exposing bottlenose dolphins to permanent magnetic field intensities of 32, 108, and 168 microteslas and showed both behavioral and physiological reactions during 79 percent, 63 percent, and 53 percent of the trials, respectively (as summarized in Bureau of Ocean Energy Management (2011)). Behavioral reactions included sharp exhalations, acoustic activity, and movement, while physiological reactions included a change in heart rate. Kremers et al. (2014) conducted another experiment to observe the spontaneous reactions of captive bottlenose dolphins from a magnetized device compared to a demagnetized device. Results from this experiment confirmed that dolphins are capable of perceiving magnetic fields from a distance of more than 1.5 m from the 1.2 tesla magnetic strength device; creating a magnetic field with a strength of approximately 0.051 to 0.240 tesla between 2 to 5 cm from the source (Kremers et al., 2014). The dolphins approached the magnetized device with shorter latency compared to the demagnetized device that was identical in form and density and otherwise undistinguishable through echolocation (Kremers et al., 2014). The findings also suggest that dolphins may be able to discriminate between two items based on their magnetic properties (Kremers et al., 2016a). It is still unclear whether magnetic fields are attractive or repulsive to dolphins (Kremers et al., 2016a; Kremers et al., 2014) and further studies on the magnetic perception threshold on dolphin behavior need to be conducted (Kremers et al., 2016a).

Although it is not fully understood, based on the available evidence described above, it is probable that marine mammals use Earth's magnetic field for orientation or migration (Walker et al., 1992). If a marine mammal was in proximity of an in-water electromagnetic field source associated with Navy training and testing, emitting a field strong enough to be detected, and that animal is sensitive to the exposure, it is conceivable that this electromagnetic field could have an effect on a marine mammal, specifically interfering with that animal's ability to navigate.

### C.7.3.2 Effects from High-Energy Lasers

As discussed in Section 3.0.3.3.3.3 (Lasers) in the 2020 SEIS/OEIS, high-energy laser weapons are designed to disable surface targets, rendering them immobile. The primary effect from high-energy lasers would be from the laser beam striking a marine mammal at or near the water's surface, which could result in injury or death.

Marine mammals could be exposed to a laser only if the beam missed the target. Should the laser strike the sea surface, individual marine mammals at or near the surface could be exposed. The potential for exposure to a high-energy laser beam decreases as the water depth increases. However, high-energy lasers automatically cease transmitting laser light if target lock is lost, eliminating any reasonably foreseeable potential for a marine mammal to be adversely affected by the laser.

## C.7.4 Physical Disturbance and Strike Stressors

### C.7.4.1 Effects from Vessels and In-Water Devices

Surface vessels can be a source of acute and chronic disturbance for cetaceans (Au & Green, 2000; Bejder et al., 2006; Hewitt, 1985; Lusseau et al., 2009; Magalhães et al., 2002; Nowacek et al., 2007; Nowacek et al., 2004b; Richter et al., 2006; Richter et al., 2003; Schoeman et al., 2020; Watkins, 1986; Würsig & Richardson, 2009). Studies have established that cetaceans engage in avoidance behavior when surface vessels move toward them. Overall, strike avoidance success is dependent on a marine mammal's ability to identify and locate the vessel from its radiated sound and the animal's ability to maneuver away from the vessel in time.

Various research findings report that mysticetes have variable responses to vessels dependent on the context (Nowacek et al., 2004a; Richardson et al., 1995; Watkins, 1986). Similarly, odontocetes have also demonstrated responses to vessels. One study showed that harbor porpoises in a net-pen displayed behavioral responses (increasing swim speed or repeated alternating surfacing and diving behaviors [i.e., porpoising]) to the high-frequency components of vessel noise at long ranges (more than 1,000 m) in shallow waters (Dyndo et al., 2015). These distances correspond to where radiated noise would be more likely to elicit the response, rather than physical presence of the vessel (Dyndo et al., 2015; Palka & Hammond, 2001). Conversely, another study demonstrated that physical vessel presence, and not just noise, was associated with a short-term reduction in foraging activity in bottlenose dolphins (Pirotta et al., 2015). It is noteworthy that the dolphins associated with this report were exposed primarily to commercial and leisure boat traffic, not related to military vessel activities. Even repeated exposures from increasing vessel traffic in the same area resulting in increased responses to the disturbance may not be biologically significant. Mathematical modeling has predicted that

bottlenose dolphin population dynamics would remain unchanged from a sixfold increase in vessel traffic (70 to 470 vessels per year) as dolphins are able to compensate for increased disturbance levels with little to no effects on health and vital rates (New et al., 2013). Aside from the potential for an increased risk of strike addressed below, physical disturbance from vessel use is not expected to result in more than a short-term behavioral response.

In some circumstances, marine mammals respond to vessels with the same behavioral repertoire and tactics they employ when they encounter predators. It is not clear what environmental cue or cues marine animals might respond to; they may include the sounds of water being displaced by the ships, the sounds of the ships' engines, or a combination of environmental cues surface vessels produce while they transit. For example, in one study, North Atlantic right whales showed little overall reaction to the playback of sounds of approaching vessels, but they did respond to a novel sound by swimming strongly to the surface, which may increase their risk of strike (Nowacek et al., 2004a).

Vessel strikes from commercial, recreational, and Navy vessels are known to have resulted in serious injury and occasional fatalities to cetaceans (Abramson et al., 2011; Berman-Kowalewski et al., 2010; Calambokidis, 2012; Douglas et al., 2008; Laggner, 2009; Lammers et al., 2003; Ransome et al., 2021; Scordino et al., 2023; Van der Hoop et al., 2013; Van der Hoop et al., 2012). Reviews of the literature on ship strikes mainly involve strikes between commercial vessels and whales (Jensen & Silber, 2004; Laist et al., 2001; Monnahan et al., 2015). Juvenile whales of some species may be particular vulnerable to vessel strikes due to their particular habitat use and surface foraging behavior in nearshore waters, where smaller vessel number are higher (Scordino et al., 2023; Stepanuk et al., 2021).

Vessel speed, size, and mass are all important factors in determining potential impacts of a vessel strike to marine mammals (Conn & Silber, 2013; Gende et al., 2011; Silber et al., 2010; Vanderlaan & Taggart, 2007; Wiley et al., 2016). For large vessels, speed and angle of approach can influence the severity of a strike. Based on modeling conducted by Silber et al. (2010), researchers found that whales at the surface experienced impacts that increased in magnitude with the ship's increasing speed. Another study found that there was a 3.4-fold decrease in close encounters between their research vessel and humpback whales when they traveled at speeds of 12.5 knots or less as opposed to greater than 12.5 knots (Currie et al., 2017).

#### C.7.4.1.1 Mysticetes

Vessel strikes have been documented for almost all of the mysticete species (Van der Hoop et al., 2012). This includes blue whales (Berman-Kowalewski et al., 2010; Calambokidis, 2012; Monnahan et al., 2015; Van Waerebeek et al., 2007), fin whales (Douglas et al., 2008; Keen et al., 2019; Van Waerebeek et al., 2007), North Atlantic right whales (Firestone, 2009; Fonnesbeck et al., 2008; Vanderlaan et al., 2009; Wiley et al., 2016) sei whales (Felix & Van Waerebeek, 2005; Van Waerebeek et al., 2007), Bryde's whales (Felix & Van Waerebeek, 2005; Van Waerebeek et al., 2007), minke whales (Van Waerebeek et al., 2007), humpback whales (Douglas et al., 2008; Lammers et al., 2003; Ransome et al., 2021; Van Waerebeek et al., 2007), gray whales (DeAngelis et al., 2011; Scordino et al., 2023), and bowhead whales (Halliday, 2020). Generally, mysticetes are larger than odontocetes and are not able to maneuver as well

as odontocetes to avoid vessels. In addition, mysticetes do not typically aggregate in large groups and are therefore may be more difficult to visually detect from the water surface.

Research suggests that the increasing noise in the ocean has made it difficult for whales to detect approaching vessels, which has indirectly raised the risk of vessel strike (Elvin & Taggart, 2008). For example, North Atlantic right whales are documented to show little overall reaction to the playback of sounds of approaching vessels, suggesting that some whales perform only a last-second flight response (Nowacek et al., 2004a). Some individuals may become habituated to low-frequency sounds from shipping and fail to respond to an approaching vessel (National Marine Fisheries Service, 2008a). Because surface activity includes feeding, breeding, and resting, whales may be engaged in this activity and not notice an approaching vessel. Acoustic shadows may also form ahead of a moving vessel, where radiated ship noise levels approach or fall below ambient noise and therefore would be hard to detect if an animal is directly ahead of the ship (Gerstein et al., 2005).

On the other hand, the lack of an acoustic cue of vessel presence can be detrimental as well. One study documented multiple cases where humpback whales struck anchored or drifting vessels; in one case a humpback whale punched a 1.5 m hole through the hull of an anchored 22 m wooden sailboat, and another instance a humpback whale rammed a powered down 10 m fiberglass sailboat (Neilson et al., 2012). These results suggest that either the whales did not detect the vessel, or they intentionally struck it. In this study, vessel strikes to multiple cetacean species were included in the investigation; however, humpback whales were the only species that displayed this type of interaction with an unpowered vessel.

Another study found that 79 percent of reported strikes between sailing vessels and cetaceans occurred when the vessels were under sail, suggesting it may be difficult for whales to detect the faint sound of sailing vessels (Ritter, 2012). However, in some instances, avoidance behavior has been observed even after exposure to noise. A blue whale was observed in a near strike with a ship while the whale was tagged with a tag that collected depth information (Szesciorka et al., 2019). A 263 m container ship approached the whale while traveling at 11.3 knots and came within 93 m of the whale while the whale was at a depth of 67.5 m ascending from a foraging dive. The whale slowed its ascent and switched to a descent dive, surfacing three minutes later. This incident took place in Southern California, and prior to the near strike with the ship, the blue whale had been exposed to simulated mid-frequency (3 to 4 kHz) active sonar (Southall et al., 2019), which ended 62 min prior to the observation presented here.

Mysticetes that occur within the Study Area have varying patterns of occurrence and distribution, which overlap with areas where vessel use associated with Navy military readiness activities may occur. For example, humpback whales, particularly mother-calf pairs that may spend more time at or near the surface and utilize the shallow waters off Saipan and Marpi Reef, may be more vulnerable to vessel strike. Risk of vessel strikes may increase depending on behavior. Increases in both nighttime foraging of some species and ship traffic overall contributes to increased risk of strike in some areas (Caruso et al., 2021).

#### C.7.4.1.2 Odontocetes

Odontocetes that occur within the Study Area have varying patterns of occurrence and distribution, which overlap with areas where vessel use associated with Navy military readiness activities would occur. Available literature suggests based on their smaller body size, maneuverability, larger group sizes, and hearing capabilities, odontocetes are not as likely to be struck by a vessel as mysticetes. When generally compared to mysticetes, odontocetes are more capable of physically avoiding a vessel strike, and, since some species occur in large groups, they are more easily seen when they are close to the water surface.

In general, odontocetes move quickly and seem to be less vulnerable to vessel strikes than other cetaceans; however, most small whale and dolphin species have at least occasionally suffered from vessel strikes, including killer whale (Van Waerebeek et al., 2007; Visser & Fertl, 2000), short-finned and long-finned pilot whales (Aguilar et al., 2000; Van Waerebeek et al., 2007), bottlenose dolphin (Bloom & Jager, 1994; Van Waerebeek et al., 2007; Wells & Scott, 1997), white-beaked dolphin (Van Waerebeek et al., 2007), short-beaked common dolphin (Van Waerebeek et al., 2007), spinner dolphin (Camargo & Bellini, 2007; Van Waerebeek et al., 2007), striped dolphin (Van Waerebeek et al., 2007), Atlantic spotted dolphin (Van Waerebeek et al., 2007), and pygmy sperm whales (*Kogia breviceps*) (Van Waerebeek et al., 2007). Beaked whales documented in vessel strikes include Arnoux's beaked whale (Van Waerebeek et al., 2007), goose-beaked whale (formerly Cuvier's beaked whale) (Aguilar et al., 2000; Van Waerebeek et al., 2007), and several species of *Mesoplodon* (Van Waerebeek et al., 2007).

However, evidence suggests that beaked whales may be able to hear the low-frequency sounds of large vessels and thus potentially avoid strike (Ketten, 1998). Sperm whales may be exceptionally vulnerable to vessel strikes as they spend extended periods of time "rafting" at the surface to restore oxygen levels within their tissues after deep dives (Jaquet & Whitehead, 1996; Watkins et al., 1999). Based on hearing capabilities and dive behavior, sperm whales may not be capable of successfully completing an escape maneuver, such as a dive, in the time available after perceiving a fast-moving vessel. This supports the suggestion that vessel speed is a critical parameter for sperm whale strike risks (Gannier & Marty, 2015). Data on vessel strikes of smaller cetaceans are generally scarce likely due, at least in part, to a reporting bias rather than strikes being less frequent (Ransome et al., 2021; Schoeman et al., 2020).

### C.7.4.2 Effects from Aircraft and Aerial Targets

Effects from aircraft and aerial targets are not applicable to marine mammals because they do not occur in airborne environments and will not be analyzed further in this section.

### C.7.4.3 Effects from Military Expended Materials

The primary concern is the potential for a marine mammal to be hit with military expended material at or near the water's surface, which could result in injury or death. While disturbance or strike from an item falling through the water column is possible, it is not very likely because the objects generally sink slowly through the water and can be avoided by most marine mammals. Therefore, the discussion of military expended material strikes focuses on the potential of a strike at the surface of the water.

While no strike from military expended materials has ever been reported or recorded, the possibility of a strike still exists. Therefore, the potential for marine mammals to be struck by military expended materials was evaluated using statistical probability modeling to estimate potential direct strike exposures to a marine mammal under a worst-case scenario. Specific details of the modeling approach, including model selection and calculation methods, are presented in Appendix F (Military Expended Materials and Direct Strike Analysis).

### C.7.4.4 Effects from Seafloor Devices

The only seafloor device used during military readiness activities that has the potential to strike a marine mammal at or near the surface is an aircraft-deployed mine shape, which is used during aerial mine laying activities. These devices are identical to non-explosive practice bombs, and, therefore the analysis of the potential effects from those devices is covered in Section C.7.4.3 (Effects from Military Expended Materials) and are not further analyzed in this section.

## C.7.5 Entanglement Stressors

This analysis includes the potential effects from two types of military expended materials: (1) wires and cables and (2) decelerators/parachutes. These materials, if encountered, may have the potential to entangle marine mammals in the Study Area at the surface, in the water column, or along the seafloor. Since potential effects depend on how a marine mammal encounters and reacts to items that pose an entanglement risk, the following subsections discuss research relevant to specific groups or species. Risk factors such as animal size, sensory capabilities, and foraging methods are also considered in the potential risk for entanglement. Most entanglements discussed are attributable to marine mammal encounters with fishing gear or other non-military materials that float or are suspended at the surface. Entanglement events are difficult to detect from land or from a boat as they may occur at considerable distances from shore and typically take place underwater. Smaller entangled animals are inherently less likely to be detected than larger ones, but larger animals may subsequently swim off while still entangled, towing lines or fishing gear behind them. Therefore, the likelihood of witnessing an entanglement event is typically low (Benjamins et al., 2014). However, the properties and size of these military expended materials, as described in Section 3.0 of the 2015 EIS/OEIS and 2020 SEIS/OEIS, makes entanglement unlikely.

Since there has never been a reported or recorded instance of a marine mammal entangled in military expended materials (Henry et al., 2016; National Oceanic and Atmospheric Administration Marine Debris Program, 2014a), the Navy considered the available literature and reports on entanglement. These reports indicate that active and derelict fishing gear is the predominant cause of entanglement. The reason for this, and the ways that fishing gear may be different from military expended materials, are as follows: (1) fishing gear is most often used in areas of high productivity where whales may congregate and feed; whereas military expended materials are generally used in broad, diverse, open-ocean areas and expenditures are not concentrated; (2) fishing gear is designed to trap/entangle marine life and are made with a high breaking strength to withstand prolonged use in the ocean environment; military expended materials are not designed to persist in the ocean environment for long periods of time and are not designed to entangle or capture marine life; and (3) fishing gear and ropes are designed to

float or be suspended in the water column for long periods of time, whereas most military expended materials sink immediately and rapidly.

### C.7.5.1 Mysticetes

Mysticete species with documented entanglement reports include humpback whales, North Atlantic right whales, gray whales, humpback whales, minke whales, and fin whales, (National Marine Fisheries Service, 2023; Scordino et al., 2023). The aforementioned species have records directly linking entanglement to marine debris as opposed to active fishing gear (Baulch & Perry, 2014; Laist, 1997). It has been estimated that a minimum of 52 percent and a maximum of 78 percent of whales have been non-lethally entangled in their lifetime in some populations (Neilson et al., 2009).

While entanglement, particularly in fishing gear, remains a risk for mysticetes in the Study Area, few strandings of marine mammals are reported in the Mariana Islands compared to other regions in the United States, such as the U.S. West Coast. In 2021, there were over 3,000 marine mammal strandings reported along the West Coast Region, which comprised 56 percent of all strandings in U.S. waters, and just 42 strandings (1 percent of total strandings) were reported in the Pacific Islands Region, which, in addition to Guam and the CNMI, also includes Hawaii (Onens et al., 2024). Pinnipeds typically make up the vast majority of all reported strandings (69 percent of national strandings in 2021), and the Pacific Islands region only has one pinniped species, the Hawaiian monk seal, which is endemic to Hawaii and does not occur in the Study Area. Out of the 42 reported strandings in 2021, 20 involved monk seals, leaving just 22 strandings of cetaceans, including 16 small cetaceans and 6 large whales, occurring across the Pacific Islands Region (Onens et al., 2024). While the report does not specify how many of the strandings were due to entanglement, compared with other regions, very few would be expected in the Study Area.

Entanglement of many large whales most often begins with rope being caught in its baleen plates. Based on feeding adaptations for mysticetes, oral entanglement may pose one of the greatest threats to survival, due to impaired foraging and possibly loss of function of the hydrostatic seal (formed when upper and lower lips come together and keep the mouth closed), requiring the whale to expend energy to actively keep the mouth closed during swimming (Cassoff et al., 2011; Werth et al., 2024). Impaired foraging could lead to deterioration of health, making the animal more susceptible to disease or eventual starvation over a long period of time, or chronic poor body condition which could result in suppressions to growth, age of sexual maturation and calving rates (Christiansen et al., 2020; Werth et al., 2024).

Compounding the issue, trailing lengths of rope or line may become wrapped around the animal's appendages as it struggles to free itself (Kozuck, 2003), limiting the animal's mobility and increasing drag. This reduced mobility can also reduce foraging success or even limit the animal's ability to surface. Notably, the single acute cause of entanglement mortalities has been associated with drowning from multiple body parts being entangled (Cassoff et al., 2011). Even if a whale is freed of an entanglement, the recovery time is estimated to be an average of 1.3–3 months (Moore et al., 2021; van der Hoop et al., 2017), extending the sub-lethal effects of an entanglement.

Common sources of entanglements for mysticetes include line and net fragments attached through the mouth or around the tail and flippers (National Oceanic and Atmospheric Administration Marine Debris Program, 2014a). Rope diameter and breaking strengths may also determine an animal's ability to break free from entanglement. Increased rope strength has been found to be positively correlated with injury severity in right whales, but not for humpback whales (Knowlton et al., 2015). Minke whales were also found entangled in lower breaking strength ropes (10.47 kilonewtons [2,617 pound (lb.)-force]) than both humpback and right whales (17.13 and 19.30 kilonewtons [3,851 and 4,339 lb.-force], respectively) (Knowlton et al., 2015). These are significantly greater than the breaking strength of torpedo guidance wires (maximum 42 lb.-force) as described in Section 3.0 of the 2015 EIS/OEIS and 2020 SEIS/OEIS on wires and cables. Entanglement would be more likely for materials with similar physical properties as those described above.

Entanglement in fishing gear is a known cause of humpback whale injury and mortality, with all components of both pot and gillnet gear documented during 33 separate humpback whale entanglement events in the Pacific. Across all ocean basins, humpback whales are the most frequently entangled large whale species, accounting for 73 percent of all confirmed entanglements in 2022 and an average of 69 percent between 2007 and 2022 (National Marine Fisheries Service, 2024). A combination of factors is likely contributing to humpback whale entanglements, including increases in abundance of some stocks or DPSs, greater overlap between distribution and locations of commercial fishing activity, and increases in reporting and outreach (National Marine Fisheries Service, 2024). In addition, humpbacks tend to occur closer to shore than other large whale species increasing the likelihood that they would be observed more frequently than species that prefer deeper offshore waters. Available data indicate that male humpback whales typically have more entanglement scars than females and may become entangled more frequently. Juvenile whales were found to have a higher rate of entanglement and be more at risk of serious injury and mortality when entangled than mature animals of the same species (Robbins, 2009, 2010).

Military expended material is expected to sink to the ocean floor. It is possible that marine mammals could encounter these items within the water column as they sink to the bottom. Less buoyant items that sink faster are not as likely to become entangled with a marine mammal compared to more buoyant materials that would sink slower to the floor. Mysticetes that occupy the water column or skim feed along the water's surface would have to encounter a military expended material at the same time and location it is either expended or as it sinks (Hamilton & Kraus, 2019).

Mysticete species that feed near or at the bottom (Gailey et al., 2022) or otherwise interact with the bottom (Stevenson & Werth, 2024) in the areas where activities are conducted that result in military expended materials could encounter items that have already sunk and, therefore, do not have to be present at the precise time when items are expended. However, most benthic foraging habitat is in relatively shallow nearshore waters, whereas most munitions and other MEM are released farther from shore where they will sink to depths inaccessible to marine mammals that are known to interact with the bottom.

### C.7.5.2 Odontocetes

Odontocete species with documented records of marine debris entanglement, excluding fishing gear, are the sperm whale, bottlenose dolphin, harbor porpoise, and Dall's porpoise (National Oceanic and Atmospheric Administration Marine Debris Program, 2014a). Bottlenose dolphins are the most commonly entangled odontocete, with most entanglements involving monofilament line, net fragments, and rope attached to appendages (National Oceanic and Atmospheric Administration Marine Debris Program, 2014a). Heezen (1957) reported two confirmed instances of sperm whales entangled in the slack lengths of telegraph cable near cable repair sites along the seafloor. These whales likely became entangled while feeding along the bottom, as the cables were found wrapped around the jaw. Other sperm whale entanglements in gill nets have been reported, resulting in various behavioral responses, injuries and in some cases, mortalities (Haase & Felix, 1994; Jacobsen et al., 2010; Pace et al., 2008). Juvenile harbor porpoises exposed to 0.5-in. diameter white nylon ropes in both vertical and horizontal planes treated the ropes as barriers, more frequently swimming under than over them. However, porpoises feeding on fish in the area crossed the ropes more frequently and became less cautious, suggesting that rope poses a greater risk in a feeding area than in a transit area. For harbor porpoises feeding along the bottom, rope suspended near the seafloor is more likely to entangle than rope higher in the water column given the animals' natural tendency is to swim beneath barriers (Kastelein et al., 2005).

## C.7.6 Ingestion Stressors

### C.7.6.1 Mysticetes

Since baleen whales feed by filtering large amounts of water, they likely encounter and consume plastic debris at higher rates than other marine animals (National Oceanic and Atmospheric Administration Marine Debris Program, 2014b; Werth et al., 2024). Species that feed at the surface or in the water column include blue, fin, humpback, Bryde's, minke, and sei whales. While humpback whales may feed by lunging through the water after krill and fish, there are data confirming that humpback whales display bottom-feeding behaviors in areas of high concentrations of preferred prey, the northern sand lance (*Ammodytes dubius*) (Hain et al., 1995; Ware et al., 2014).

Baleen whales are believed to routinely encounter microplastics within the marine environment based on concentrations of these items and baleen whale feeding behaviors (Andrady, 2011; Werth et al., 2024). A body of research on ingestion of marine debris, particularly plastics, by baleen whales has been building for over two decades (Andrady, 2011; Laist, 1987; Werth et al., 2024). Observations of bowhead whale mouths have provided insights into potential threats to bowhead and right whales from oral entanglement of marine debris, including a greater probability of lethal consequences due to interference of the hydrostatic oral seal (Lambertsen et al., 2005). In a comprehensive review of documented ingestion of debris by marine mammals by Laist (1997), there are two species of mysticetes (bowhead and minke whale) with records of having ingested debris items that included plastic sheeting and a polythene bag. This effort was followed up by a comparative summary of the earlier review with additional information and the number of mysticete species with documented records of ingestion increased to seven species, including right whales, pygmy right whales, gray whales,

and four rorqual species (Bergmann et al., 2015). Similarly, information compiled by (Williams et al., 2011) listed humpback whale, fin whale, minke whale as three species of mysticetes known to have ingested debris including items the authors characterized as fishing gear, polyethylene bag, plastic sheeting, plastic bags, rope, and general debris. Besseling et al. (2015) documented the first occurrence of microplastics in the intestines of a humpback whale. Werth et al. (2024) conducted experiments using the baleen of four whales (fin, humpback, minke, and North Atlantic right) to test the capture rate of a variety of plastic debris. The study revealed that polystyrene foam was the most easily type of plastic captured by all baleen types, but other types of plastic debris, including fragments, fibers, and microbeads were also captured. The underlying risks to baleen whales are clogging, entanglement, and damage to the baleen and its ability to function as a filter facilitating feeding.

Feeding behaviors of mysticete species suggest that potential encounters with ingestion stressors would only occur when debris items at the water's surface have spatial and temporal overlap with skim feeding animals, or while whales are engulfing prey in the water column as items sink to the bottom. Bottom-feeding humpback whales may also encounter ingestion stressors that have already sunk.

### C.7.6.2 Odontocetes

In a comprehensive review of documented ingestion of debris by marine mammals, odontocetes had the most ingestion records, with 21 species represented (Laist, 1997). A follow-up to this review by Bergmann et al. (2015) revealed marine debris ingestion for odontocetes has increased, where 40 species now have documented records of ingestion.

Beaked whales use suction feeding to ingest benthic prey and may incidentally ingest other items (MacLeod et al., 2003). Both sperm whales and beaked whales are known to incidentally ingest foreign objects while foraging; however, this does not always result in negative consequences to health or vitality (Laist, 1997; Walker & Coe, 1990). While this incidental ingestion has led to sperm whale mortality in some cases, Whitehead (2003) suggested the scale to which this affects sperm whale populations was not substantial. Sperm whales are recorded as having ingested fishing net scraps, rope, wood, and plastic debris such as plastic bags and items from the seafloor (Jacobsen et al., 2010; Walker & Coe, 1990; Whitehead, 2003).

Weaned juveniles who are investigating multiple types of prey items may be particularly vulnerable to ingesting non-food items, as found in a study of juvenile harbor porpoises (Baird & Hooker, 2000). Similarly, a male pygmy sperm whale reportedly died from blockage of two stomach compartments by hard plastic, and a Blainville's beaked whale (*Mesoplodon densirostris*) washed ashore in Brazil with a ball of plastic thread in its stomach (Derraik, 2002). In one study, all 12 animals investigated from six odontocete species in the eastern Atlantic were found to have ingested microplastics, primarily fibers, and none larger than 5 mm (Montoto-Martínez et al., 2021).

### C.7.7 Secondary Stressors

This section analyzes potential effects on marine mammals exposed to stressors indirectly through effects on their habitat (sediment or water quality) or prey. For the purposes of this

analysis, indirect effects on marine mammals via sediment or water quality that do not require trophic transfer (e.g., bioaccumulation) to be observed are considered here. The invertebrates (Section 3.8), marine habitats (Section 3.3), and fish (Section 3.9) analyses indicated minimal to no effects on potential prey species of marine mammals due to bioaccumulation. It is important to note that the terms "indirect" and "secondary" do not imply reduced severity of environmental consequences but instead describe how the effect may occur in an organism. Bioaccumulation is considered in the *Ecosystem Technical Report for the Hawaii-Southern California Training and Testing (HSTT) Final Environmental Impact Statement* (U.S. Department of the Navy, 2013c). While not specific to the MITT Study Area, the discussion on the potential for effects from bioaccumulation are applicable.

Stressors from Navy military readiness activities that could pose indirect effects on marine mammals via habitat or prey include: (1) explosives, (2) explosive byproducts and unexploded munitions, (3) metals, (4) chemicals, and (5) transmission of disease and parasites. Analyses of the potential effects on sediment and water quality are discussed in Section 3.1 (Sediment and Water Quality).

### C.7.7.1 Explosives

Explosives may have an effect on marine mammal prey species. In addition to the physical effects of an underwater blast, prey might have behavioral reactions to underwater sound. For instance, prey species might exhibit a strong startle reaction to explosions that might include swimming to the surface or scattering away from the source. This startle and flight response is the most common secondary defense among animals (Hanlon & Messenger, 1996; Mather, 2004). The abundances of prey species near the detonation point could be diminished for a short period of time before being repopulated by animals from adjacent waters. Alternatively, any prey species that would be directly injured or killed by the blast could draw in scavengers from the surrounding waters that would feed on those organisms, and in turn could be susceptible to becoming directly injured or killed by subsequent explosions. Any of these scenarios would be temporary, only occurring during activities involving explosives, and no lasting effect on prey availability or the pelagic food web would be expected.

### C.7.7.2 Explosion Byproducts and Unexploded Munitions

A series of research efforts that focused on World War II underwater munitions disposal sites in Hawaii (Briggs et al., 2016; Edwards et al., 2016; Kelley et al., 2016; Koide et al., 2016; University of Hawaii, 2010) and an intensively used live fire range in the Mariana Islands (Smith & Marx, 2016) provide information regarding the effects of undetonated materials and unexploded munitions on marine species. Findings from these studies indicate that there were no adverse effects on the local ecology from the presence of degrading munitions and there was no bioaccumulation of munitions-related chemicals in local marine species.

The island of Farallon De Medinilla (in the Mariana Islands) has been used as a target area since 1971. Between 1997 and 2012, there were 14 underwater scientific survey investigations around the island providing long-term insight to the potential effects on the marine life from training and testing involving the use of munitions (Smith & Marx, 2016). Munitions use has included high-explosive rounds from gunfire, high-explosives bombs by Navy aircraft and U.S.

Air Force B-52s, in addition to the expenditure of inert rounds and non-explosive practice bombs. Marine life assessed during these surveys included algae, corals, benthic invertebrates, sharks, rays, bony fishes, and sea turtles. Over the 16-year period, investigators found no evidence that the condition of biological resources has been adversely affected to a significant degree by the training activities (Smith & Marx, 2016). Furthermore, they found that the health, abundance, and biomass of fishes, corals, and other marine resources were comparable, or superior to, those in similar habitats at other locations within the Mariana Archipelago.

### C.7.7.3 Metals

Metals are introduced into seawater and sediments as a result of military readiness activities involving ship hulks, targets, munitions, and other military expended materials (Environmental Sciences Group, 2005). Some metals bioaccumulate and physiological effects begin to occur only after several trophic transfers concentrate the toxic metals. Evidence from a number of studies (Briggs et al., 2016; Kelley et al., 2016; Koide et al., 2016; U.S. Department of the Navy, 2013e; University of Hawaii, 2010) indicate metal contamination is very localized and that bioaccumulation resulting from munitions cannot be demonstrated. Specifically in sampled marine life living on or around munitions on the seafloor, metal concentrations could not be definitively linked to the munitions since comparison of metals in sediment next to munitions show relatively little difference in comparison to other “clean” marine sediments used as a control/reference (Koide et al., 2016). Research has demonstrated that some smaller marine organisms are attracted to metal munitions as a hard substrate for colonization or as shelter (Kelley et al., 2016; Smith & Marx, 2016), but this is unlikely to substantively affect marine mammal prey availability.

### C.7.7.4 Chemicals

Several Navy military readiness activities introduce chemicals into the marine environment that are potentially harmful at higher concentrations; however, rapid dilution would occur, and toxic concentrations are unlikely to be encountered. Introduced chemicals are principally from flares and propellants from missiles and torpedoes. Properly functioning flares, missiles, and torpedoes combust most of their propellants, leaving benign, or readily diluted soluble combustion byproducts (e.g., hydrogen cyanide). Operational failures may allow propellants and their degradation products to be released into the marine environment. Flares and missiles that operationally fail may release perchlorate, which is highly soluble in water, persistent, and affects metabolic processes in many plants and animals if in sufficient concentration. Such concentrations are not likely to persist in the ocean. Research has demonstrated that perchlorate did not bioconcentrate or bioaccumulate, which was consistent with the expectations for a water-soluble compound (Furin et al., 2013). Perchlorate from failed expendable items is therefore unlikely to compromise water quality to that point that it would act as a secondary stressor to marine mammals. It should also be noted that chemicals in the marine environment as a result of Navy military readiness activities would not occur in isolation and are typically associated with military expended materials that release the chemicals while in operation. Because marine mammal avoidance of an expended flare, missile, or torpedo in the water is almost certain, it would further reduce the potential for introduced chemicals to act as a secondary stressor.

### C.7.7.5 Transmission of Marine Mammal Diseases and Parasites

The U.S. Navy deploys trained common bottlenose dolphins (*Tursiops truncatus*) for integrated training involving two primary mission areas: to find objects such as inert mine shapes, and to detect swimmers or other intruders around Navy facilities such as piers. When deployed, the animals are part of what the Navy refers to as Marine Mammal Systems. These Marine Mammal Systems include one or more motorized small boats, several crew members, and a trained marine mammal. Based on the standard procedures with which these systems are deployed, it is not reasonably foreseeable that use of these Marine Mammals Systems would result in the transmission of disease or parasites to cetaceans in the Study Area based on the following.

Each trained animal is deployed under behavioral control to find the intruding swimmer or submerged object. Upon finding the target of the search, the animal returns to the boat and alerts the animal handlers that an object or swimmer has been detected. In the case of a detected object, the human handlers give the animal a marker that the animal can bite onto and carry down to place near the detected object. In the case of a detected swimmer, animals are given a localization marker or leg cuff that they are trained to deploy via a pressure trigger. After deploying the localization marker or leg cuff, the animal swims free of the area to return to the animal support boat. For detected objects, human divers or remote vehicles are deployed to recover the item. Swimmers that have been marked with a leg cuff are reeled in by security support boat personnel via a line attached to the cuff.

Marine Mammal Systems deploy approximately one to two weeks before the beginning of a training exercise to allow the animals to acclimate to the local environment. Four to 12 marine mammals are involved per exercise. Marine Mammal Systems typically participate in object detection and recovery, both participating in mine warfare exercises and assisting with the recovery of non-explosive mine shapes at the conclusion of an exercise. Marine Mammal Systems may also participate in port security and anti-terrorism/force protection exercises.

During the past 40 years, the Navy Marine Mammal Program has been deployed globally. To date, there have been no known instances of deployment-associated disease transfer to or from Navy marine mammals. Navy animals are maintained under the control of animal handlers and are prevented from having sustained contact with indigenous animals.

When not engaged in the training event, Navy marine mammals are either housed in temporary enclosures or aboard ships involved in training exercises. All marine mammal waste is disposed of in a manner approved for the specific holding facilities. When working, dolphins are transferred in boats or by swimming alongside the boat under the handler's control. Their open-ocean time is under stimulus control and is monitored by their trainers.

Navy marine mammals receive excellent veterinarian care (per Secretary of the Navy Instruction 3900.41E). Appendix A, Section 8, of the Swimmer Interdiction Security System Final EIS (U.S. Department of the Navy, 2009b) presents an overview of the veterinary care provided for the Navy's marine mammals. Appendix B (Activity Stressor Matrices), Section 2, of the Swimmer Interdiction Security System Final EIS presents detailed information on the health

screening process for communicable diseases. The following is a brief summary of the care received by all of the Navy's marine mammals:

- Qualified veterinarians conduct routine and pre-deployment health examinations on the Navy's marine mammals; only animals determined as healthy are allowed to deploy.
- Restaurant-quality frozen fish are fed to prevent diseases that can be caused by ingesting fresh fish (e.g., parasitic diseases).
- Navy animals are routinely dewormed to prevent parasitic and protozoal diseases.
- If a valid and reliable screening test is available for a regionally relevant pathogen (e.g., polymerase chain reaction assays for morbillivirus), such tests are run on appropriate animal samples to ensure that animals are not shedding these pathogens.

The Navy Marine Mammal Program routinely does the following to further mitigate the low risk of disease transmission from captive to wild marine mammals during training exercises:

- Marine mammal waste is disposed of in an approved system dependent upon the animal's specific housing enclosure and location.
- Onsite personnel are made aware of the potential for disease transfer and report any sightings of wild marine mammals so that all personnel are alert to the presence of the animal.
- Marine mammal handlers visually scan for indigenous marine animals for at least five minutes before animals are deployed and maintain a vigilant watch while the animal is working in the water. If a wild marine mammal is seen approaching or within 100 m, the animal handler will hold the marine mammal in the boat or recall the animal immediately if the animal has already been sent on the mission.
- The Navy obtains appropriate state agriculture and other necessary permits and strictly adheres to the conditions of the permit.

Due to the limited amount of time that the Navy marine mammals spend in the open ocean, the control that the trainers have over the animals, the collection and proper disposal of marine mammal waste, the exceptional screening and veterinarian care given to the Navy's animals, the visual monitoring for indigenous marine mammals, and more than 40 years with zero known incidents, there is no scientific basis to conclude that the use of Navy marine mammals during training activities will have an effect on wild marine mammals.

## C.8 Sea Turtles

### C.8.1 Acoustic Stressors

Background information supporting the analysis of acoustic stressors is presented in the *Acoustic and Explosives Concepts Technical Report*.

### C.8.2 Explosive Stressors

Background information supporting the analysis of explosive stressors is presented in the *Acoustic and Explosives Concepts Technical Report*.

## C.8.3 Energy Stressors

### C.8.3.1 Effects from High-Energy Lasers

As discussed in Section 3.0.3.3.3.3 (Lasers) in the 2020 SEIS/OEIS, high-energy laser weapons testing involves the use of up to 30 kilowatts of directed energy as a weapon against small surface vessels and airborne targets. These weapons systems are deployed from a surface ship or aircraft platform to create small but critical failures in potential targets and used at short ranges from the target.

The primary concern for high-energy weapons testing is the potential for a sea turtle to be struck by a high-energy laser beam at or near the water's surface, potentially resulting in injury. Sea turtles could be exposed to a laser only if the beam missed the target. Should the laser strike the sea surface, individual sea turtles at or near the surface could be exposed. The potential for exposure to a high-energy laser beam decreases as the water depth increases. However, high-energy lasers automatically cease transmitting laser light if target lock is lost, eliminating any reasonably foreseeable potential for a sea turtle to be adversely affected by the laser.

## C.8.4 Physical Disturbance and Strike Stressors

### C.8.4.1 Effects from Vessels and In-Water Devices

#### Vessels

Sea turtles spend a majority of their time submerged (Renaud & Carpenter, 1994; Sasso & Witzell, 2006), though Hazel et al. (2009) and Hazel et al. (2007) showed most species of sea turtles staying within the top 3 m of water despite deeper water being available. Any of the sea turtle species found in the Study Area can occur at or near the surface in open ocean and coastal areas, whether feeding or periodically surfacing to breathe. Distribution of species is not uniform, however. Typically in the Study Area, loggerheads, leatherbacks, and olive ridleys are not seen in nearshore habitats because they are either transiting (relatively briefly occurring within nearshore waters) or are in their preferred pelagic habitats. Green and hawksbill sea turtles are regularly seen within nearshore waters of Guam and the CNMI, but not other species. Green sea turtles are the most abundant sea turtles found in the nearshore environment of the Study Area (U.S. Department of the Navy, 2024).

Green and hawksbill sea turtles are more likely to forage in nearshore waters of the Study Area than other species, and although they may feed along the seafloor, they surface periodically to breathe while feeding and moving between nearshore habitats (Gaos et al., 2024). Loggerheads, considered to be the most generalist of sea turtle species in terms of feeding and foraging behavior, apparently exhibit varied dive behavior that is linked to the quantity and quality of available resources (Morales-Zárate et al., 2021). Foley et al. (2011) found that loggerheads spent 7.3 percent of time at the surface (associated with breathing), 42 percent of time under the surface but close to the surface within one body length, and 44 percent of time within the water column (the remaining time observed at or near the seafloor). Leatherback sea turtles are more likely to feed at or near the surface in open ocean areas. It is important to note that leatherbacks can forage for jellyfish at depth but bring them to the surface to ingest

(Benson et al., 2007; Fossette et al., 2007; James & Herman, 2001). Basking on the water's surface is common for all species within the Study Area as a strategy to thermoregulate, and the reduced activity associated with basking may pose higher risks for sea turtle strikes because of a likely reduced capacity to avoid cues.

In an attempt to determine traffic patterns for Navy and non-Navy vessels, the Center for Naval Analysis conducted a review of historic data for commercial vessels, coastal shipping patterns, and Navy vessels (Starcovic & Mintz, 2021). Although Guam and the Mariana Islands lack a major commercial shipping port, many thousands of trans-Pacific shipments to and from Asia occur as part of the global shipping transportation network and pass in proximity to the Mariana Islands and throughout the Study Area (Kaluza et al., 2010; Starcovic & Mintz, 2021). Shipping vessels bring shipments of goods to Guam as well as shipments between the Guam and the CNMI. Trans-Pacific vessel traffic that passes through offshore waters near Guam link Asian ports with ports in Hawaii and along the U.S. west coast, including Los Angeles and Long Beach in California. The study by Starcovic and Mintz (2021) showed that commercial and other non-Navy vessel traffic, which included cargo vessels, bulk carriers, passenger vessels, and oil tankers (all over 20 m in length), was heaviest between Guam and the Hawaiian Islands with transits continuing to the U.S. West Coast(Starcovic & Mintz, 2021). Within the Mariana Islands, smaller barge traffic primarily occurs between Guam and Saipan, with less vessel traffic extending to Rota and Tinian, and even more sporadic vessel traffic serving the smaller islands within the archipelago (Freightnet, 2025).

The frequency of vessel strike in open ocean waters of the Study Area is much less clear. It is assumed if an animal is struck in waters further from shore, it is less likely to strand and be documented. There has been one recent report of a stranded turtle in Hawaii that appeared as though it may have been struck by a large propeller (such as those used by some Navy vessels) (National Marine Fisheries Service, 2008b). However, it is more likely turtles struck by large propellers would not strand because the damage to the carcass would be so extensive as to facilitate sinking or consumption by scavengers.

Most observations of stranded sea turtles in the Study Area were of green sea turtles, which is consistent with known abundance and nearshore densities (Naval Facilities Engineering Command Marianas, 2022). In June 2021, a vessel strike was confirmed for a green sea turtle, with evidence of propeller strike (Dell, 2025). In September 2024, a green sea turtle carcass was observed in Inner Apra Harbor, but the carcass (despite response by NAVFAC Marinas marine resource and GovGuam DAWR personnel) was not recovered (Naval facilities Engineering Command Marianas, 2024). However, subsequent examination of photographs of the carcass in water did not indicate blunt trauma typical of vessel strike (Dell, 2025). In both instances, the cause of death could not be attributed to military, recreational, or commercial activities within Apra Harbor or nearshore waters of Guam.

Disturbance of sea turtles from vessel movements is expected to occur with more frequency than actual strikes. Visual cues from vessels nearby and vessel noise would likely induce short-term behavioral changes, such as cessation of foraging activities or moving away from the disturbance (Foley et al., 2019; Welsh & Witherington, 2023).

### In-Water Devices

Devices that could pose a collision risk to sea turtles are those operated at high speeds and are unmanned. The Navy reviewed torpedo design features and a large number of previous anti-submarine warfare torpedo exercises to assess the potential of torpedo strikes on marine mammals, and its conclusions are also relevant to sea turtles. The acoustic homing programs of Navy torpedoes are sophisticated and would not confuse the acoustic signature of a marine mammal with a submarine or target. It is reasonable to assume that acoustic signatures of sea turtles, which are substantially smaller than most marine mammals, would also not be confused with a submarine or target. All exercise torpedoes are recovered and refurbished for eventual re-use. Review of the exercise torpedo records indicates there has never been an effect on a sea turtle. In thousands of exercises in which torpedoes were fired or in-water devices used, there have been no recorded or reported instances of a marine species strike from a torpedo or any other in-water device.

Since some in-water devices are identical to support craft, (typically less than 15 m in length), sea turtles could respond to the physical presence of the device similar to how they respond to the physical presence of a vessel (see Table 3.0-8). Physical disturbance from the use of in-water devices is not expected to result in more than a momentary behavioral response. These responses would likely include avoidance behaviors (swimming away or diving) and cessation of normal activities (e.g., foraging). As with an approaching vessel, not all sea turtles would exhibit avoidance behaviors and be at higher risk of a strike.

In-water devices, such as unmanned underwater vehicles, that move slowly through the water are highly unlikely to strike sea turtles because the turtle could easily avoid the object. Towed devices are unlikely to strike a sea turtle because of the observers on the towing platform and other standard safety measures employed when towing in-water devices. Sea turtles that occur in areas that overlap with in-water device use within the Study Area may encounter in-water devices. It is possible that sea turtles may be disturbed by the presence of these activities, but any disturbance from the use of in-water devices is not expected to result in more than a temporary behavioral response.

Propulsion testing events occur infrequently but pose a higher strike risk because of the higher speeds at which the vessels need to achieve in order to complete the testing activity. These activities could occur in most locations in the Study Area. However, there are just a few of these events proposed per year, so the increased risk is nominal compared to all vessel use proposed under Alternative 1.

As discussed in Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]), testing activities involving the use of in-water devices would occur in the Study Area at any time of year. Unmanned surface vehicle use would occur mainly within the MIRC.

As with training activities, the likelihood is low for testing activities to cause harmful interaction with a vessel or in-water device but cannot be wholly discounted. Sea turtle strikes in high vessel traffic areas (e.g., Apra Harbor) have been reported. Potential effects of exposure to vessels may result in substantial changes in an individual's behavior, growth, survival, annual

reproductive success, lifetime reproductive success (fitness), or species recruitment. Any strike at high speed is likely to result in significant injury. Potential effects of exposure to vessels are not expected to result in population-level effects for all sea turtle species. Under Alternative 1 testing activities, the Navy will continue to implement activity-based mitigation to avoid or reduce the potential for vessel and in-water device strike of sea turtles. Within a mitigation zone of a vessel or in-water device, trained observers will relay sea turtle locations to the operators, who are required to change course (no course change would be implemented if the vessel's safety is threatened, the vessel is restricted in its ability to maneuver [e.g., during launching and recovery of aircraft or landing craft, during towing activities, when mooring], or if the vessel is operated autonomously). A mitigation zone size is not specified for sea turtles to allow flexibility based on vessel type and mission requirements (e.g., small boats operating in a narrow harbor).

### C.8.4.2 Effects from Military Expended Materials

The primary concern is the potential for a sea turtle to be struck with a military expended material at or near the water's surface, which could result in injury or death. For sea turtles, although disturbance or strike from an item as it falls through the water column is possible, it is not likely because the objects generally sink through the water slowly and can be avoided by most sea turtles. Materials will slow in their velocity as they approach the bottom of the water and will likely be avoided by any juvenile or adult sea turtles (e.g., olive ridley, green, loggerhead, or hawksbill turtles) that happen to be in the vicinity foraging in benthic habitats. Therefore, the discussion of military expended materials strikes focuses on the potential of a strike at the surface of the water.

There is a possibility that an individual turtle at or near the surface may be struck if they are in the target area at the point of physical impact at the time of non-explosive munitions delivery. Expended munitions may strike the water surface with sufficient force to cause injury or mortality. Adult sea turtles are generally at the surface for short periods, and spend most of their time submerged; however, hatchlings and juveniles spend more time at the surface while in ocean currents or at the surface while basking. The leatherback sea turtle is more likely to be foraging at or near the surface in the open ocean than other species, but the likelihood of being struck by a projectile remains very low because of the wide spatial distribution of leatherbacks relative to the point location of an activity. Furthermore, projectiles are aimed at targets, which will absorb the impact of the projectile.

While no strike from military expended materials has ever been reported or recorded on a reptile, the possibility of a strike still exists. Therefore, the potential for sea turtles to be struck by military expended materials was evaluated using statistical probability modeling to estimate potential direct strike exposures to a sea turtle (see Appendix F, Military Expended Materials and Direct Strike Analysis). To estimate potential direct strike exposures, a worst-case scenario was calculated using the sea turtle with the highest average year-round density in areas with the highest military expended material expenditures in the Study Area (see Appendix F, Military Expended Materials and Direct Strike Analysis). The green sea turtle was used as a proxy for all sea turtle species because this species has the highest density estimates, which would provide the most conservative modeling output results. For estimates of expended materials in all

areas, see Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]). Input values include munitions data (frequency, footprint and type), size of the training or testing area, sea turtle density data, and size of the animal. To estimate the potential of military expended materials to strike a sea turtle, the impact area of all military expended materials was totaled over one year in the area with the highest combined amounts of military expended materials for the Proposed Action. The analysis of the potential for a sea turtle strike is influenced by the following assumptions:

- The model is two-dimensional, assumes that all sea turtles would be at or near the surface 100 percent of the time, and does not consider any time a sea turtle would be submerged.
- The model also does not take into account the fact that most of the projectiles fired during training and testing activities are fired at targets, and that most projectiles hit those targets, so only a very small portion of those would hit the water with their maximum velocity and force.
- The model assumes the animal is stationary and does not account for any movement of the sea turtle or any potential avoidance of the training or testing activity.

The potential of fragments from high-explosive munitions or expended material other than munitions to strike a sea turtle is likely lower than for the worst-case scenario calculated above because those events happen with much lower frequency. Fragments may include metallic fragments from the exploded target, as well as from the exploded munitions.

There is a possibility that an individual turtle at or near the surface may be struck if they are in the target area at the point of physical impact at the time of non-explosive munitions delivery. Expended munitions may strike the water surface with sufficient force to cause injury or mortality. Direct munitions strikes from non-explosive bombs, missiles, and rockets are potential stressors to some species. Some individuals at or near the surface may be struck directly if they are at the point of impact at the time of non-explosive practice munitions delivery. However, most missiles hit their target or are disabled before hitting the water. Thus, most of these missiles and aerial targets hit the water as fragments, which quickly dissipates their kinetic energy within a short distance of the surface.

Other factors that further reduce the likelihood of a sea turtle being struck by an expended munition include the recovery of all non-explosive torpedoes as well as target-related materials that are intact after the activity. The Navy will implement mitigation (e.g., not conducting gunnery activities against a surface target when a specified distance from sea turtles) to avoid potential effects from military expended materials on sea turtles throughout the Study Area (see Section 5.6, Activity-based Mitigation).

### C.8.4.3 Effects from Seafloor Devices

The types of activities that use seafloor devices include items placed on, dropped on, or that move along the seafloor such as mine shapes, anchor blocks, anchors, bottom-placed instruments, and bottom-crawling unmanned underwater vehicles. The likelihood of any sea turtle species encountering seafloor devices is considered low because these items are either

stationary or move very slowly along the bottom. A benthic-foraging sea turtle would likely avoid the seafloor device. In the unlikely event that a sea turtle is in the vicinity of a seafloor device, the slow movement and stationary characteristics of these devices would not be expected to physically disturb or alter natural behaviors of sea turtles. Moreover, objects falling through the water column will slow in velocity as they sink toward the bottom and could be avoided by most sea turtles. Therefore, these items do not pose a significant strike risk to sea turtles. The only seafloor device used during military readiness activities that has the potential to strike a sea turtle at or near the surface is an aircraft deployed mine shape, which is used during aerial mine laying activities. These devices are identical to non-explosive practice bombs discussed above in Section C.8.2.2 (Effects from Military Expended Materials).

Based on the analysis, there is a reasonable level of certainty that no sea turtles would be struck by seafloor devices, because these devices are not likely to interfere with foraging, migratory, or reproductive behaviors within the Study Area. Encountering a seafloor device would only occur in benthic habitats within the foraging depths of certain species known to forage on the seafloor. Green and hawksbill sea turtles occur primarily in nearshore waters of the Study Area where seafloor devices may be used and can occur near the bottom when foraging or resting. Sea turtles encountering seafloor devices are likely to avoid them just as they would avoid a diver or other object moving in close proximity. Given the slow movement of seafloor devices, the effort expended by sea turtles to avoid them would be minimal, temporary, and not have fitness consequences for the individual or population.

## C.8.5 Entanglement Stressors

### C.8.5.1 Effects from Fiber Optic Cables and Guidance Wires

Fiber optic cables are flexible cables that can range in size up to 3,000 m in length. Longer cables present a higher likelihood of sea turtle interactions, and therefore present an increased risk of entanglement of a sea turtle. Other factors that increase risk of sea turtle interactions with fiber optic cables include the amount of time a fiber optic cable is in the same vicinity of a sea turtle; however, these cables will only be within the water column during the activity and while they sink, the likelihood of a sea turtle encountering and becoming entangled within the water column is extremely low. Fiber optic cables exhibit several physical qualities that reduce the risk of entanglement. The cables are brittle and easily broken when kinked, twisted, or bent sharply. The cables are often designed with controlled buoyancy to minimize the cable's effect on vehicle movement. The fiber optic cable would be suspended within the water column during the activity, and then be expected to sink to the seafloor. Further, activities that use fiber optic cables occur in deep waters. These factors reduce the likelihood that a fiber optic cable would be in close proximity to a sea turtle—the cable is only buoyant during the training and testing activity, and subsequently sinks after use to rest in benthic habitats.

factors reduce the likelihood that a fiber optic cable would be in close proximity to a sea turtle—the cable is only buoyant during the training and testing activity, and subsequently sinks after use to rest in benthic habitats. If the isobaths is greater than the maximum benthic foraging ability (dive depth) of a sea turtle, then these cables would not present an entanglement risk. For example, as discussed previously, leatherbacks may dive to depths greater than 1,000 m in search of prey (e.g., jellyfish), while other species (e.g., loggerheads)

may forage in benthic habitats as deep as approximately 200 m, and juvenile sea turtles (e.g., green sea turtles) resting and foraging in waters as deep as approximately 30 m (Hochscheid, 2014).

In addition, because of the physical properties of the fiber optic material, the cable is unlikely to entangle a sea turtle body or appendage because the cable would likely break before an entangling loop would form. If a loop did form around an appendage or sea turtle body, the cable would subsequently break quickly on its own or in response to sea turtle movement. Therefore, fiber optic cables present an entanglement risk to sea turtles, but it is unlikely that an entanglement event would occur and any entanglement would be temporary (a few seconds) before the sea turtle could resume normal activities.

As noted in Section C.6.5, entanglement by fishing gear is a serious global threat to sea turtles. The various types of marine debris attributed to sea turtle entanglement (e.g., commercial fishing gear, towed gear, stationary gear, or gillnets) have substantially higher (up to 500–2,000 lb.) breaking strengths at their "weak links." If fiber optic cables and fragments of cables sink to the seafloor in an area where the bottom is calm, they would remain there undisturbed. In an area with bottom currents or active tidal influence, the fiber optic strands may move along the seafloor, away from the location in which they were expended and potentially into sea turtle benthic foraging habitats. Over time, these strands may become covered by sediment in most areas or colonized by attaching and encrusting organisms, which would further stabilize the material and reduce the potential for reintroduction as an entanglement risk.

Similar to fiber optic cables discussed above, guidance wires may pose an entanglement threat to sea turtles either in the water column or after the wire has settled to the seafloor. The Navy previously analyzed the potential for entanglement of sea turtles by guidance wires and concluded that the potential for entanglement is low (U.S. Department of the Navy, 1996). These conclusions have also been carried forward in NMFS analyses of Navy training and testing activities (National Marine Fisheries Service, 2013). The likelihood of a sea turtle encountering and becoming entangled in a guidance wire depends on several factors. With the exception of a chance encounter with the guidance wire while it is sinking to the seafloor (at an estimated rate of 0.7 ft. per second), it is most likely that a sea turtle would only encounter a guidance wire once it had settled on the seafloor. Since the guidance wire will only be within the water column during the activity and while it sinks, the likelihood of a sea turtle encountering and becoming entangled within the water column is extremely low. Guidance wires have a relatively low tensile breaking strength; between 10 and 42 lb. and can be broken by hand (National Marine Fisheries Service, 2008b). In addition, based on degradation times, the guidance wires would break down within one to two years and therefore no longer pose an entanglement risk. As with fiber optic cables, guidance wire fragments may move with bottom currents or active tidal influence, and present an enduring entanglement risk if the wires were moved into benthic foraging habitats. Subsequent colonization by encrusting organisms, burying by sediment, and chemical breakdown of the copper filament would further reduce the potential for reintroduction as an entanglement risk. The length of the guidance wires varies, as described in Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]), but greater lengths increase the likelihood that a sea turtle could

become entangled. The behavior and feeding strategy of a species can determine whether it may encounter items on the seafloor, where guidance wires will most likely be available. There is potential for those species that feed on the seafloor to encounter guidance wires and potentially become entangled; however, the relatively few guidance wires being expended within the Study Area limits the potential for encounters.

Sonobuoys consist of a surface antenna and float unit and a subsurface hydrophone assembly unit. The two units are attached through a thin-gauge, dual-conductor, hard draw copper strand wire, which is then wrapped by a hollow rubber tubing or bungee in a spiral configuration. The tensile breaking strength of the sonobuoy wire and rubber tubing is no more than 40 lb. The length of the sonobuoy wire is housed in a plastic canister dispenser, which remains attached upon deployment. The length of cable that extends out is no more than 1,500 ft. and is dependent on the water depth and type of sonobuoy. Attached to the sonobuoy wire is a kite-drogue and damper disk stabilizing system made of non-woven nylon fabric. The nylon fabric is very thin and can be broken by hand. The sonobuoy wire runs through the stabilizing system and leads to the hydrophone components. The hydrophone components may be covered by thin plastic netting depending on type of sonobuoy. Each sonobuoy has a saltwater activated polyurethane float that inflates when the sonobuoy is submerged and keeps the sonobuoy components floating vertically in the water column below it. Sonobuoys remain suspended in the water column for no more than 30 hours, after which they sink to the seafloor. Several factors reduce the likelihood of sea turtle entanglement from sonobuoy components. The materials that present an entanglement risk in sonobuoys are weak, and if wrapped around an adult or juvenile sea turtle, would likely break soon after entanglement or break while bending into potentially entangling loops, although hatchlings would not likely be able to escape entrapment if entangled. These materials, however, are only temporarily buoyant and would begin sinking after use in an activity. The entanglement risk from these components would only occur when a sea turtle and these components were in close proximity, which is only in the water column. These materials would be expended in waters too deep for benthic foraging, so bottom foraging sea turtles would not interact with these materials once they sink. Some sonobuoy components, once they sink to the bottom, may be transported by bottom currents or active tidal influence, and present an enduring entanglement risk. In the benthic environment, subsequent colonization by encrusting organisms, burying by sediment, and chemical breakdown of the various materials would further reduce the potential for reintroduction as an entanglement risk.

Based on the numbers and geographic locations of their use, wires and cables used during military readiness activities are analyzed for their potential to entangle sea turtles. Any species of sea turtle that occurs in the Study Area could at some time encounter expended cables or wires. The sink rates of cables and wires would rule out the possibility of these drifting great distances into nearshore and coastal areas where green, hawksbill, olive ridley, and loggerhead sea turtles are more likely to occur and feed on the bottom. The leatherback is more likely to co-occur with these activities, given its preference for open-ocean habitats, but this species is known to forage on jellyfish at or near the surface. Hatchlings and juveniles of some sea turtle species (e.g. greens and loggerheads), may occur in open-ocean habitats, too. Under Alternative 1, exposure to cables and wires used in training activities may cause short-term or

long-term disturbance to an individual turtle because if a sea turtle were to become entangled in a cable or wire, it could free itself, or the entanglement could lead to injury or death. Potential effects of exposure to cable or wire may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, wires and cables are generally not expected to cause disturbance to sea turtles because (1) sea turtles would only be exposed to potential entanglement risk as the wire or cable sinks through the water column; (2) due to their behavior, sea turtles are unlikely to become entangled in an object that is resting on the seafloor, and (3) there is a low concentration of expended wires and cables in the Study Area. Therefore, it is unlikely that an individual sea turtle would be in close proximity to a sinking wire or cable, and if so, would unlikely become entangled. Potential effects of exposure to cables and wires are not expected to result in population-level effects.

The locations of training activities that expend wires and cables are the same under Alternatives 1 and 2. Table 3.0-19 shows the number and location of wires and cables expended during proposed training activities. Even though training activities under Alternative 2 occur at a slightly higher rate and frequency relative to Alternative 1, entanglement stress experienced by sea turtles from guidance wires, fiber optic cables, and sonobuoy wires under Alternative 2 are not expected to be meaningfully different than those described under Alternative 1. The number of sonobuoys would increase under Alternative 2 training activities, thereby increasing the number of sonobuoy wires expended into the marine environment. However, wires and cables are generally not expected to cause disturbance to sea turtles because (1) sea turtles would only be exposed to potential entanglement risk as the wire or cable sinks through the water column; (2) due to their behavior, sea turtles are unlikely to become entangled in an object that is resting on the seafloor; and (3) there is a low concentration of expended wires and cables in the Study Area. Therefore, it is unlikely that an individual sea turtle would be in close proximity to a sinking wire or cable, and if so, would unlikely become entangled. Potential effects of exposure to cables and wires are not expected to result in population-level effects. Further, the differences in species overlap and potential effects from wires and cables on sea turtles during training activities would not be discernible from those described for training activities in Section 3.5.3.6 (Entanglement Stressors). As with Alternative 1, the use of wires and cables in training activities may cause short-term or long-term disturbance to an individual turtle, because if a sea turtle were to become entangled in a cable or wire, it could free itself or the entanglement could lead to injury or death. Potential effects of exposure to cable or wire may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential effects of exposure to cables and wires are not expected to result in population-level effects.

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term disturbance to an individual turtle, because if a sea turtle were to become entangled in a cable or wire, it could free itself or the entanglement could lead to injury or death. Potential effects of exposure to a cable or wire may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. Potential effects of exposure to cables and wires are not expected to result in population-level effects.

### C.8.5.2 Effects from Decelerators/Parachutes

Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]) provides the number of training and testing exercises that involve the use of decelerators/parachutes and the geographic areas where they would be expended. Training and testing activities that introduce decelerators/parachutes into the water column can occur anywhere in the Study Area and may pose an entanglement risk to sea turtles. Potential effects from decelerators/parachutes as ingestion stressors to sea turtles are discussed in Section 3.5.3.7 (Ingestion Stressors).

As described in Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]), decelerators/parachutes used during the proposed activities range in size from 18 in. up to 19–82 ft. in diameter. The vast majority of expended decelerators/parachutes are small (18 in.), cruciform shaped, and used with sonobuoys. Illumination flares use large decelerators/parachutes, up to 19 ft. in diameter. Drones use a larger decelerator/parachute system, ranging from 30 ft. to 82 ft. in diameter. Decelerators/parachutes have short attachment cords and upon impact with water may remain at the surface for 5–15 seconds before sinking to the seafloor, where they flatten. Sonobuoy decelerators/parachutes are designed to sink within 15 minutes, but the rate of sinking depends upon sea conditions and the shape of the decelerator/parachute, and the duration of the descent would depend on the water depth. Unlike the small- and medium-sized decelerators/parachutes, drone decelerators/parachutes do not have weights attached and may remain at the surface or suspended in the water column for some time prior to eventual settlement on the seafloor.

While in the water column or at the surface, a sea turtle is less likely to become entangled because the decelerator/parachute would have to land directly on the turtle, or the turtle would have to swim into the decelerator/parachute before it sank. Prior to reaching the seafloor, it could be carried along in a current or snagged on a hard structure near the bottom. Conversely, it could settle to the bottom, where it would be buried by sediment in most soft-bottom areas or colonized by attaching and encrusting organisms, which would further stabilize the material and reduce the potential for reintroduction as an entanglement risk. Decelerators/parachutes, particularly attached lines, are an entanglement risk for sea turtles while suspended in the water column or floating at the surface. A sea turtle would have to surface to breathe or grab prey from under the decelerator/parachute and swim into the decelerator/parachute or its lines to potentially become entangled. While smaller sonobuoy decelerator parachutes are weighted and designed to sink rapidly through the water column after deployment to the seafloor, larger drone decelerator/parachutes are not weighted and are intended to float at the surface to allow aircrews to recover the parachute.

Once unrecovered decelerator/parachutes sink to the seafloor, they can be transported by bottom currents, if present in that particularly area, and the canopy may billow and pose an entanglement risk to sea turtles that feed or rest in benthic habitats (i.e., green and hawksbill sea turtles). Bottom-feeding sea turtles tend to forage in nearshore areas rather than offshore, where these decelerators/parachutes are used; therefore, sea turtles are not likely to encounter decelerators/parachutes once they reach the seafloor. The potential for a sea turtle to encounter an expended decelerator/parachute at the surface or in the water column is extremely low, and is even less probable at the seafloor, given the general improbability of a sea turtle being near the deployed decelerator/parachute, as well as the general behavior of sea turtles. Depending on how quickly the decelerator/parachute may degrade, the risk may increase with time if the decelerator/parachute remains intact or if underwater currents delay settling of the decelerator/parachute on the seafloor (where they would likely be covered by sediment and encrusted). Factors that may influence degradation times include exposure to ultraviolet radiation and the extent of physical damage of the decelerator/parachute on the water's surface, as well as water temperature and sinking depth. It should be noted there are no reported instances of sea turtle entanglement with a decelerator/parachute assembly.

Based on the numbers and geographic locations of their use, decelerators/parachutes used in military readiness activities pose a risk of entanglement for all sea turtle species considered in this analysis. Any species of sea turtle that occurs in the Study Area could at some time encounter expended decelerator/parachute. The sink rates of a decelerator/parachute assembly would rule out the possibility of these drifting great distances into nearshore and coastal areas where green, hawksbill, olive ridley, and loggerhead sea turtles are more likely to occur and feed on the bottom. The leatherback is more likely to co-occur with these activities, given its preference for open-ocean habitats, but this species is known to forage on jellyfish at or near the surface. Early juveniles and hatchlings of other sea turtle species (e.g., green sea turtles and loggerheads) may also co-occur with these activities, as well. Exposure to decelerators/parachutes used in training activities may cause short-term or long-term disturbance to an individual turtle, because if a sea turtle were to become entangled in a decelerator/parachute, it could free itself (or become unentangled), or the entanglement could lead to injury or death. Potential effects of exposure to decelerator/parachute may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, decelerators are generally not expected to cause disturbance to sea turtles because the decelerator/parachute would have to land directly on an animal, or an animal would have to swim into it before it sinks. Decelerators/parachutes have small footprints which further reduce the potential for entanglement. It is possible, however, that a benthic feeding sea turtle could become entangled when foraging in areas where decelerators/parachutes have settled on the seafloor. For example, if bottom currents are present, the canopy may temporarily billow and pose a greater entanglement threat.

### C.8.6 Ingestion Stressors

The potential effects from ingesting MEM is dependent upon the probability of the animal encountering these items in their environment, which is primarily contingent on where the

items are expended and how a sea turtle feeds. Sea turtles commonly mistake debris for prey, and ingesting debris, particularly items made from non-digestible materials like plastics, can lead to injury or mortality. The risk is prolific throughout sea turtle habitats, and ingestion of expended materials by sea turtles could occur in all large marine ecosystems and open ocean areas and can occur at the surface, in the water column, or at the seafloor, depending on the size and buoyancy of the expended object and the feeding behavior of the turtle. Susceptibility of sea turtles to ingestion risk is a factor of the life-stage of the individual sea turtle, foraging habits of the species, the location of the item within the water column, and the type of debris. For example, floating material could be eaten by turtles such as leatherbacks, juveniles, and hatchlings of all species that feed at or near the water surface, while materials that sink to the seafloor pose a risk to bottom-feeding turtles such as loggerheads. The variety of items eaten by juvenile and hatchling sea turtles of all species and adult leatherbacks that feed are prone to ingesting non-prey items (Fujiwara & Caswell, 2001; Hardesty & Wilcox, 2017; Mitchelmore et al., 2017; Schuyler et al., 2014; Schuyler et al., 2016).

The consequences of ingestion could range from temporary and inconsequential to long-term physical stress or even death. Ingestion of these items may not be directly lethal; however, ingestion of plastic and other fragments can restrict food intake and have sublethal effects caused by reduced nutrient intake (McCauley & Bjorndal, 1999). Poor nutrient intake can lead to decreased growth rates, depleted energy, reduced reproduction, and decreased survivorship. These long-term sublethal effects may lead to population-level effects, but this is difficult to assess because the affected individuals remain at sea and the trends may only arise after several generations have passed. Schuyler et al. (2014) determined that most sea turtles, at some point, ingest some amount of debris. Because bottom-feeding occurs in nearshore areas, materials that sink to the seafloor in the open ocean are less likely to be ingested due to their location. While these depths may be within the diving capabilities of most sea turtle species, especially leatherback sea turtles, bottom foraging species (i.e., greens, hawksbills, olive ridleys, and loggerheads) are more likely to forage in the shallower waters less than 100 m in depth. This overlaps with only a small portion of the depth range at which military materials are expended.

### C.8.6.1 Effects from Military Expended Materials – Munitions

Many different types of explosive and non-explosive practice munitions are expended at sea during training and testing activities. Types of non-explosive practice munitions generally include projectiles, missiles, and bombs. Of these, only small- or medium-caliber projectiles would be small enough for a sea turtle to ingest. Small- and medium-caliber projectiles include all sizes up to and including 2.25 in. (57 mm) in diameter. These solid metal materials would quickly move through the water column and settle to the seafloor. Ingestion of non-explosive practice munitions is not expected to occur in the water column because the munitions sink quickly. Instead, they are most likely to be encountered by species that forage on the bottom. Types of high-explosive munitions that can result in fragments include demolition charges, projectiles, missiles, and bombs. Fragments would result from fractures in the munitions casing and would vary in size depending on the size of the net explosive weight and munitions type; however, typical sizes of fragments are unknown. These solid metal materials would quickly

move through the water column and settle to the seafloor; therefore, ingestion is not expected by most species. Fragments are primarily encountered by species that forage on the bottom. Other military expended materials such as targets, large-caliber projectiles, intact training and testing bombs, guidance wires, 55-gallon drums, sonobuoy tubes, and marine markers are too large for sea turtles to consume. Leatherback sea turtles, primarily feeding on soft-bodied prey items in the water column (Bailey et al., 2012; Nordstrom et al., 2020) would be the least at risk of ingesting military expended materials.

Sublethal effects due to ingestion of munitions used in training and activities may cause short-term or long-term disturbance to an individual turtle because: (1) if a sea turtle were to incidentally ingest and swallow a projectile or solid metal high-explosive fragment, it could potentially disrupt its feeding behavior or digestive processes; and (2) if the item is particularly large in proportion to the turtle ingesting it, the item could become permanently encapsulated by the stomach lining, with a rare chance that this could impede the turtle's ability to feed or take in nutrients. Potential effects of exposure to munitions may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment.

In open ocean environments, munitions used in training activities are generally not expected to cause disturbance to sea turtles because: (1) sea turtles are not expected to encounter most small- and medium-caliber projectiles or high-explosive fragments on the seafloor because of the depth at which these would be expended; and (2) in some cases, a turtle would likely pass the projectile through their digestive tract and expel the item without affecting the individual. Schuyler et al. (2014) noted that less than 10 percent of sea turtles (out of a sample size of 454) that ingested a wide range of debris suffered mortality, and 4 percent of turtles necropsied were killed by plastics ingestion (out of a sample size of 1,106 necropsied turtles).

Because green, loggerhead, olive ridley, and hawksbill sea turtles feed along the seafloor, they are more likely to encounter munitions of ingestible size that settle on the bottom than leatherbacks that primarily feed at the surface and in the water column. Furthermore, these four species typically use nearshore feeding areas, while leatherbacks are more likely to feed in the open ocean. Given the very low probability of a leatherback encountering and ingesting materials on the seafloor, this analysis will focus on green, loggerhead, olive ridley, and hawksbill sea turtles and ingestible materials expended in offshore waters.

In open ocean waters and nearshore habitats, the amount of non-explosive practice munitions and high-explosive munitions fragments that an individual sea turtle would encounter is generally low based on the patchy distribution of both the projectiles and sea turtle feeding habits. In addition, a sea turtle would not likely ingest every projectile it encountered. Furthermore, a sea turtle may attempt to ingest a projectile or fragment and then reject it when it realizes it is not a food item. Therefore, potential effects of non-explosive practice munitions and fragments ingestion would be limited to the unlikely event in which a sea turtle might suffer a negative response from ingesting an item that becomes embedded in tissue or is too large to be passed through the digestive system. The Navy considers the likelihood of ingestion of military expended materials by sea turtles s to be very low.

### C.8.6.2 Effects from Military Expended Materials Other Than Munitions

Target-related material, chaff, flares, and decelerators/parachutes (and their subcomponents) have the potential to be ingested by a sea turtle, although that is considered unlikely since most of these materials would quickly drop through the water column, settle on the seafloor, or rapidly decay, and not present an ingestion hazard. Some Styrofoam, plastic endcaps, chaff, and other small items may float for some time before sinking.

While the smaller items discussed here may pose a hazard to sea turtles, as discussed for non-explosive practice munitions ingestion, the effects of ingesting these forms of expended materials on sea turtles would be minor because of the following factors:

- the limited geographic area where materials other than munitions are expended during a given event
- the limited period of time these military expended materials would remain in the water column
- the unlikely chance that a sea turtle might encounter and swallow these items on the seafloor, particularly given that many of these items would be expended over deep, offshore waters

The effects of ingesting military expended materials other than munitions would be limited to cases where an individual sea turtle might eat an indigestible item too large to be passed through the gut. The sea turtle would not be preferentially attracted to these military expended materials, with the possible exception of decelerators/parachutes that may appear similar to the prey of some sea turtle species and life stages that feed on jellyfish and similar organisms. For the most part, these military expended materials would most likely only be incidentally ingested by individuals feeding on the bottom in the precise location where these items were deposited. Non-munition military expended materials that would remain floating on the surface are too small to pose a risk of intestinal blockage to any sea turtle that happened to encounter it. Because leatherbacks and juveniles of some species (e.g., green sea turtles) are more likely to feed at or near the surface, they are more likely to encounter materials at the surface than are other species of turtles that primarily feed along the seafloor. Furthermore, leatherbacks typically feed in the open ocean, while other species are more likely to feed in nearshore areas. Though they are bottom-feeding species that generally feed nearshore, green, hawksbill, olive ridley, and loggerhead sea turtles may occur in the open ocean during migrations, as well as hatchling and juvenile stage turtles.

Sublethal effects due to ingestion of military expended materials other than munitions used in training activities may cause short-term or long-term disturbance to an individual turtle because (1) if a sea turtle were to incidentally ingest and swallow a decelerator/parachute, target fragment, chaff or flare component, it could potentially disrupt its feeding behavior or digestive processes; and (2) if the item is particularly large in proportion to the turtle ingesting it, the item could become permanently encapsulated by the stomach lining, with a rare chance that this could impede the turtle's ability to feed or take in nutrients. Potential effects of exposure to these items may result in changes to an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, decelerators/parachutes, target fragments, chaff, and flare components used in

training activities are generally not expected to cause disturbance to sea turtles because (1) leatherbacks are likely to forage further offshore than within range complexes, and other sea turtles primarily forage on the bottom in nearshore areas; (2) in some cases, a turtle would likely pass the item through its digestive tract and expel the item without affecting the individual; and (3) chaff, if ingested, would occur in very low concentration and is similar to spicules, which sea turtles (species and life stages that consume sponges and other organisms containing spicules) ingest without harm. Potential effects of exposure to military expended materials other than munitions are not expected to result in population-level effects.

### Target-Related Materials

At-sea targets are usually remotely operated airborne, surface, or subsurface traveling units, most of which are designed to be recovered for reuse. If they are severely damaged or displaced, targets may sink before they can be retrieved. Expendable targets include air-launched decoys, marine markers (smoke floats), cardboard boxes, and 10 ft. diameter red balloons tethered by a sea anchor. Most target fragments would sink quickly in the sea. Floating material, such as Styrofoam, may be lost from target boats and remain at the surface for some time, however during target recovery, personnel would collect as much floating debris and Styrofoam as possible Sea turtles would be exposed to potential ingestion risk of target-related materials where these items are expended in offshore and inshore waters.

### Chaff

Chaff is an electronic countermeasure designed to reflect radar waves and obscure aircraft, vessels, and other equipment from radar tracking sources. Chaff is composed of an aluminum alloy coating on glass fibers of silicon dioxide (U.S. Department of the Air Force, 1997). It is released or dispensed in cartridges or projectiles that contain millions of chaff fibers. When deployed, a diffuse cloud of fibers undetectable to the human eye is formed. Chaff is a very light material that can remain suspended in air anywhere from 10 minutes to 10 hours and can travel considerable distances from its release point, depending on prevailing atmospheric conditions (Arfsten et al., 2002; U.S. Department of the Air Force, 1997). Doppler radar has tracked chaff plumes containing approximately 900 grams (g) of chaff drifting 200 mi. from the point of release, with the plume covering greater than 400 cubic miles (1,667 cubic kilometers) (Arfsten et al., 2002).

The chaff concentrations that sea turtles could be exposed to following release of multiple cartridges (e.g., following a single day of training) are difficult to accurately estimate because it depends on several unknown factors. First, specific release points are not recorded and tend to be random, and chaff dispersion in air depends on prevailing atmospheric conditions. After falling from the air, chaff fibers would be expected to float on the sea surface for some period, depending on wave and wind action. The fibers would be dispersed further by sea currents as they float and slowly sink toward the bottom. Chaff concentrations in benthic habitats following release of a single cartridge would be lower than the values noted in this section, based on dispersion by currents and the enormous dilution capacity of the receiving waters.

Several literature reviews and controlled experiments have indicated that chaff poses little risk, except at concentrations substantially higher than those that could reasonably occur from

military training (Arfsten et al., 2002; Spargo et al., 1999; U.S. Department of the Air Force, 1997). Nonetheless, some sea turtle species within the Study Area could be exposed to chaff through direct body contact and ingestion. Chemical alteration of water and sediment from decomposing chaff fibers is not expected to result in exposure. Based on the dispersion characteristics of chaff, it is likely that sea turtles would occasionally come in direct contact with chaff fibers while at the water's surface and while submerged, but such contact would be inconsequential. Chaff is similar to fine human hair (U.S. Department of the Air Force, 1997). Because of the flexibility and softness of chaff, external contact would not be expected to affect most wildlife (U.S. Department of the Air Force, 1997), and the fibers would quickly wash off shortly after contact. Given the properties of chaff, skin irritation is not expected to be a problem (U.S. Department of the Air Force, 1997). Arfsten et al. (2002); Spargo et al. (1999); U.S. Department of the Air Force (1997) reviewed the potential effects of chaff inhalation on humans, livestock, and animals and concluded that the fibers are too large to be inhaled into the lung. The fibers are predicted to be deposited in the nose, mouth, or trachea and are either swallowed or expelled; however, these reviews did not specifically consider sea turtles.

Although chaff fibers are too small for sea turtles to confuse with prey and forage, there is some potential for chaff to be incidentally ingested along with other prey items, particularly if the chaff attaches to other floating marine debris. If ingested, chaff is not expected to affect sea turtles due to the low concentration that would be ingested and the small size of the fibers. While no similar studies to those discussed in Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]) on the effects of chaff have been conducted on sea turtles, they are also not likely to be affected by incidental ingestion of chaff fibers. For instance, some sea turtles ingest spicules (small spines within the structure of a sponge) in the course of eating the sponges, without harm to their digestive system. Since chaff fibers are of similar composition and size as these spicules (Spargo et al., 1999), ingestion of chaff should be inconsequential for sea turtles.

Chaff cartridge plastic end caps and pistons would also be released into the marine environment, where they would persist for long periods and could be ingested by sea turtles while initially floating on the surface and sinking through the water column. Chaff end caps and pistons would eventually sink in saltwater to the seafloor (Spargo, 2007), which reduces the likelihood of ingestion by sea turtles at the surface or in the water column. However, bottom-feeding sea turtles (e.g., green and hawksbill sea turtles), would be at increased risk if these items were deposited in potential benthic feeding areas and before these items would be encrusted or buried.

**Flares**

Flares are designed to burn completely. The only material that would enter the water would be a small, round, plastic compression pad or piston (0.45–4.1 g depending on flare type). The flare pads and pistons float in sea water.

An extensive literature review and controlled experiments conducted by the United States Air Force demonstrated that self-protection flare use poses little risk to the environment or animals (U.S. Department of the Air Force, 1997). For sea turtles, these types of flares are large enough to not be considered an ingestion hazard. Nonetheless, sea turtles within the vicinity of

flares could be exposed to light generated by the flares. It is unlikely that sea turtles would be exposed to any chemicals that produce either flames or smoke since these components are consumed in their entirety during the burning process. Animals are unlikely to approach or get close enough to the flame to be exposed to any chemical components.

### Decelerators/Parachutes

As noted previously in Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]), decelerators/parachutes are classified into four different categories based on size: small, medium, large, and extra-large. The majority of expended decelerators/parachutes are in the small category. Decelerators/parachutes in the three remaining size categories (medium – up to 19 ft. in diameter, large – between 30 and 50 ft. in diameter, and extra-large – up to 80 ft.in diameter) are likely too big to be mistaken for prey items and ingested by a sea turtle.

The majority of decelerators/parachutes are weighted and by design must sink below the surface within five minutes of contact with the water. Once on the seafloor, decelerators/parachutes become flattened (Environmental Sciences Group, 2005). Ingestion of a decelerator/parachute by a sea turtle at the surface or within the water column would be unlikely, since the decelerator/parachute would not be available for very long before it sinks. Once on the seafloor, if bottom currents are present, the canopy may temporarily billow and be available for potential ingestion by a sea turtle feeding on or near the seafloor. Conversely, the decelerator/parachute could be buried by sediment in most soft bottom areas or colonized by attaching and encrusting organisms, which would further stabilize the material and reduce the potential for an ingestion risk. Some decelerators/parachutes may be too large to be a potential prey item for certain age classes (e.g., hatchlings and pre-recruitment juveniles), although degradation of the decelerator/parachute may create smaller items that are potentially ingestible. The majority of these items (from sonobuoys), however, would be expended in deep offshore waters. Bottom-feeding sea turtles (e.g., green, hawksbill, olive ridley, and loggerhead turtles) tend to forage in nearshore and coastal areas rather than offshore, where the majority of these decelerators/parachutes are used. Since these materials would most likely be expended in offshore waters too deep for benthic foraging, it would be unlikely for bottom-foraging sea turtles to interact with these materials once they sink; therefore, it is unlikely that sea turtles would encounter decelerators/parachutes once they reach the seafloor.

## C.8.7 Secondary Stressors

This section analyzes potential effects on sea turtles exposed to stressors indirectly through effects on habitat and prey availability.

### Explosives

Underwater explosions could affect other species in the food web, including sea turtle prey species, and could disrupt ecological relationships and conditions that would lead to decreased availability of forage. The effects of explosions would differ depending on the type of prey species in the area of the blast. As described in Chapter 2 (Description of Proposed Action and Alternatives), training and testing activities resulting in underwater explosions will occur in the Study Area.

In addition to the physical effects of an underwater blast (e.g., injury or mortality from the blast pressure wave), prey might have behavioral reactions to underwater sound. For instance, prey might exhibit a strong startle reaction to detonations that might include swimming to the surface or scattering away from the source. This startle and flight response is the most common secondary defense among animals (Mather, 2004). The abundance of prey near the detonation point could be diminished for a short period before being repopulated by animals from adjacent waters (Berglind et al., 2009; Craig Jr., 2001). Many sea turtle prey items, such as jellyfish, sponges, and molluscs, have limited mobility and ability to react to pressure waves; therefore, mobile prey species for sea turtles would be less affected because of their ability to respond to other stressors preceding an underwater blast (e.g., vessel noise or visual cues). Any of these scenarios would be temporary, only occurring during activities involving explosives, and no lasting effect on prey availability or the pelagic food web would be expected. For example, if prey were removed from an area resulting from a stressor introduced by a training or testing activity, prey species would be expected to return to or recolonize rapidly in the area because there would be little or no permanent change to the habitat.

The Navy will implement mitigation during gunnery activities within 350 yards of shallow-water coral reefs to avoid potential effects from explosives and physical disturbance and strike stressors on seafloor resources in mitigation areas throughout the Study Area. This mitigation will consequently help avoid potential effects from explosives on sea turtle prey species that inhabit shallow-water coral reefs, live hard bottom, , artificial reefs, and shipwrecks.

**Explosion Byproducts and Unexploded Munitions**

High-order explosions consume most of the explosive material, creating typical combustion products. In the case of Royal Demolition Explosive, also known as cyclonite and hexogen, 98 percent of the byproducts are common seawater constituents, and the remainder is rapidly diluted below threshold effect level (Section 3.1, Sediments and Water Quality). Explosion byproducts associated with high-order detonations present no indirect stressors to sea turtles through sediment or water. Furthermore, most explosions occur in depths exceeding those which normally support seagrass beds and coral reefs, areas that are commonly used by green and hawksbill sea turtles. For example, most detonations would occur in waters greater than 200 ft. in depth, and greater than 3 NM from shore, although mine warfare, demolition, and some testing detonations would occur in shallow water close to shore. These low-order detonations and unexploded munitions present elevated likelihood of secondary effects on sea turtles.

Deposition of undetonated explosive materials into the marine environment can be reasonably well estimated by the known failure and low-order detonation rates of high explosives (Appendix C, Acoustic and Non-Acoustic Effects Supporting Information, Table C-2). While it is remotely possible for sea turtles to come into contact with an undetonated explosive, to have contact with unexploded materials in the sediment or water, and or to ingest unexploded materials in sediments, it is very unlikely.

Indirect effects by explosives and unexploded munitions to sea turtles via sediment contamination would only be possible only if a sea turtle ingested the sediment. Degradation of explosives proceeds through several pathways. Degradation products of Royal Demolition

Explosive are not toxic to marine organisms at realistic exposure levels (Rosen & Lotufo, 2010). Relatively low solubility of most explosives and their degradation products means that concentrations of these contaminants in the marine environment are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in marine sediment approximately 6–12 in. away from degrading munitions, the concentrations of these compounds were not statistically distinguishable from background beyond 3–6 ft. from the degrading munitions. Taken together, it is possible that sea turtles could be exposed to degrading explosives, but it would be within a very small radius of the explosive (1 to 6 ft.).

A series of research efforts focused on World War II underwater munitions disposal sites in Hawaii (Edwards et al., 2016; Kelley et al., 2016; Koide et al., 2016; University of Hawaii, 2010) and an intensively used live fire range in the Mariana Islands (Smith & Marx, 2016) provide information in regard to the effects of undetonated materials and unexploded munitions on marine life. Findings from these studies indicate that there were no adverse effects on the local ecology from the presence of degrading munitions and there was no bioaccumulation of munitions-related chemicals in local marine species.

The island of Farallon De Medinilla (in the Mariana Islands) has been used as a target area since 1971. Between 1997 and 2012, there were 14 underwater scientific survey investigations around the island providing a long-term look at potential effects on marine life from training and testing involving the use of munitions (Smith & Marx, 2016). Munitions use has included high-explosive rounds from gunfire, high-explosives bombs by Navy aircraft and U.S. Air Force B-52s, in addition to the expenditure of inert rounds and non-explosive practice bombs. Marine life assessed during these surveys included algae, corals, benthic invertebrates, sharks, rays, and bony fishes, and sea turtles. The investigators found no evidence over the 16-year period that the condition of the biological resources had been adversely affected to a significant degree by the training activities (Smith & Marx, 2016). Furthermore, they found that the health, abundance, and biomass of fishes, corals and other marine resources were comparable to or superior to those in similar habitats at other locations within the Mariana Archipelago.

These findings are consistent with other assessments such as that done for the Potomac River Test Range at Dahlgren, Virginia, which was established in 1918 and is the nation's largest fully instrumented, over-the-water gun-firing range. Munitions tested at Naval Surface Warfare Center, Dahlgren have included rounds from small-caliber guns up to the Navy's largest (16 in. guns), bombs, rockets, mortars, grenades, mines, depth charges, and torpedoes {U.S. Department of the Navy, 2013 #9134}. Results from the assessment indicate that munitions expended at Naval Surface Warfare Center, Dahlgren have not contributed to significant concentrations of metals to the Potomac River water and sediments, given those contributions are orders of magnitude lower than concentrations already present in the Potomac River from natural and manmade sources {U.S. Department of the Navy, 2013 #9134}.

The concentration of munitions/explosions, expended material, or devices in any one location in the Study Area would be a small fraction of that from a World War II dump site, or a target island used for 45 years, or a water range in a river used for almost 100 years. Based on findings from much more intensively used locations, the water quality effects from the use of munitions, expended material, or devices resulting from any of the proposed actions would be negligible

by comparison. As a result, explosion by-products and unexploded munitions would have no meaningful effect on water quality and would therefore not constitute a secondary indirect stressor for sea turtles.

### Metals

Metals are introduced into seawater and sediments as a result of training and testing activities involving ship hulks, targets, munitions, and other military expended materials (Environmental Sciences Group, 2005). Some metals bioaccumulate and physiological effects begin to occur only after several trophic transfers concentrate the toxic metals (Section 3.1 Sediments and Water Quality). Evidence from a number of studies (Briggs et al., 2016; Edwards et al., 2016; Kelley et al., 2016; Koide et al., 2016) indicate metal contamination is very localized and that bioaccumulation resulting from munitions cannot be demonstrated. Specifically, in sampled marine life living on or around munitions on the seafloor, metal concentrations could not be definitively linked to the munitions since comparison of metals in sediment next to munitions show relatively little difference in comparison to other "clean" marine sediments used as a control/reference (Koide et al., 2016). Research has demonstrated that some smaller marine organisms are attracted to metal munitions as a hard substrate for colonization or as shelter (Kelley et al., 2015) (Smith & Marx, 2016). Although this would likely increase prey availability for some benthic foraging sea turtles that feed on molluscs (e.g., loggerheads), the relatively low density of metals deposited by training and testing activities compared to concentrated dump and range sites would not likely substantively benefit sea turtles.

### Chemicals

Several Navy training and testing activities introduce chemicals into the marine environment that are potentially harmful in higher concentrations; however, rapid dilution would occur, and toxic concentrations are unlikely to be encountered. Chemicals introduced are principally from flares and propellants for missiles and torpedoes. Properly functioning flares, missiles, and torpedoes combust most of their propellants, leaving benign or readily diluted soluble combustion byproducts (e.g., hydrogen cyanide). Operational failures may allow propellants and their degradation products to be released into the marine environment. Flares and missile that operationally fail may release perchlorate, which is highly soluble in water, persistent, and affects metabolic processes in many plants and animals if in sufficient concentration. Such concentrations are not likely to persist in the ocean. Research has demonstrated that perchlorate did not bioconcentrate or bioaccumulate, which was consistent with the expectations for a water-soluble compound (Furin et al., 2013). Perchlorate from failed expendable items is therefore unlikely to compromise water quality to that point that it would act as a secondary stressor to sea turtles. It should also be noted that chemicals in the marine environment as a result of Navy training and testing activities would not occur in isolation and are typically associated with military expended materials that release the chemicals while in operation. Because sea turtles would likely avoid expended flares, missiles, or torpedoes in the water (because of other cues such as visual and noise disturbance), avoidance would further reduce the potential for introduced chemicals to act as a secondary stressor.

### C.8.7.1 Effects on Habitat

As presented in Section C.7.5 (Secondary Stressors), Navy activities that introduce explosive byproducts and unexploded munitions, metals, and chemicals into the marine environment have not demonstrated long-term effects on sediment and water quality. Explosive byproducts and unexploded munitions from ongoing Navy activities have not resulted in water quality effects, and the likelihood of sea turtles being in contact with sediments contaminated from degrading explosives is low, given the small radius of impact around the location of the explosive. Furthermore, there is no evidence of bioconcentration or bioaccumulation of chemicals introduced by Navy activities that would alter water quality to an extent that would result in overall habitat degradation for sea turtles.

As stated previously, most detonations would occur in waters greater than 200 ft. in depth, and greater than 3 NM from shore, although mine warfare, demolition, and some testing detonations would occur in shallow water close to shore. In deep waters, explosions would not likely affect habitat for sea turtles because the explosion would not be on or proximate to the sea floor. In nearshore waters, explosions would typically occur in the same locations, limiting the removal of habitat to previously disturbed areas. Therefore, habitat loss from training and testing activities that use explosions would not substantially remove habitats available to sea turtles and not affect sea turtle individuals or populations. Secondary stressors from Navy training and testing activities in the Study Area are not expected to result in substantial changes in an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment, and as such are not expected to result in population-level impacts for all sea turtle species.

### C.8.7.2 Effects on Prey Availability

As presented above in Section C.7.5 (Secondary Stressors), Navy activities that introduce explosives, metals, and chemicals into the marine environment have not demonstrated long-term effects on prey availability for sea turtles. Bioaccumulation of metals from munitions in prey species has not been demonstrated, and no effects to prey availability from metals and chemicals are known to occur. In-water explosions have the potential to injure or kill prey species that sea turtles feed on within a small area affected by the blast; however, impacts would not substantially impact prey availability for sea turtles.

Training and testing activities in the Study Area would be unlikely to affect coral reefs (a direct and indirect source of prey and forage items for sea turtles) because the Navy implements mitigation for shallow-water coral reefs. These mitigation measures would continue under both Alternative 1 and Alternative 2. Secondary stressors from Navy training and testing activities in the Study Area that may influence prey availability are not expected to result in substantial changes in an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment, and as such are not expected to result in population-level impacts for all sea turtle species.

### C.8.7.3 Summary of Potential Effects on Sea Turtles

**Additive Stressors–** There are generally two ways that a sea turtle could be exposed to multiple additive stressors. The first would be if an animal were exposed to multiple sources of stress

from a single event or activity (e.g., a mine warfare event may include the use of a sound source and a vessel).

The potential for a combination of these effects from a single activity would depend on the range to effects of each of the stressors and the response or lack of response to that stressor. Most of the activities proposed under Alternative 1 generally involve the use of moving platforms (e.g., ships, torpedoes, aircraft) that may produce one or more stressors; therefore, it is likely that if a sea turtle were within the potential effects range of those activities, it may be affected by multiple stressors simultaneously. Individual stressors that would otherwise have minimal to no effect, may combine to cause a response. However, due to the wide dispersion of stressors, speed of the platforms, general dynamic movement of many training and testing activities, and behavioral avoidance exhibited by sea turtles, it is very unlikely that a sea turtle would remain in the potential effects range of multiple sources or sequential exercises. Exposure to multiple stressors is more likely to occur at an instrumented range where training and testing using multiple platforms may be concentrated during a particular event. In such cases involving a relatively small area on an instrumented range, a behavioral reaction resulting in avoidance of the immediate vicinity of the activity would reduce the likelihood of exposure to additional stressors. Nevertheless, the majority of the proposed activities are unit-level training and small testing activities which are conducted in the open ocean. Unit level exercises occur over a small spatial scale (one to a few square miles) and with few participants (usually one or two vessels) or short duration (the order of a few hours or less).

Secondly, a sea turtle could be exposed to multiple training and testing activities over the course of its life, however, training and testing activities are generally separated in space and time in such a way that it would be unlikely that any individual sea turtle would be exposed to stressors from multiple activities within a short timeframe. However, sea turtles with a home range intersecting an area of concentrated Navy activity have elevated exposure risks relative to sea turtles that simply transit the area through a migratory corridor.

**Synergistic Stressors–**Multiple stressors may also have synergistic effects on sea turtles. Sea turtles that react to a sound source (behavioral response) or experience injury from acoustic stressors could be more susceptible to physical strike and disturbance stressors via a decreased ability to detect and avoid threats. Sea turtles that experience behavioral and physiological consequences of ingestion stressors could be more susceptible to entanglement and physical strike stressors via malnourishment and disorientation. Similarly, sea turtles that may be weakened by disease (e.g., fibropapillomatosis) or other factors that are not associated with Navy training and testing activities may be more susceptible to stressors analyzed in this Draft SEIS/OEIS. These interactions are speculative, and without data on the combination of multiple Navy stressors, the synergistic effects from the combination of Navy stressors are difficult to predict in any meaningful way. Research and monitoring efforts have included before, during, and after-event observations and surveys, data collection through conducting long-term studies in areas of Navy activity, occurrence surveys over large geographic areas, biopsy of animals occurring in areas of Navy activity, and tagging studies where animals are exposed to Navy stressors. These efforts are intended to contribute to the overall understanding of what effects may be occurring overall to animals in these areas. To date, the findings from the research and

monitoring and the regulatory conclusions from previous analyses by NMFS (National Oceanic and Atmospheric Administration, 2013; National Oceanic and Atmospheric Administration, 2015) are that majority of effects from Navy training and testing activities are not expected to have deleterious effects on the fitness of any individuals or long-term consequences to populations of sea turtles.

Although potential effects on certain sea turtle species from training and testing activities under Alternative 1 may include injury to individuals, those injuries are not expected to lead to consequences for populations. The potential effects anticipated from Alternative 1 are summarized in Sections 3.8.4 (Endangered Species Act Determinations). For a discussion of cumulative effects, see Chapter 4 (Cumulative Effects).

## C.9 Birds

### C.9.1 Acoustic Stressors

#### C.9.1.1 Background

The sections below include a survey and synthesis of best-available-science published in peer-reviewed journals, technical reports, and other scientific sources pertinent to effects on birds potentially resulting from sound-producing Navy training and testing activities. Effects on birds depends on the sound source and context of exposure. Possible effects include auditory or non-auditory trauma, hearing loss resulting in temporary or permanent hearing threshold shift, auditory masking, physiological stress, or changes in behavior, including changing habitat use and activity patterns, increasing stress response, decreasing immune response, reducing reproductive success, increasing predation risk, and degrading communication (Larkin et al., 1996). Numerous studies have documented that birds and other wild animals respond to human-made noise (Bowles et al., 1994; Larkin et al., 1996; National Park Service, 1994). The manner in which birds respond to noise could depend on species physiology life stage, characteristics of the noise source, loudness, onset rate, distance from the noise source, presence/absence of associated visual stimuli, and previous exposure. Noise may cause physiological or behavioral responses that reduce the animals' fitness or ability to grow, survive, and reproduce successfully.

The types of birds exposed to sound-producing activities depend on where training and testing activities occur. Birds in the study area can be divided into three groups based on breeding and foraging habitat: (1) those species such as albatrosses, petrels, frigatebirds, tropicbirds, boobies, alcids, and some terns that forage over the ocean and nest on oceanic islands; (2) species such as pelicans, cormorants, gulls, and some terns that nest along the coast and forage in nearshore areas; and (3) those few species such as skuas, jaegers, Franklin's gull, Bonaparte's gulls, ring-billed gulls, black terns, and ducks and loons that nest and forage in inland habitats and come to the coastal areas during nonbreeding seasons. In addition, birds that are typically found inland, such as songbirds, may be present flying in large numbers over open ocean areas during annual spring and fall migration periods.

Birds could be exposed to sounds from a variety of sources. While above the water surface, birds may be exposed to airborne sources such as weapons noise, vessel noise, and aircraft noise. While foraging and diving, birds may be exposed to underwater sources such as sonar

and vessel noise. While foraging birds will be present near the water surface, migrating birds may fly at various altitudes. Some species such as sea ducks and loons may be commonly seen flying just above the water's surface, but the same species can also be spotted flying high enough (5,800 ft.) that they are barely visible through binoculars (Lincoln et al., 1998). While there is considerable variation, the favored altitude for most small birds appears to be between 500 ft. (152 m) and 1,000 ft. (305 m). Radar studies have demonstrated that 95 percent of the migratory movements occur at less than 10,000 ft. (3,050 m), with the bulk of the movements occurring under 3,000 ft. (914 m) (Lincoln et al., 1998).

Seabirds use a variety of foraging behaviors that could expose them to underwater sound. Most seabirds plunge-dive from the air into the water or perform aerial dipping (the act of taking food from the water surface in flight); others surface-dip (swimming and then dipping to pick up items below the surface) or jump-plunge (swimming, then jumping upward and diving underwater). Birds that feed at the surface by surface or aerial dipping with limited to no underwater exposure include petrels, jaegers, and phalaropes. Birds that plunge-dive are typically submerged for short durations, and any exposure to underwater sound would be very brief. Birds that plunge-dive include albatrosses, some tern species, masked boobies, gannets, shearwaters, and tropicbirds. Some birds, such as cormorants, seaducks, alcids, and loons pursue prey under the surface, swimming deeper and staying underwater longer than other plunge-divers. Some of these birds may stay underwater for up to several minutes and reach depths between 50 ft. (15 m) and 550 ft. (168 m) (Alderfer, 2003; Durant et al., 2003; Jones, 2001; Lin, 2002; Ronconi, 2001). Birds that forage near the surface would be exposed to underwater sound for shorter periods of time than those that forage below the surface. Exposures of birds that forage below the surface may be reduced by destructive interference of reflected sound waves near the water surface (see the *Acoustic and Explosives Concepts Technical Report*). Sounds generated underwater during training and testing would be more likely to affect birds that pursue prey under the surface, although as previously stated, little is known about seabird hearing ability underwater.

#### C.9.1.1.1 Injury

Auditory structures can be susceptible to direct mechanical injury due to high levels of impulsive sound. This could include tympanic membrane rupture, disarticulation of the middle ear ossicles, and trauma to the inner ear structures such as hair cells within the organ of Corti. Auditory trauma differs from auditory fatigue in that the latter involves the overstimulation of the auditory system, rather than direct mechanical damage, which may result in hearing loss. There are no data on damage to the middle ear structures of birds due to acoustic exposures. Because birds are known to regenerate auditory hair cells, studies have been conducted to purposely expose birds to very high sound exposure levels (SELs) in order to induce hair cell damage in the inner ear. Because damage can co-occur with fatiguing exposures at high SELs, effects to hair cells are discussed in Section C.9.1.1.2 (Hearing Loss).

Because there is no data on non-auditory injury to birds from intense non-explosive sound sources, it may be useful to consider information for other similar-sized vertebrates. The rapid large pressure changes near non-explosive impulsive underwater sound sources are thought to be potentially injurious to other small animals (fishes and sea turtles). While long-duration

exposures (i.e., minutes to hours) to high sound levels of sonars are thought to be injurious to fishes, this has not been experimentally observed [see Popper et al. (2014)]. Potential for injury is generally attributed to compression and expansion of body gas cavities, either due to rapid onset of pressure changes or resonance (enhanced oscillation of a cavity at its natural frequency). Because water is considered incompressible and animal tissue is generally of similar density as water, animals would be more susceptible to injury from a high-amplitude sound source in water than in air since waves would pass directly through the body rather than being reflected. Proximal exposures to high-amplitude non-impulsive sounds underwater could be limited by a bird's surfacing response.

In air, the risk of barotrauma would be associated with high-amplitude impulses, such as from explosives (discussed in Section 3.8.3.2, Explosive Stressors). Unlike in water, most acoustic energy will reflect off the surface of an animal's body in air. Plus, air is compressible whereas water is not, allowing energy to dissipate more rapidly. For these reasons, in-air non-explosive sound sources in this analysis are considered to pose little risk of non-auditory injury.

#### C.9.1.1.2 Hearing Loss

Exposure to intense sound may result in hearing loss which persists after cessation of the noise exposure. Hearing loss may be temporary or permanent, depending on factors such as the exposure frequency, received sound pressure level (SPL), temporal pattern, and duration. Hearing loss could impair a bird's ability to hear biologically important sounds within the affected frequency range. Biologically important sounds come from social groups, potential mates, offspring, or parents; environmental sounds; prey; or predators.

Because in-air measures of hearing loss and recovery in birds due to an acoustic exposure are limited [e.g., quail, budgerigars, canaries, and zebra finches (Ryals et al., 1999); budgerigar (Hashino et al., 1988); parakeet (Saunders & Dooling, 1974); quail (Niemiec et al., 1994)] and no studies exist of bird hearing loss due to underwater sound exposures, auditory threshold shift in birds is considered to be consistent with general knowledge about noise-induced hearing loss described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section C.1.1). The frequencies affected by hearing loss would vary depending on the exposure frequency. The limited data on hearing loss in birds shows that the frequency of exposure is the hearing frequency most likely to be affected (Saunders & Dooling, 1974).

Hearing loss can be due to biochemical (fatiguing) processes or tissue damage. Tissue damage can include damage to the auditory hair cells and their underlying support cells. Hair cell damage has been observed in birds exposed to long duration sounds that resulted in initial threshold shifts greater than 40 dB (Niemiec et al., 1994; Ryals et al., 1999). Unlike many other animals, birds have the ability to regenerate hair cells in the ear, usually resulting in considerable anatomical, physiological, and behavioral recovery within several weeks (Rubel et al., 2013; Ryals et al., 1999). Still, intense exposures are not always fully recoverable, even over periods up to a year after exposure, and damage and subsequent recovery vary significantly by species (Ryals et al., 1999). Birds may be able to protect themselves against damage from sustained sound exposures by reducing middle ear pressure, an ability that may protect ears while in flight (Ryals et al., 1999) and from injury due to pressure changes during diving (Dooling & Therrien, 2012).

Hearing loss is typically quantified in terms of threshold shift—the amount (in dB) that hearing thresholds at one or more specified frequencies are elevated, compared to their pre-exposure values, at some specific time after the noise exposure. The amount of threshold shift measured usually decreases with increasing recovery time — the amount of time that has elapsed since a noise exposure. If the threshold shift eventually returns to zero (i.e., the hearing threshold returns to the pre-exposure value), the threshold shift is called a TTS. If the threshold shift does not completely recover (the threshold remains elevated compared to the pre-exposure value), the remaining threshold shift is called a PTS. By definition, TTS is a function of the recovery time, therefore comparing the severity of noise exposures based on the amount of induced TTS can only be done if the recovery times are also considered. For example, a 20 dB TTS measured 24 hours post-exposure indicates a more hazardous exposure than one producing 20 dB of TTS measured only two minutes after exposure; if the TTS is 20 dB after 24 hours, the TTS measured after two minutes would have likely been much higher. Conversely, if 20 dB of TTS was measured after two minutes, the TTS measured after 24 hours would likely have been much smaller.

Studies in mammals have revealed that noise exposures resulting in high levels of TTS (greater than 40 dB) may also result in neural injury without any permanent hearing loss (Kujawa & Liberman, 2009; Lin et al., 2011). It is unknown if a similar effect would be observed in birds.

**Hearing Loss due to Non-Impulsive Sounds**

Behavioral studies of threshold shift in birds within their frequencies of best hearing (between 2 and 4 kHz) due to long-duration (30 minutes to 72 hours) continuous, non-impulsive, high-level sound exposures in air have shown that susceptibility to hearing loss varies substantially by species, even in species with similar auditory sensitivities, hearing ranges, and body size (Niemiec et al., 1994; Ryals et al., 1999; Saunders & Dooling, 1974). For example, Ryals et al. (1999) conducted the same exposure experiment on quail and budgerigars, which have very similar audiograms. A 12-hour exposure to a 2.86 kHz tone at 112 dB re 20 µPa SPL [cumulative SEL of 158 dB re 20 $\mu Pa^2 s$] resulted in a 70 dB threshold shift measured after 24 hours of recovery in quail, but a substantially lower 40 dB threshold shift measured after just 12 hours of recovery in budgerigars which recovered to within 10 dB of baseline after three days and fully recovered by one month (Ryals et al., 1999). Although not directly comparable, this SPL would be perceived as extremely loud but just under the threshold of pain for humans per the American Speech-Language-Hearing Association. Whereas the 158 dB re 20 $\mu Pa^2$-s SEL tonal exposure to quail discussed above caused 20 dB of PTS (Ryals et al., 1999), a shorter (four-hour) tonal exposure to quail with similar SEL (157 dB re 20 $\mu Pa^2$-s) caused 65 dB of threshold shift that fully recovered within two weeks (Niemiec et al., 1994).

Data on threshold shift in birds due to relatively short-duration sound exposures that could be used to estimate the onset of threshold shift is limited. Saunders and Dooling (1974) provide the only threshold shift growth data measured for birds. Saunders and Dooling (1974) exposed young budgerigars to four levels of continuous 1/3-octave band noise (76, 86, 96, and 106 dB re 20 µPa) centered at 2.0 kHz and measured the threshold shift at various time intervals during the 72-hour exposure. The earliest measurement found 7 dB of threshold shift after approximately 20 minutes of exposure to the 96 dB re 20 µPa SPL noise (127 dB re 20 $\mu Pa^2$-s

SEL). Generally, onset of TTS in other species has been considered 6 dB above measured threshold (Finneran, 2015), which accounts for natural variability in auditory thresholds. The Saunders and Dooling (1974) budgerigar data is the only bird data showing low levels of threshold shift. Because of the observed variability of threshold shift susceptibility among bird species and the relatively long duration of sound exposure in Saunders and Dooling (1974), the observed onset level cannot be assumed to represent the SEL that would cause onset of TTS for other bird species or for shorter duration exposures (i.e., a higher SEL may be required to induce threshold shift for shorter duration exposures).

Since the goal of most bird hearing studies has been to induce hair cell damage to study regeneration and recovery, exposure durations were purposely long. Studies with other non-avian species have shown that long-duration exposures tend to produce more threshold shift than short-duration exposures with the same SEL [e.g., see Finneran (2015)]. The SELs that induced TTS and PTS in these studies likely over-estimate the potential for hearing loss due to any short-duration sound of comparable SEL that a bird could encounter outside of a controlled laboratory setting. In addition, these studies were not designed to determine the exposure levels associated with the onset of any threshold shift or to determine the lowest SEL that may result in PTS.

With insufficient data to determine PTS onset for birds due to a non-impulsive exposure, data from other taxa are considered. Studies of terrestrial mammals suggest that 40 dB of threshold shift is a reasonable estimate of where PTS onset may begin [see (Southall et al., 2007)]. Similar amounts of threshold shift have been observed in some bird studies with no subsequent PTS. Of the birds studied, the budgerigars showed intermediate susceptibility to threshold shift; the budgerigars exhibited threshold shifts in the range of 40– 50 dB after 12-hour exposures to 112 dB and 118 dB re 20 µPa SPL tones at 2.86 kHz (158 – 164 dB re 20 $\mu Pa^2$-s SEL), which recovered to within 10 dB of baseline after three days and fully recovered by one month (Ryals et al., 1999). These experimental SELs are a conservative estimate of the SEL above which PTS may be considered possible for birds.

All of the above studies were conducted in air. There are no studies of hearing loss to diving birds due to underwater exposures.

**Hearing Loss due to Impulsive Sounds**

The only measure of hearing loss in a bird due to an impulsive noise exposure was conducted by Hashino et al. (1988), in which budgerigars were exposed to the firing of a pistol with a received level of 169 dB re 20 µPa peak SPL (two gunshots per each ear); SELs were not provided. While the gunshot frequency power spectrum had its peak at 2.8 kHz, threshold shift was most extensive below 1 kHz. Threshold shift recovered at frequencies above 1 kHz, while a 24 dB PTS was sustained at frequencies below 1 kHz. Studies of hearing loss in diving birds exposed to impulsive sounds underwater do not exist.

Because there is only one study of hearing loss in birds due to an impulsive exposure, the few studies of hearing loss in birds due to exposures to non-impulsive sound are the only other avian data upon which to assess bird susceptibility to hearing loss from an impulsive sound source. Data from other taxa (U.S. Department of the Navy, 2017) indicate that, for the same

SEL, impulsive exposures are more likely to result in hearing loss than non-impulsive exposures. This is due to the high peak pressures and rapid pressure rise times associated with impulsive exposures.

#### C.9.1.1.3 Masking

Masking occurs when one sound, distinguished as the 'noise,' interferes with the detection or recognition of another sound. The quantitative definition of masking is the amount in decibels an auditory detection or discrimination threshold is raised in the presence of a masker (Erbe et al., 2016). As discussed in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (Section C.1.1), masking can effectively limit the distance over which an animal can communicate and detect biologically relevant sounds. Masking only occurs in the presence of the masking noise and does not persist after the cessation of the noise.

Critical ratios are the lowest ratio of signal-to-noise at which a signal can be detected. When expressed in decibels, critical ratios can easily be calculated by subtracting the noise level (in dB re 1 $\mu Pa^2$ /Hz) from the signal level (in dB re 1 µPa) at detection threshold. A signal must be received above the critical ratio at a given frequency to be detectable by an animal. Critical ratios have been determined for a variety of bird species [e.g., Dooling (1980), Noirot et al. (2011), Dooling and Popper (2000), and Crowell (2016)] and inter-species variability is evident. Some birds exhibit low critical ratios at certain vocal frequencies, perhaps indicating that hearing evolved to detect signals in noisy environments or over long distances (Dooling & Popper, 2000).

The effect of masking is to limit the distance over which a signal can be perceived. An animal may attempt to compensate in several ways, such as by increasing the source level of vocalizations (the Lombard effect), changing the frequency of vocalizations, or changing behavior (e.g., moving to another location, increase visual display). Birds have been shown to shift song frequencies in the presence of a tone at a similar frequency (Goodwin & Podos, 2013), and in continuously noisy urban habitats, populations have been shown to have altered song duration and shift to higher frequencies (Slabbekoorn & den Boer-Visser, 2006). Changes in vocalization may incur energetic costs and hinder communication with conspecifics, which, for example, could result in reduced mating opportunities. These effects are of long-term concern in constant noisy urban environments (Patricelli & Blickley, 2006) where masking conditions are prevalent.

#### C.9.1.1.4 Physiological Stress

Animals in the marine environment naturally experience stressors within their environment and as part of their life histories. Changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, nesting, and interactions with predators all contribute to stress. Anthropogenic sound-producing activities have the potential to provide additional stressors beyond those that naturally occur, as described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section C.1.1).

Chronic stress due to disturbance may compromise the general health and reproductive success of birds (Kight et al., 2012), but a physiological stress response is not necessarily indicative of

negative consequences to individual birds or to populations (Larkin et al., 1996; National Park Service, 1994). The reported behavioral and physiological responses of birds to noise exposure can fall within the range of normal adaptive responses to external stimuli, such as predation, that birds face on a regular basis. These responses can include activation of the neural and endocrine systems, causing changes such as increased blood pressure, available glucose, and blood levels of corticosteroids (Manci et al., 1988). It is possible that individuals would return to normal almost immediately after short-term or transient exposure, and the individual's metabolism and energy budget would not be affected in the long term. Studies have also shown that birds can habituate to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). However, the likelihood of habituation is dependent upon a number of factors, including species of bird (Bowles et al., 1991), and frequency of and proximity to exposure. Although Andersen et al. (1990) did not evaluate noise specifically, they found evidence that anthropogenic disturbance is related to changes in home ranges; for example, raptors have been shown to shift their terrestrial home range when concentrated military training activity was introduced to the area. On the other hand, cardinals nesting in areas with high levels of military training activity (including gunfire, artillery, and explosives) were observed to have similar reproductive success and stress hormone levels as cardinals in areas of low activity (Barron et al., 2012).

While physiological responses such as increased heart rate or startle response can be difficult to measure in the field, they often accompany more easily measured reactions like behavioral responses. A startle is a reflex characterized by rapid increase in heart rate, shutdown of nonessential functions, and mobilization of glucose reserves. Habituation keeps animals from expending energy and attention on harmless stimuli, but the physiological component might not habituate completely (Bowles, 1995).

A strong and consistent behavioral or physiological response is not necessarily indicative of negative consequences to individuals or to populations (Bowles, 1995; Larkin et al., 1996; National Park Service, 1994). For example, many of the reported behavioral and physiological responses to noise are within the range of normal adaptive responses to external stimuli, such as predation, that wild animals face on a regular basis. In many cases, individuals would return to homeostasis or a stable equilibrium almost immediately after exposure. The individual’s overall metabolism and energy budgets would not be affected if it had time to recover before being exposed again. If the individual does not recover before being exposed again, physiological responses could be cumulative and lead to reduced fitness. However, it is also possible that an individual would have an avoidance reaction (i.e., move away from the noise source) to repeated exposure or habituate to the noise when repeatedly exposed.

Due to the limited information about acoustically induced stress responses, the Navy conservatively assumes in its effects analysis that any physiological response (e.g., hearing loss or injury) or significant behavioral response is also associated with a stress response.

#### C.9.1.1.5 Behavioral Reactions

Numerous studies have documented that birds and other wild animals respond to human-made noise, including aircraft overflights, weapons firing, and explosions (Larkin et al., 1996; National

Park Service, 1994; Plumpton, 2006). The manner in which an animal responds to noise could depend on several factors, including life history characteristics of the species; characteristics of the noise source, sound source intensity, onset rate, distance from the noise source, presence or absence of associated visual stimuli, food and habitat availability, and previous exposure (see Section C.1.1, Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities). Researchers have documented a range of bird behavioral responses to noise, including no response, head turn, alert behavior, startle response, flying or swimming away, diving into the water, and increased vocalizations (Brown et al., 1999; Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006; Pytte et al., 2003; Stalmaster & Kaiser, 1997). Some behavioral responses may be accompanied by physiological responses, such as increased heart rate or short-term changes in stress hormone levels (Partecke et al., 2006).

Behavioral responses may depend on the characteristics of the noise, and whether the noise is similar to biologically relevant sounds such as alarm calls by other birds and predator sounds. For example, European starlings (*Sturnus vulgaris*) took significantly longer to habituate to repeated bird distress calls than white noise or pure tones (Johnson et al., 1985). Starlings may have been more likely to continue to respond to the distress because it is a more biologically meaningful sound. Starlings were also more likely to habituate in winter than summer, possibly meaning that food scarcity or seasonal physiological conditions may affect intensity of behavioral response (Johnson et al., 1985).

**Behavioral Reactions to Impulsive Sound Sources**

Studies regarding behavioral responses by non-nesting birds to impulsive sound sources are limited. Seismic surveys had no noticeable effects on the movements or diving behavior of long-tailed ducks undergoing wing molt, a period in which flight is limited and food requirements are high (Lacroix et al., 2003). The birds may have tolerated the seismic survey noise to stay in preferred feeding areas.

Responses to aircraft sonic booms are informative of responses to single impulsive sounds. Responses to sonic booms are discussed below in Behavioral Reactions to Aircraft.

**Behavioral Reactions to Sonar and Other Active Acoustic Sources**

There are no studies of bird responses underwater to sonars, but the effect of pingers on fishing nets has been examined. Fewer common murres (*Uria aalge*) were entangled in gillnets when the gillnets were outfitted with 1.5 kHz pingers with a source level of 120 dB re 1 µPa; however, there was no significant reduction in rhinoceros auklet (*Cerorhinca monocerata*) bycatch in the same nets (Melvin et al., 2011; Melvin et al., 1999). It was unknown whether the pingers elicited a behavioral response by the birds or decreased prey availability.

**Behavioral Reactions to Aircraft**

There are multiple possible factors involved in behavioral responses to aircraft overflights, including the noise stimulus as well as the visual stimulus.

Observations of tern colonies responses to balloon overflights suggest that visual stimulus is likely to be an important component of disturbance from overflights (Brown, 1990). Although it was assumed nesting colonial waterbirds would be more likely to flush or exhibit a mob

response when disturbed, observations of nesting black skimmers and nesting least, gull-billed, and common terns showed they did not modify nesting behavior in response to military fixed-wing aircraft engaged in low-altitude tactical flights and rotary-wing overflights (Hillman et al., 2015). Maximum behavioral responses by crested tern (*Sterna bergii*) to aircraft noise were observed at sound level exposures greater than 85 A-weighted decibels (dBA) re 20 µPa. However, herring gulls (*Larus argentatus*) significantly increased their aggressive interactions within the colony and their flights over the colony during overflights with received SPLs of 101–116 dBA re 20 µPa (Burger, 1981).

Raptors and wading birds have responded minimally to jet (110 dBA re 20 µPa) and propeller plane (92 dBA re 20 µPa) overflights, respectively (Ellis, 1981). Jet flights greater than 1,640 ft. (500 m) distance from raptors were observed to elicit no response (Ellis, 1981). The effects of low-altitude military training flights on wading bird colonies in Florida were estimated using colony distributions and turnover rates. There were no demonstrated effects of military activity on wading bird colony establishment or size (Black et al., 1984). Fixed-winged jet aircraft disturbance did not seem to adversely affect waterfowl observed during a study in coastal North Carolina (Conomy et al., 1998); however, harlequin ducks were observed to show increased agonistic behavior and reduced courtship behavior up to one to two hours after low-altitude military jet overflights (Goudie & Jones, 2004).

It is possible that birds could habituate and no longer exhibit behavioral responses to aircraft noise, as has been documented for some impulsive noise sources (Ellis, 1981; Russel et al., 1996) and aircraft noise (Conomy et al., 1998). Ellis (1981), found that raptors would typically exhibit a minor short-term startle response to simulated sonic booms, and no long-term effect to productivity was noted.

#### C.9.1.1.6 Long Term Consequences

Long term consequences to birds due to acoustic exposures are considered following the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section C.1.1).

Long-term consequences due to individual behavioral reactions and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies. It is more likely that any long-term consequences to an individual would be a result of costs accumulated over a season, year, or life stage due to multiple behavioral or stress responses resulting from exposures to multiple stressors over significant periods of time. Conversely, some birds may habituate to or become tolerant of repeated acoustic exposures over time, learning to ignore a stimulus that in the past did not accompany any overt threat. Most research on long-term consequences to birds due to acoustic exposures has focused on breeding colonies or shore habitats, and does not address the brief exposures that may be encountered during migration or foraging at sea. More research is needed to better understand the long-term consequences of human-made noise on birds, although intermittent exposures are assumed to be less likely than prolonged exposures to have lasting consequences.

## C.9.2 Explosive Stressors

### C.9.2.1 Effects from Explosives

#### C.9.2.1.1 Injury

If a bird is close to an explosive detonation, the exposure to high pressure levels and sound impulse can cause barotrauma. Barotrauma is physical injury due to a difference in pressure between an air space inside the body and the surrounding air or water. Sudden very high pressures can also cause damage at tissue interfaces due to the way pressure waves travel differently through tissues with different material properties. Damage could also occur to the structure of the ear, considered to be the body part most susceptible to pressure damage.

Detonations that occur underwater could injure, kill, or disturb diving birds, particularly pursuit divers that spend more time underwater than other foraging birds (Danil & St Leger, 2011). Studies show that birds are more susceptible to underwater explosions when they are submerged versus partially submerged on the surface. Two species of duck were exposed to explosive blasts while submerged 0.61 m and while sitting on the water surface. Onset of mortality ($LD_1$) was predicted to occur at an impulse exposure of 248 pascal seconds (Pa-s) (36 pounds per square inch per millisecond [psi-ms]) for birds underwater and 690 Pa-s (100 psi-ms) for birds at the water surface (Yelverton & Richmond, 1981). No injuries would be expected for birds underwater at blast pressures below 41 Pa-s (6 psi-ms) and for birds on the surface at blast pressures below 207 Pa-s (30 psi-ms) (Yelverton & Richmond, 1981). Tests of underwater explosive exposures to other taxa (fish, mammals) have shown that susceptibility to injury is related to animal mass, with smaller animals being more susceptible to injury (Yelverton & Richmond, 1981). It is reasonable to assume that this relationship would apply to birds as well. The range to these thresholds would be based on several factors including charge size, depth of the detonation, and how far the bird is beneath the water surface.

Detonations in air or at the water surface could also injure birds while either in flight or at the water surface. Experiments that exposed small, medium, and large birds to blast waves in air were conducted to determine the exposure levels that would be injurious (Damon et al., 1974). Birds were assessed for internal injuries to air sacs, organs, and vasculature, as well as injury to the auditory tympanum, but internal auditory damage was not assessed. Results indicated that peak pressure exposure of 5 psi would be expected to produce no blast injuries, 10 psi would produce slight to extensive injuries, and 20 psi would produce 50 percent mortality. These results also suggested that birds with higher mass may be less susceptible to injury. In addition to the risk of direct blast injury, exposure to an explosion in air may cause physical displacement of a bird that could be injurious. The same study examined displacement injuries to birds (Damon et al., 1974). Results indicated that impulse exposures below 5 psi-ms would not be expected to result in injuries.

One experiment was conducted with birds in flight, showing how birds can withstand relatively close exposures to in-air explosions (Damon et al., 1974). Flying pigeons were exposed to a 64-pound (lb.) net explosive weight explosion. Birds at 44–126 ft. from the blast exhibited no signs of injury, while serious injuries were sustained at ranges less than 40 ft. The no injury zone in

this experiment was also for exposures less than 5 psi-ms impulse, similar to the results of the displacement injury study.

Ranges to the no injury threshold for a range of in-air explosives are shown in Table C-7.

**Table C-7: Range to No Blast Injury for Birds Exposed to Aerial Explosives**

| Net explosive weight | Range to 5 psi |
|---|---|
| 5 pounds (lb.) | 21 feet (ft.) |
| 10 lb. | 26 ft. |
| 100 lb. | 57 ft. |

Note: Ranges calculated using the methods in U.S. Department of the Navy (1975).

Another risk of explosions in air is exposure to explosive fragmentation, in which pieces of the casing of a cased explosive are ejected at supersonic speeds from the explosion. The risk of direct strike by fragmentation would decrease exponentially with distance from the explosion, as the worst case for strike at any distance is the surface area of the casing fragments, which ultimately would decrease their outward velocity under the influence of drag. It is reasonable to assume that a direct strike in air or at the water surface would be mortal. Once in water, the drag on any fragments would quickly reduce their velocity to non-hazardous levels (Swisdak & Montanaro, 1992).

The initial detonation in a series of detonations may deter birds from subsequent exposures via an avoidance response, however, birds have been observed taking interest in surface objects related to detonation events and subsequently being killed by a following detonation [Stemp, R. in Greene et al. (1985)].

#### C.9.2.1.2 Hearing Loss

Exposure to intense sound may result in hearing loss which persists after cessation of the noise exposure. There are no data on hearing loss in birds specifically due to explosives; therefore, the limited data on hearing loss due to impulsive sounds, apply to explosive exposures.

#### C.9.2.1.3 Physiological Stress

Birds naturally experience stressors within their environment and as part of their life histories. Changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, nesting, and interactions with predators all contribute to stress. Exposures to explosives have the potential to provide additional stressors beyond those that naturally occur, as described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section C.1.1).

There are no data on physiological stress in birds specifically due to explosives; therefore, the limited data on physiological stress due to impulsive sounds, apply to explosive exposures.

#### C.9.2.1.4 Masking

Masking occurs when one sound, distinguished as the ‘noise,’ interferes with the detection or recognition of another sound. Exposure to explosives may result in masking. There are no data

on masking in birds specifically due to explosives; therefore, the limited data on masking due to impulsive sounds, apply to explosive exposures. Due to the very brief duration of an explosive sound, any masking would be brief during an explosive activity.

#### C.9.2.1.5 Behavioral Reactions

Numerous studies have documented that birds and other wild animals respond to human-made noise, including aircraft overflights, weapons firing, and explosions (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). The limited data on behavioral reactions due to impulsive sounds, apply to explosive exposures.

Because data on behavioral responses by birds to explosions is limited, information on bird responses to other impulsive sounds may be informative. Seismic surveys had no noticeable effects on the movements or diving behavior of long-tailed ducks undergoing wing molt, a period in which flight is limited and food requirements are high (Lacroix et al., 2003). The birds may have tolerated the seismic survey noise to stay in preferred feeding areas. The sensitivity of birds to disturbance may also vary during different stages of the nesting cycle. Similar noise levels may be more likely to cause nest abandonment during incubation of eggs than during brooding of chicks because birds have invested less time and energy and have a greater chance of re-nesting (Knight & Temple, 1986).

#### C.9.2.1.6 Long Term Consequences

Long-term consequences to birds due to explosive exposures are considered following the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (Section C.1.1).

Long-term consequences to a population are determined by examining changes in the population growth rate. Physical effects that could lead to a reduction in the population growth rate include mortality or injury, which could remove animals from the reproductive pool, and permanent hearing impairment, which could affect foraging and communication. The long-term consequences due to individual behavioral reactions and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies. It is more likely that any long-term consequences to an individual would be a result of costs accumulated over a season, year, or life stage due to multiple behavioral or stress responses resulting from exposures to multiple stressors over significant periods of time. Conversely, some birds may habituate to or become tolerant of repeated acoustic exposures over time, learning to ignore a stimulus that in the past did not accompany any overt threat. More research is needed to better understand the long-term consequences of anthropogenic stressors, although intermittent exposures to explosive noise are assumed to be less likely to have lasting consequences.

### C.9.3 Energy Stressors

#### C.9.3.1 Effects from In-Water Electromagnetic Devices

The kinetic energy weapon referred to as a rail gun is an in-water electromagnetic device that will be tested and eventually used in training events aboard surface vessels, firing non-explosive projectiles at land- or sea-based targets. This system charges for approximately two minutes

and discharges in less than a second. The duration of the firing event is extremely short (about eight milliseconds), which makes it quite unlikely that a bird would fly over at the precise moment of firing. The short duration of each firing event also means that the likelihood of affecting any animal using magnetic fields for orientation is extremely small. Further, the high magnetic field levels experienced within 80 ft. of the launcher quickly dissipate and return to background levels beyond 80 ft. The magnetic field levels outside of the 80 ft. buffer zone would be below the most stringent guidelines for humans (i.e., people with pacemakers or active implantable medical devices). Therefore, the electromagnetic effects would be temporary in nature and not expected to result in effects on organisms (U.S. Department of the Navy, 2009a), and are not analyzed further in this section.

Birds are known to use the Earth's magnetic field as a navigational cue during seasonal migrations (Akesson & Hedenstrom, 2007; Fisher, 1971; Wiltschko & Wiltschko, 2005). Birds use numerous other orientation cues to navigate in addition to magnetic fields. These include position of the sun, celestial cues, visual cues, wind direction, and scent (Akesson & Hedenstrom, 2007; Fisher, 1971; Haftorn et al., 1988; Wiltschko & Wiltschko, 2005). It is believed that birds successfully navigate long distances by using a combination of these cues. A magnetite-based (magnetic mineral) receptor mechanism in the upper beak of birds provides information on position and compass direction (Wiltschko & Wiltschko, 2005). Towed in-water electromagnetic device effects on birds would only occur underwater and would only affect diving species or species on the surface in the immediate area where the device is deployed. There is no information available on how birds react to electromagnetic fields underwater.

### C.9.3.2 Effects from In-Air Electromagnetic Devices

Currently, questions exist about far-field, non-thermal effects from low-power, in-air electromagnetic devices. Manville (2016) performed a literature review of this topic. Although findings are not always consistent, Manville (2016) reported that several peer-reviewed studies have shown non-thermal effects can include (1) affecting behavior by preventing birds from using their magnetic compass, which may in turn affect migration; (2) fragmenting the DNA of reproductive cells, decreasing the reproductive capacity of living organisms; (3) increasing the permeability of the blood-brain barrier; (4) other behavioral effects; (5) other molecular, cellular, and metabolic changes; and (6) increasing cancer risk.

Cucurachi et al. (2013) also performed a literature review of 113 studies and reported that (1) few field studies were performed (the majority were conducted in a laboratory setting); (2) 65 percent of the studies reported ecological effects both at high as well as low dosages (i.e., those that are compatible with real field situations, at least on land); (3) no clear dose-effect relationship could be discerned but that studies finding an effect applied longer durations of exposure and focused more on mobile phone frequency ranges; and (4) a lack of standardization and a limited number of observations limited the possibility of generalizing results from an organism to an ecosystem level.

Many bird species return to the same stopover, wintering, and breeding areas every year and often follow the exact same or very similar migration routes (U.S. Department of the Navy, 2002), and ample evidence exists that displaced birds can successfully reorient and find their way when one or more cues are removed (U.S. Department of the Navy, 2009a). For example,

Haftorn et al. (1988) found that after removal from their nests and release into a different area, snow petrels (*Pagodrama nivea*) were able to successfully navigate back to their nests even when their ability to smell was removed. Furthermore, Wiltschko and Wiltschko (2005) report that in-air electromagnetic pulses administered to birds during an experimental study on orientation do not deactivate the magnetite-based receptor mechanism in the upper beak altogether but instead cause the receptors to provide altered information, which in turn causes birds to orient in different directions. However, these effects were temporary, and the ability of the birds to navigate eventually returned. Similar results were found by a subsequent study by Wiltschko et al. (2011) on European robins (*Erithacus rubecula*) that tested the effects of exposure to specific wavelengths of visible light. Therefore, in the unlikely event that an electromagnetic device temporarily disorients a bird, it is expected that it would still be able to reorient using its internal magnetic compass to aid in navigation once the stressor ceases or the bird and stressor are separated by sufficient distance. Therefore temporary disorientation may be considered short-term for birds experiencing electromagnetic interference in the Study Area. Furthermore, other orientation cues may include position of the sun and moon, visual cues, wind direction, infrasound, and scent; these cues would not be affected by in-air electromagnetic devices.

A study was conducted on the effects of extremely low-frequency in-air electromagnetic fields on breeding and migrating birds around the Navy's extra-low-frequency communication system antenna in Wisconsin. The study found no evidence that bird distribution or abundance was affected by in-air electromagnetic fields produced by the antenna. In addition, radars, including X-band systems, are frequently used to track bird movements as it has been demonstrated that they do not affect bird behavior. Moreover, previous studies have consistently determined that the chances that a bird will move in the same direction and at the same speed as a constant beam of electromagnetic radiation (e.g., while an in-air electromagnetic device tracks a target), and therefore be exposed to radiation that could cause thermal damage, are extremely small (Bruderer et al., 1999; Nicholls & Racey, 2009).

If present in the open water areas where training activities involving in-air electromagnetic stressors occur, Hawaiian petrel, short-tailed albatross, or Newell's shearwater could be temporarily disturbed while foraging or migrating.

Given (1) the information provided above; (2) the dispersed nature of Navy military readiness activities at sea; and (3) the relatively low-level and dispersed use of these systems at sea, the following conclusions are reached:

- The chance that in-air electromagnetic devices would cause thermal damage to an individual bird is extremely low;
- It is possible, although unlikely, that some bird individuals would be exposed to levels of electromagnetic radiation that would cause discomfort, in which case they would likely avoid the immediate vicinity of military readiness activities;
- Non-thermal effects, such as temporary orientation disruption, is likely if the bird is near the emitting source.
- The strength of any avoidance response would likely decrease with increasing distance from the in-air electromagnetic device; and

- No long-term or population-level effects would occur.

### C.9.4 Physical Disturbance and Strike Stressors

#### C.9.4.1 Effects from Vessels

Direct collisions with most Navy vessels (or a vessel's rigging, cables, poles, or masts) are unlikely but may occur, especially at night. Many bird species are attracted to artificial lighting, particularly Procellariiformes. Newell's shearwater and Hawaiian petrel fledglings are particularly attracted to light, which can cause exhaustion and increase potential for collision with land-based structures (Reed et al., 1985). Fledglings, however, would not occur within the Study Area, as birds at this lifestage would be limited to near shore waters of the Hawaiian Islands. Lighting on boats and vessels has also contributed to bird fatalities in open-ocean environments when birds are attracted to these lights, usually in inclement weather conditions (Merkel & Johansen, 2011). Birds can become disoriented at night in the presence of artificial light (Favero et al., 2011; Hamilton, 1958; Hyrenbach, 2001, 2006), and lighting on vessels may attract some birds, increasing the potential for harmful encounters. Other effects would be the visual and behavioral disturbance from a vessel. Birds respond to moving vessels in various ways. Some birds, including certain species of gulls, storm petrels, and albatrosses, commonly follow vessels (Favero et al., 2011; Hyrenbach, 2001, 2006); while other species such as plovers, curlews, frigatebirds, and sooty terns seem to avoid vessels (Borberg et al., 2005; Hyrenbach, 2006). There could be a slightly increased risk of effects during the winter, or fall/spring migrations when migratory birds use celestial clues during night time flight and are concentrated in coastal areas. However, despite this concentration, most birds would still be able to avoid collision with a vessel. Vessel movements could elicit short-term behavioral or physiological responses (e.g., alert response, startle response, fleeing the immediate area, temporary increase in heart rate).

Navy aircraft carriers, surface combatant vessels, and amphibious warfare ships are minimally lighted for tactical purposes. For vessels of this type, there are two white lights that shine forward and one that shines aft; these lights must be visible for at least 6 NM. A single red and a single green light are located on the port and starboard sides of vessels, respectively. These lights are visible for a minimum of 3 NM. Solid white lighting appears more problematic for birds, especially nocturnal migrants (Gehring et al., 2009; Poot et al., 2008). Navy vessel lights are mostly solid, but sometimes may not appear solid because of the constant movement of the vessel (wave action), making vessel lighting potentially less problematic for birds in some situations.

While some potential exists for birds to be struck by vessels as they are foraging, resting, or flying near the water surface, most birds would be expected to see or hear an oncoming vessel and to fly or swim away to avoid a potentially harmful encounter. Injury or mortality could occur if a bird was struck, but most bird encounters with vessels would be expected to result in a brief behavioral and physiological response as described above. It should be noted that such responses involve at the least a temporary displacement of birds from foraging areas, resulting in energetic costs to the birds (Velando & Munilla, 2011). Birds would be expected to return and resume foraging soon after the vessel passed through the area, or to forage elsewhere, and the fitness of individual birds would probably not be compromised.

Other harmful bird-vessel interactions are commonly associated with commercial fishing vessels because birds are attracted to concentrated food sources around these vessels (Dietrich & Melvin, 2004; Melvin & Parrish, 2001). However, concentrated food sources are not associated with Navy vessels, so birds following Navy vessels would be very unlikely.

Amphibious vessel movements could elicit short-term behavioral or physiological responses such as alert response, startle response, cessation of feeding, fleeing the immediate area, nest abandonment, and a temporary increase in heart rate. There could be a slightly increased risk of effects during the winter, or fall/spring migrations and during nesting season when migratory birds are concentrated in terrestrial habitats on islands within the Mariana Archipelago, which are used as stopover habitat along the general migratory routes within the West Pacific Flyway. The general health of individual birds would not be compromised, unless a direct strike occurred. However, it is highly unlikely that a bird would be struck in this scenario because most foraging shorebirds near the approaching amphibious vessel would likely be dispersed by the noise of its approach before it could come close enough to strike a bird (Section 3.6.2.4, Physical Disturbance and Strike Stressors).

### C.9.5 Entanglement Stressors

#### C.9.5.1 Effects from Decelerators/Parachutes

If the decelerator/parachute and its lines sink to the seafloor in an area where the bottom is calm, it would remain there undisturbed. Over time, it may become covered by sediment in most areas or colonized by attaching and encrusting organisms, which would further stabilize the material and reduce the potential for reintroduction as an entanglement risk. If bottom currents are present, the canopy may billow and pose an entanglement threat to birds that feed in benthic habitats. Bottom-feeding birds tend to forage in nearshore areas rather than offshore, where these decelerators/parachutes are used; therefore, birds are not likely to encounter decelerators/parachutes once they reach the seafloor. The potential for a bird to encounter an expended decelerator/parachute at the surface or in the water column as it sinks to the seafloor is extremely low. The probability of a bird encountering a decelerator/parachute at the seafloor is even lower given birds are unlikely to be near the decelerator/parachute where it rests on the seafloor as well as the general behavior of birds. The risk may increase with time if the decelerator/parachute remains intact and accessible to birds at the water's surface or in the water column. Factors that may influence degradation times include exposure to ultraviolet radiation and the extent of physical damage of the decelerator/parachute on the water's surface, as well as water temperature and sinking depth.

### C.9.6 Ingestion Stressors

#### C.9.6.1 Effects from Military Expended Materials Other Than Munitions

The analysis in this section includes the potential ingestion of military expended materials other than munitions, all of which are expended away from nearshore habitats and close to the water surface. Tables 3.0-12, 3.0-13, 3.0-14, and 3.0-16 describe the annual quantities and locations where these materials would be generated by training and testing activities under Alternatives 1 and 2. Appendix A (Military Readiness Activities Descriptions) provides specific information on

the activities that may result in ingestion stressors, and the typical locations where these activities occur.

While it has been widely documented that a wide range of marine organisms (including zooplankton, baleen whales, and seabirds) will ingest plastic, the mechanism that causes these organisms to do so was discovered only recently (Savoca, 2016; Savoca et al., 2016). Procellariiformes, or tube-nosed seabirds (e.g., albatrosses, shearwaters and petrels) utilize a highly developed sense of smell to find food that is patchily distributed in offshore and open ocean environments. Specifically, these birds are attracted to dimethyl sulfide, which is produced when the cell walls of algae are damaged (e.g., when marine herbivores such as krill eat it), thereby alerting the seabirds that food (e.g., krill) are nearby. Through a literature review, Savoca et al. (2016) demonstrated that seabirds that utilize dimethyl sulfide as a foraging cue consumed plastic nearly six times more frequently than species that were not attracted to dimethyl sulfide. Savoca et al. (2016) also performed field studies that confirmed that algae growing on three of the most common types of plastic debris (polypropylene and low- and high-density polyethylene) can produce dimethyl sulfide within three weeks at concentrations at least four orders of magnitude above the behavioral detection threshold for Antarctic prions (*Pachyptila desolata*), thereby creating an "olfactory trap."

Birds could potentially ingest expended materials other than munitions used by the Navy during training and testing activities within the Study Area. The Navy expends the following types of materials that could become ingestion stressors for birds during training and testing in the Study Area: missile components, target fragments, chaff and flare endcaps/pistons, and decelerators/parachutes.

Ingestion of expended materials by birds could occur in all large marine ecosystems and open ocean areas and would occur either at the surface or just below the surface portion of the water column, depending on the size and buoyancy of the expended object and the feeding behavior of the birds. Floating material of ingestible size could be eaten by birds that feed at or near the water surface, while materials that sink pose a potential risk to diving birds that feed just below the water's surface (Titmus & Hyrenbach, 2011). Some items, such as decelerators/parachutes or sonobuoys are too large to be ingested and will not be discussed further. In addition, most decelerators/parachutes are designed to sink rapidly to the seafloor.

Physiological effects on birds from ingestion stressors include blocked digestive tracts preventing food passage, blockage of digestive enzymes, nutrient dilution (nonnutritive debris displaces nutritious food in the gut), and altered appetite satiation (the sensation of feeling full), which can lead to starvation (Azzarello & Van Vleet, 1987). Additional physiological effects may include lowered steroid hormone levels, delayed ovulation (egg maturation), reproductive failure, and exposure to indirect effects from harmful chemicals found in and on the plastic material (Azzarello & Van Vleet, 1987). While ingestion of marine debris has been linked to bird mortalities, sublethal effects are more common (Moser & Lee, 1992).

Many species of seabirds are known to ingest floating plastic debris and other foreign matter while feeding on the surface of the ocean (Auman et al., 1997; Yamashita et al., 2011). Evidence indicates that physical and toxicological effects from plastic ingestion by seabirds are widespread among species and pervasive in terms of the number of individuals affected, and

that effects are increasing (Kain et al., 2016; Wilcox et al., 2015). For example, 21 of 38 seabird species (55 percent) collected off the coast of North Carolina from 1975 to 1989 contained plastic particles (Moser & Lee, 1992). The mean particle sizes of ingested plastic were positively correlated with the birds' size though the mean mass of plastic found in the stomachs and gizzards of 21 species was below 3 grams. In Hawaii, the proportion of necropsied Newell's shearwaters and wedge-tailed shearwaters (*Ardenna pacifica*) that were found to have ingested plastic more than doubled from 2007 to 2014 (Kain et al., 2016). The number of plastic particles found in the stomachs of northern fulmars in the North Sea increased by two-to-three-fold from the mid-1980s to mid-1990s and has remained at about 30 particles per bird since then. Since the 1980s, concentrations of industrial plastics in the ocean waters and their consumption by fulmars has decreased by about 75 percent, while the abundance of user plastics and their consumption has shown no obvious trend (van Franeker & Law, 2015). It is reasonable to assume that birds within the Study Area have increased rates of plastic ingestion, similar to other locations where necropsies have been conducted. Some seabirds have used plastic and other marine debris for nest building which may lead to ingestion of that debris (Votier et al., 2011). Indirect ingestion of plastic also occurs from consuming prey (such as fishes) that ingests plastic.

Plastic is often mistaken for prey, and the incidence of plastic ingestion appears to be related to a bird's feeding mode and diet (Henry et al., 2011; Provencher et al., 2014). Seabirds that feed by pursuit-diving, surface-seizing, and dipping tend to ingest plastic, while those that feed by plunging or piracy typically do not ingest plastic (Azzarello & Van Vleet, 1987; Provencher et al., 2014). Birds of the order Procellariiformes, which include petrels, shearwaters, and albatrosses, tend to accumulate more plastic than other species (Azzarello & Van Vleet, 1987; Moser & Lee, 1992; Pierce et al., 2004; Provencher et al., 2014). Some birds, including gulls and terns, commonly regurgitate indigestible parts of their food items such as shell and fish bones. However, the structure of the digestive systems of most Procellariiformes makes it difficult to regurgitate solid material such as plastic (Azzarello & Van Vleet, 1987; Moser & Lee, 1992; Pierce et al., 2004). Two species of albatross (*Diomedeidae*) have also been reported to ingest plastic while feeding at sea. While such studies have not conclusively shown that plastic ingestion is a significant source of direct mortality, it may be a contributing factor to other causes of albatross mortality (Naughton et al., 2007).

As summarized by Pierce et al. (2004), Auman et al. (1997) and Azzarello and Van Vleet (1987) documented consequences of plastic ingestion by seabirds include blockage of the intestines and ulceration of the stomach, reduction in the functional volume of the gizzard leading to a reduction of digestive capability, and distention of the gizzard leading to a reduction in hunger. Dehydration has also been documented in seabirds that have ingested plastic (Sievert & Sileo, 1993). Studies have found negative correlations between body weight and plastic load, as well as between body fat (a measure of energy reserves) and the number of pieces of plastic in a seabird's stomach (Auman et al., 1997; Ryan, 1987; Sievert & Sileo, 1993). Other possible concerns that have been identified include toxic plastic additives and toxic contaminants that could be adsorbed to the plastic from ambient seawater. Pierce et al. (2004) described two cases where plastic ingestion caused seabird mortality from starvation. The examination of a deceased adult northern gannet revealed that a 1.5 in. diameter plastic bottle cap lodged in its

gizzard blocked the passage of food into the small intestine, which resulted in its death from starvation. Northern gannets are substantially larger, and dive deeper than the ESA-listed birds in the Study Area. Also, since gannets typically utilize flotsam in nest building (Votier et al., 2011), they may be more susceptible to ingesting marine debris than other species as it gathers that material. Dissection of an adult greater shearwater's gizzard revealed that a 1.5 by 0.5 in. fragment of plastic blocked the passage of food in the digestive system, which also resulted in death from starvation.

Species such as storm-petrels, albatrosses, shearwaters, fulmars, and noddies that forage by picking prey from the surface may have a greater potential to ingest any floating plastic debris (Donnelly-Greenan et al., 2014). Ingestion of plastic military expended material by any species from the taxonomic groups found within the Study Area has the potential to affect individual birds. The risk of plastic ingestion and impaction in chicks of many species of seabirds may be different from the risks to adults. Albatross chicks appear to be at greater risk compared to adults, because of their high rates of ingestion and apparent low frequency of regurgitative casting of indigestible material. Hyrenbach et al. (2015) demonstrated that almost 100 percent of chicks of black-footed and Laysan albatrosses breeding in the Northwestern Hawaiian Islands ingest plastics during the pre-fledging period when they are dependent upon food brought to the breeding colony by parents. Floating plastic items are ingested by adult albatrosses and regurgitated to chicks along with normal food items. Negative effects of plastic ingestion may result from impaction of the upper gastrointestinal tract and interference with passage of food through the digestive system, contributing to reduced resistance to disease and lowered post-fledging survival. Significant correlations between plastic loads and body condition or growth rates, were not found, however (Hyrenbach et al., 2015). Flesh-footed shearwater (*Puffinus carnipes*) fledglings in eastern Australia have been found to contain relatively large amounts of plastics, which is correlated with poor body condition and tissue contaminant loads (Lavers et al., 2014).

The distribution of floating expended items would be irregular in both space and time, as training and testing activities do not occur in the same place each time. The random distribution of items across the large Study Area yields very low probabilities that seabirds will encounter a floating item. However, when a seabird does encounter a floating item of ingestible size, an ingestion risk may exist. Although most military expended material components are expected to sink to the seafloor and spend limited periods within the water column, some items remain buoyant for an extended period. Expended training and testing material, such as missile components or target fragments that float, may be encountered by seabirds in the waters of the Study Area, increasing the potential for ingestion of smaller components. Ocean currents concentrate plastic debris, making seabirds that feed along frontal zones more susceptible (Azzarello & Van Vleet, 1987). While some seabird ingestion of expended materials could occur, these factors indicate that a small number of birds would be affected and that population level effects would not be expected.

### Target-Related Materials

As described in Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]), at-sea targets are usually remotely operated airborne, surface, or subsurface traveling units, most of which are designed to be recovered for reuse. However, if they are used during activities that use high explosives then they may result in fragments. Expendable targets that may result in fragments would include air-launched decoys, surface targets (e.g., marine markers, paraflares, cardboard boxes, and 10 ft. diameter red balloons), and mine shapes. Most target fragments would sink quickly to the seafloor. Floating material, such as Styrofoam, may be lost from target boats and remain at the surface for some time. Only targets that may result in smaller fragments that do not immediately sink are included in the analyses of ingestion potential.

There are additional types of targets discussed previously, but only surface targets, subsurface targets, air targets, Sinking Exercise ship hulks, and mine shapes would be expected to result in fragments when high-explosive munitions are used.

### Chaff

As described in Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]), large areas of air space and open water within the Study Area would be exposed to chaff at very low concentrations. This same section also provides a general discussion of chaff as an ingestion stressor and concludes that chaff poses little risk to organisms, except at concentrations substantially higher than those that could reasonably occur from military training. Additional information is provided below.

It is unlikely that chaff would be selectively ingested (U.S. Department of the Air Force, 1997). Ingestion of chaff fibers is not expected to cause physical damage to a bird's digestive tract based on the fibers' small size (ranging in lengths of 0.25 to 3 in. with a diameter of about 40 micrometers) and flexible nature, as well as the small quantity that could reasonably be ingested. In addition, concentrations of chaff fibers that could reasonably be ingested are not expected to be toxic to seabirds. Scheuhammer (1987) reviewed the metabolism and toxicology of aluminum in birds and mammals and found that intestinal adsorption of orally ingested aluminum salts was very poor, and the small amount adsorbed was almost completely removed from the body by excretion. Dietary aluminum normally has minor effects on healthy birds and mammals, and often high concentrations (greater than 1,000 milligrams per kilogram) are needed to induce effects such as impaired bone development, reduced growth, and anemia (U.S. Department of the Navy, 1999). A bird weighing 2.2 lb. would need to ingest more than 83,000 chaff fibers per day to receive a daily aluminum dose equal to 1,000 per kilogram; this analysis was based on chaff consisting of 40 percent aluminum by weight and a 5 ounce chaff canister containing 5 million fibers. As an example, an adult herring gull weighs about 1.8–2.7 lb. (Cornell Lab of Ornithology, 2009). It is highly unlikely that a bird would ingest a toxic dose of chaff based on the anticipated environmental concentration of chaff (i.e., 1.8 fibers per square foot for an unrealistic, worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point).

### Flares

A general discussion of flares as an ingestion stressor is presented in Section 3.0.4.1.3 (Other Stressors [Energy, Physical Disturbance/Strike, and Entanglement/Ingestion]). Ingestion of flare compression pads or pistons 1.3 in. in diameter and 0.13 in. thick (U.S. Department of the Air Force, 1997) by birds may result in gastrointestinal obstruction or reproductive complications. Based on the information presented above, if a seabird were to ingest a compression pads or pistons, the response would vary based on the species and individual bird. The responses could range from none to sublethal (reduced energy reserves), to lethal (digestive tract blockage leading to starvation). Ingestion of compression pads or pistons by species that regularly regurgitate indigestible items would likely have no adverse effects. However, compression pads or pistons are similar in size to those plastic pieces described above that caused digestive tract blockages and eventual starvation. Therefore, ingestion of compression pads or pistons could be lethal to some individual seabirds. Species with small gizzards and anatomical constrictions that make it difficult to regurgitate solid material would likely be most susceptible to blockage (such as Procellariiformes). Based on available information, it is not possible to accurately estimate ingestion rates or responses of individual birds.

## C.9.7 Secondary Stressors

This section analyzes potential effects on birds exposed to stressors indirectly through effects on habitat and prey availability.

### C.9.7.1 Effects on Habitat

The potential indirect effect of water quality, air quality, and abiotic habitat stressors associated with training and testing activities as a secondary stressor to birds was analyzed. The assessment of potential water, air quality, and abiotic habitat stressors is discussed in previous sections in this SEIS/OEIS (Section 3.1, Sediments and Water Quality; and Section 3.2, Air Resources). These analyses address specific activities in local environments that may affect bird habitats. At-sea activities that may affect water and air include general emissions, and at-sea activities that may affect habitats include explosives and physical disturbance and strike.

As noted in Section 3.1 (Sediments and Water Quality) and Section 3.2 (Air Resources), implementation of the No Action Alternative, Alternative 1, or Alternative 2 would minimally affect sediments, water, air quality, or habitats, and therefore would not indirectly affect seabirds as secondary stressors. Furthermore, any physical effects on seabird habitats would be temporary and localized because training and testing activities would occur infrequently. These activities would not be expected to have any adverse effects on seabirds or seabird habitats.

Indirect effects on sediments, water or air quality under Alternative 1 or Alternative 2 would have no effect on ESA-listed bird species due to: (1) the temporary nature of effects on sediments, water, or air quality, (2) the distribution of temporary sediments, water, or air quality effects, (3) the wide distribution of birds in the Study Area, and (4) the dispersed spatial and temporal nature of the training and testing activities that may have temporary sediments, water, or air quality effects. No long-term or population-level effects are expected.

### C.9.7.2 Effects on Prey Availability

As noted in Section 3.8 (Marine Invertebrates) and Section 3.9 (Fishes), implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not adversely affect populations of invertebrate or fish prey resources (e.g., crustaceans, bivalves, worms, sand lance, herring) of birds and therefore would not indirectly affect birds as secondary stressors. Any effects on seabird prey resources would be temporary and localized. Furthermore, as discussed above, these activities are expected to have minimal effects on bird habitats. Additional detail is provided below.

Effects on invertebrate prey availability resulting from explosives, explosives byproducts, unexploded munitions, metals, and chemicals would likely be negligible overall and population-level effects on marine invertebrates are not expected. Because individuals of many invertebrate taxa prey on other invertebrates, mortality resulting from explosions or exposure to metals or chemical materials would reduce the number of invertebrate prey items available. A few species prey upon fish, and explosions and exposure to metals and chemical materials could result in a minor reduction in the number of fish available. However, the effect is expected to be small and discountable. Any vertebrate or invertebrate animal killed or significantly impaired by Navy activities could potentially represent a temporary increase in food availability for scavenging invertebrates. None of the effects described above would likely be detectable at the population or subpopulation level.

Prey species might exhibit a strong startle reaction to detonations that might include swimming to the surface or scattering away from the source. This startle and flight response is the most common secondary defense among animals (Hanlon & Messenger, 1996). The sound from underwater explosions might induce startle reactions and temporary dispersal of schooling fishes if they are within close proximity to an explosion (Popper et al., 2014; Wright, 1982), which in turn could make them more visible to predators (Kastelein et al., 2008). The abundances of fish and invertebrate prey species near the detonation point could be diminished for a short period before being repopulated by animals from adjacent waters. Alternatively, any prey species that would be directly injured or killed by the blast could draw in scavengers from the surrounding waters that would feed on those organisms, who in turn could be susceptible to becoming directly injured or killed by subsequent explosions. Any of these scenarios would be temporary, only occurring during activities involving explosives, and no lasting effect on prey availability or the food web would be expected. Indirect effects of underwater detonations and high explosive munitions use under the Proposed Action would not result in a decrease in the quantity or quality of fish populations in the Study Area.

Based on Sections 3.8 (Marine Invertebrates) and 3.9 (Fishes), project-related stressors would not affect populations of invertebrates and fishes that support birds in the Study Area. Therefore, no secondary effects associated with prey availability are expected. Furthermore, the Navy will implement mitigation (e.g., not conducting gunnery activities within a specified distance of shallow-water coral reefs) to avoid potential effects from explosives and physical disturbance and strike stressors on seafloor resources in mitigation areas throughout the Study Area (see Sections 4.7.1, Shallow-Water Coral Reef Mitigation Areas; and Section 4.7.2, Artificial Reef, Hard Bottom Substrate, and Shipwreck Mitigation Areas). This mitigation will

consequently help avoid potential effects on bird prey that inhabits shallow-water coral reefs, live hard bottom, artificial reefs, and shipwrecks.

## C.10 Terrestrial Species and Habitats

The analysis for terrestrial species and habitats in this SEIS/OEIS is limited to FDM. The Navy conducted a review of stressors that may occur on FDM and determined that energy stressors, entanglement stressors, and ingestion stressors would not occur on the island, therefore, these stressors are not analyzed further. Physical disturbance and strike stressors are analyzed in Section 3.10 (Terrestrial Species and Habitats), along with acoustic and explosive stressors. Section 3.10 has been further updated for the SEIS/OEIS to include an analysis of nesting seabirds on FDM

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# Appendix D Air Quality Emissions Calculations and Record of Non-Applicability

# Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Mariana Islands Training and Testing

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# APPENDIX D AIR QUALITY EMISSIONS CALCULATIONS AND RECORD OF NON-APPLICABILITY

This appendix discusses supplemental information, emission factor development, calculations, and assumptions used in the air quality analyses presented in Section 3.2 (Air Resources) of the Draft Mariana Islands Training and Testing (MITT) Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (SEIS/OEIS). The Record of Non-applicability for the affected area is also included.

## D.1 Air Quality Supplemental Information and Emission Calculations

Air pollution can damage the health of people, plants, animals, and water bodies as well as the exteriors of buildings, monuments, and statues. It also creates haze or smog that reduces visibility and interferes with aviation. A region's air quality is influenced by many factors, including the type and emission rate of pollutants, local meteorology, the size and topography of the air basin, and atmospheric chemistry. Wind speed and direction, the vertical temperature gradient of the atmosphere, and precipitation patterns affect the dispersal, dilution, and removal of air pollutant emissions from the atmosphere. Most air pollutants originate from human-made sources, including mobile sources (e.g., gasoline- or diesel-fueled vehicles) and stationary sources (e.g., power plants, refineries, etc.), as well as indoor sources (e.g., some building materials and cleaning solvents). Air pollutants are also released from natural sources such as volcanic eruptions and wildfires. Ambient air quality is reported as the atmospheric concentrations of specific air pollutants at a particular time and location. The units of measure are expressed as a mass per unit volume (e.g., micrograms per cubic meter of air) or as a volume fraction (e.g., parts per million [ppm] by volume).

### D.1.1 Emission Sources

Criteria air pollutants and Hazardous Air Pollutants (HAP are generated by the combustion of fuel by surface vessels and by fixed-wing and rotary-wing aircraft. They also are generated by the combustion of explosives and propellants in various types of munitions. Propellants used to fire small-, medium-, and large-caliber projectiles generate pollutants when detonated. Nonexplosive practice munitions may contain spotting charges and propellants that generate air pollutants when they function. Powered targets require fuel, generating air pollutants during their operation, and towed targets generate air pollutants secondarily because another aircraft or vessel is required to provide power. Stationary targets may generate air pollutants if all or portions of the item burn in a high-order detonation. Chaff cartridges used by ships and aircraft are launched by an explosive charge that generates small quantities of air pollutants. Chaff itself may also be a particles with aerodynamic diameters less than or equal to a nominal 10 micrometers ($PM_{10}$)/ particles with aerodynamic diameters less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$) pollutant, depending on its size. Countermeasure flares, decelerators/parachute flares, and smoke floats are designed to burn for a prescribed period, emitting pollutants in the process. Emissions from activities related to modernization and sustainment of ranges are also estimated and the impacts analyzed.

### D.1.2 Emissions Estimates

The emissions calculations performed for each alternative conservatively assume that each training and testing activity is separately conducted. In practice, a testing activity may be conducted during a training flight. It is also probable that two or more training activities may be conducted during one flight or one

vessel movement (e.g., chaff or flare exercises may occur during electronic warfare activities; or air-to-surface gunnery and air-to-surface bombing activities may occur during a single flight operation, or ship may conduct large-, medium-, and small-caliber surface-to-surface gunnery exercises during one vessel movement). Conservative assumptions may produce elevated emissions calculations but account for the possibility, however remote, that each training and testing activity is separately conducted.

The estimated change in emissions includes transit emissions from shore location to range location for ship and aircraft, startup/idle/shutdown emissions to prepare for shore connect and disconnect, and emissions due to aircraft startup/idle, and idle/shutdown activities.

#### D.1.2.1 Aircraft Activities

Fleet training and Naval Air Systems Command testing use various aircraft. Aircraft operations of concern, for calculating criteria pollutant and HAP, are those that occur from ground level up to 3,000 feet (ft.) above ground level (AGL). The 3,000 ft. AGL altitude was assumed to be the ceiling of the mixing zone (known as the atmospheric mixing height) above which any pollutant generated would not contribute to increased pollutant concentrations at ground level. Pollutants emitted by aircraft above 3,000 ft. AGL are excluded from the analysis of compliance with National Ambient Air Quality Standards. The pollutant emission rate is a function of the aircraft engine's fuel flow rate and efficiency. Emissions for one complete training activity for a particular aircraft are calculated by knowing the specific engine pollutant emission factors for each mode of operation.

Emission factors for most military engines were obtained from the Navy's Aircraft Environmental Support Office memoranda. For those aircraft for which engine data were unavailable from Aircraft Environmental Support Office, emission factors from Air Emissions Guide for Air Force Mobile Source, June 2024 (U.S. Department of the Air Force, 2024), were used. Emission rates, in pounds per hour, were developed based on the emission indices in pounds of pollutant per 1,000 gallons of fuel, number of engines per aircraft, and the fuel flow rate per engine at a given power setting. Using these data, as well as the number of sorties, pollutant emissions for each aircraft were calculated by applying the equation below.

$$Emissions = N \times FF \times EF \times ENG \times CF$$

*Where:*

*Emissions = annual aircraft emissions (pounds [lb.]/yr.)*
*N = Hours of operation of aircraft operations per year for each type of aircraft per activity (hr./yr.)*
*EF = pollutant emission rate by engine type and power setting (lb/hr)*
*CF = conversion factor (0.001)*

"Taxi/Idle out and Taxi/Idle in" emission factors were used to estimate aircraft emissions during preparation for shore connect and disconnect. "Approach" or "Cruise" modes emission factors were used to estimate the transit emissions from shore location to range location. It was assumed that fixed-wing aircraft would fly above 3,000 ft. AGL during transit to range locations, and rotary aircraft would fly within 3,000 ft. AGL during transit.

HAP emissions were estimated based on June 2024 Air Emissions Guide for Air Force Mobile Sources, Table 2-10 (Volatile Organic Compound and HAP Emission Factors for Select Engines) (Air Force Civil Engineer Center, 2023). HAP emissions from activities in many range areas occur well offshore and far

from any publicly accessible areas. HAP emissions from activities that occur within 12 nautical miles (NM) may impact the publicly accessible areas on shore.

#### D.1.2.2 Military Vessel Activities

Military vessel traffic in the Study Area includes military ships and vessels providing security for military training and testing activities during transit from the pier to the range and back. Fleet training activities use a variety of marine vessels, including cruisers, destroyers, carriers, submarines, amphibious vessels, and small boats. Testing activities use a variety of marine vessels, including various testing support vessels, work boats, torpedo recovery vessels, unmanned surface vehicles, and small boats. These vessels use diverse propulsion methods, including marine outboard engines, diesel engines, and gas turbines.

Emissions from military vessels and small boats are estimated based on the type of vessel, the anticipated activity, and the average operating hours in each operational area, both within state waters and beyond state waters. The types of military ships and boats as well as the numbers of activities for Alternatives 1 and 2 are derived from range records and Navy subject matter experts regarding ship participant data. Estimates of future military vessel activities are based on anticipated evolutionary changes in the military's force structure and mission assignments.

Emission factors for small surface craft involved in amphibious training and testing activities were obtained from the Navy and Military Sealift Command Marine Engine Fuel Consumption & Emission Calculator database Version October 2024. Emissions for surface craft using outboard engines were calculated using Navy and Military Sealift Command emission factors which are provided in terms of Vessel Emission Total per hour and multiplied by the hours of operation.

$$Emissions = HR/YR \times EF$$

Where:

Emissions = surface craft emissions (*pounds [lb.]/yr)*

HR/YR = hours per year per vessel per activity (hr/yr)

EF = emission factor for specific vessel (lb./hr)

Large vessel emissions were calculated in a similar fashion using emission factors from the Naval Sea Systems Command Navy and Military Sealift Command Marine Engine Fuel Consumption and Emission Calculator for the propulsion system and the supplemental ship service generator(s).

"Not Underway" emission factors were used to estimate ship emissions during preparation for shore connect and disconnect. "Restricted Waters" emission factors were used to estimate the transit emissions from shore location to range location.

To obtain the total criteria pollutant emissions for the Proposed Action, emissions were calculated for each training or testing activity, type of surface vessel, and criteria pollutant. These individual estimates of emissions, in units of tons per year, were then summed by criteria pollutant to obtain the aggregate emissions for surface vessel emissions activities.

HAP emissions were estimated based on the speciation factors in the U.S. Environmental Protection Agency (USEPA) Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions (U.S. Environmental Protection Agency, 2022).

#### D.1.2.3 Munitions

Naval gunfire, missiles, bombs, and other types of munitions used in training and testing activities emit air pollutants. To estimate the amounts of air pollutants emitted by munitions, the numbers and types of munitions used during training or testing activities are first totaled. Then generally accepted emissions factors, such as those from USEPA AP-42, *Compilation of Air Pollutant Emission Factors* Section 15, for criteria air pollutants and HAPs are applied to the total amounts. These factors are multiplied by the net weight of the explosive and the number of items that were used per year. This calculation provides estimates of annual emissions.

$$Emissions = EXP/YR \times EF \times Net\ Wt$$

*Where:*

*Emissions = annual ordnance emissions*
*EXP/YR = number of explosives, propellants, and pyrotechnics items used per year*
*EF = air pollutant emissions factor per item*
*Net Wt = net weight of explosive, propellant, or pyrotechnics per ordnance item*

### D.1.3 Modernization and Sustainment of Ranges

The Proposed Action also includes modernization and sustainment of ranges activities that involve Navy and contractor vessels. The vessel emissions are estimated based on the methodology described in Section D.1.2.2.

## D.2 Greenhouse Gas Emissions

The Proposed Action is anticipated to release greenhouse gases into the atmosphere. These emissions are quantified using the aircraft and vessel emission calculation methodologies described in Section D.1.2. Emissions of greenhouse gases from aircraft and vessels participating in training and testing activities, as well as targets and munitions expended, are applicable regardless of altitude.

## D.3 Meteorological Conditions and Topography of the Study Area

Pollution dispersion in the air is influenced by meteorological conditions, such as temperature, wind speed and wind direction, and atmospheric stability. Warmer air traps cooler air near the surface and can slow dispersion, whereas unstable atmospheric conditions can facilitate dispersion. Topography is another factor that influences pollutant dispersion. Urban areas with tall buildings can disrupt wind patterns and trap pollutants. Mountains and valleys can channel air and promote dispersion or trap pollutants during inversions. Wind direction determines the dispersion path pollutants take. Higher wind speeds disperse pollutants over a larger area; stagnant conditions or light winds allow pollutant concentrations to build up due to a more coherent plume. A wind rose for a particular location provides a view of how wind speed and direction are typically distributed. The wind rose represents the directions around a compass, and the length of the petal or spoke indicates wind direction and frequency toward the center point. Individual segments of the spoke represent the frequency of winds for defined wind speed categories, with the slowest winds closest to and the fastest winds furthest from the center of the diagram.

Figure D-1 depicts wind rose data from January 2020 to December 2024, collected by the weather station located at Guam International Airport. Figure D-2 and Figure D-3 depict wind roses for Saipan and Tinian, respectively.

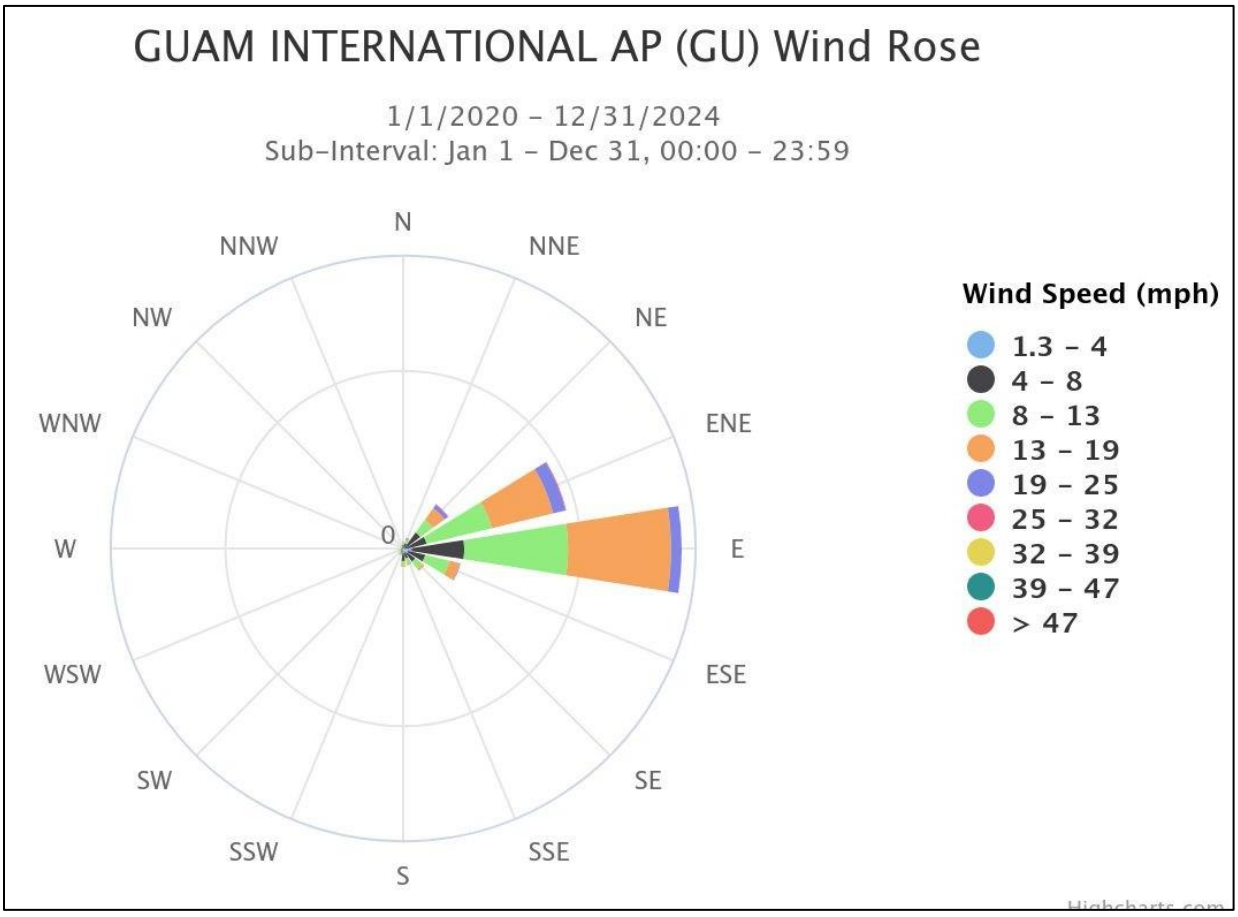


**Figure D-1: Annual Wind Speed and Direction at Guam International Airport**

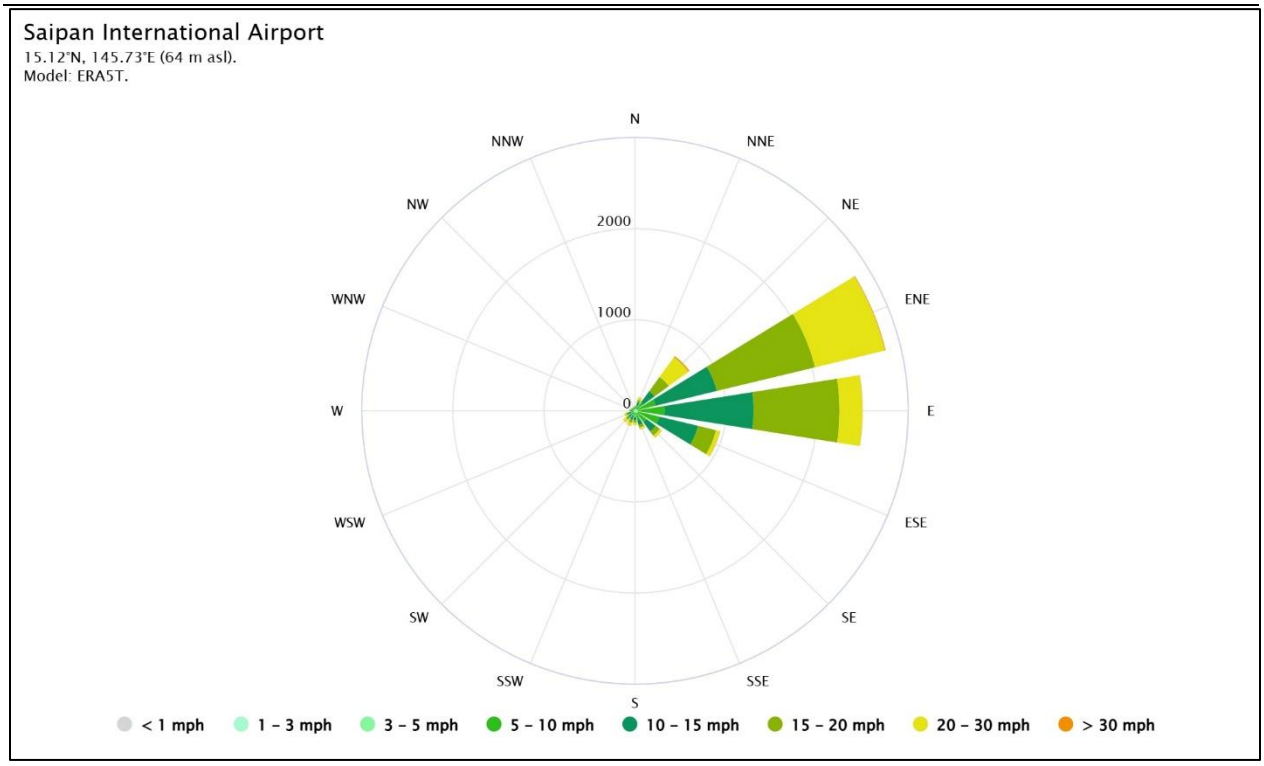


**Figure D-2: Wind Speed and Direction Snapshot at Saipan International Airport**

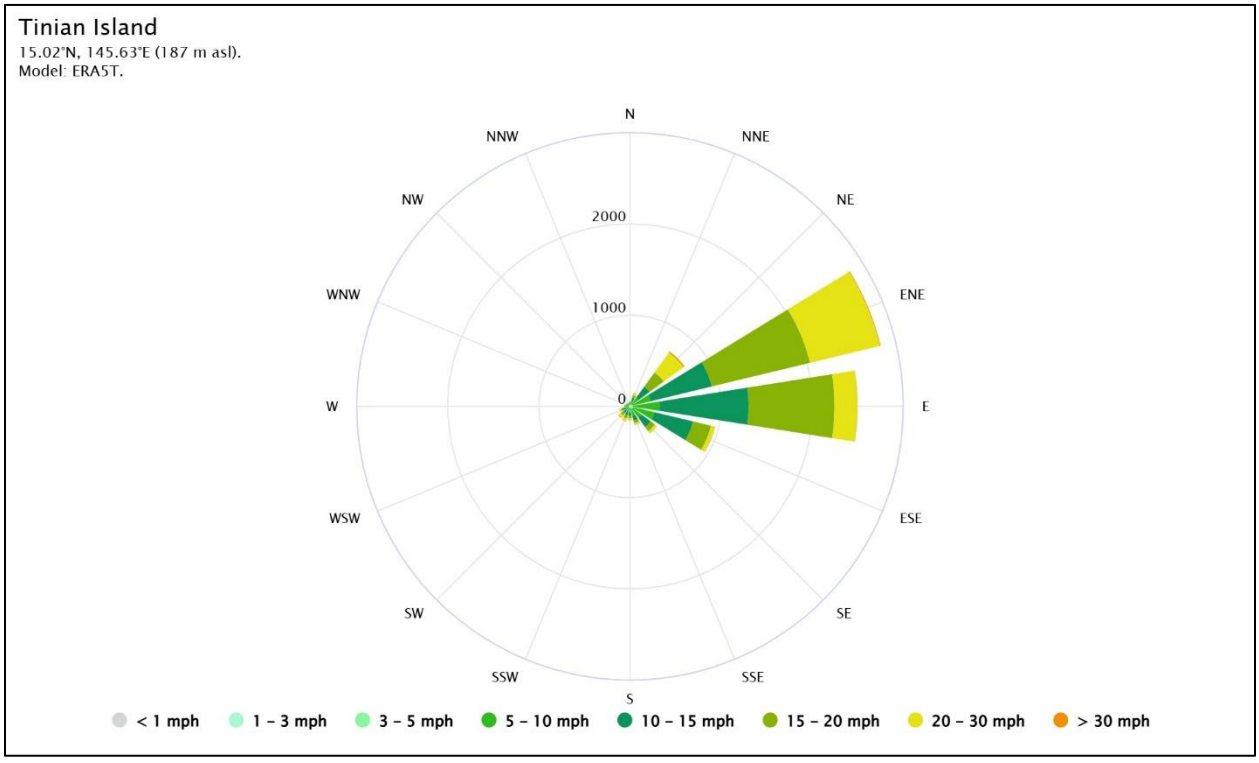


**Figure D-3: Wind Speed and Direction Snapshot at Tinian Island**

## D.4 Existing Air Quality

The USEPA designated the Northern Mariana Islands to be in attainment or unclassified for all criteria pollutants (40 Code of Federal Regulations 81.354). Because the Commonwealth of the Northern Mariana Islands is in attainment of the National Ambient Air Quality Standards (NAAQS), a state implementation plan is not required. As shown in Figure D-4, Guam is in attainment with all NAAQS, except for areas centered on Piti and Tanguisson power plants that are in nonattainment for the 1971 Sulfur Dioxide ($SO_2$) NAAQS ((U.S. Environmental Protection Agency, 2025), and the Piti-Cabras area is in nonattainment for the 2010 $SO_2$ NAAQS, effective April 9, 2018 (U.S. Environmental Protection Agency, 2025).

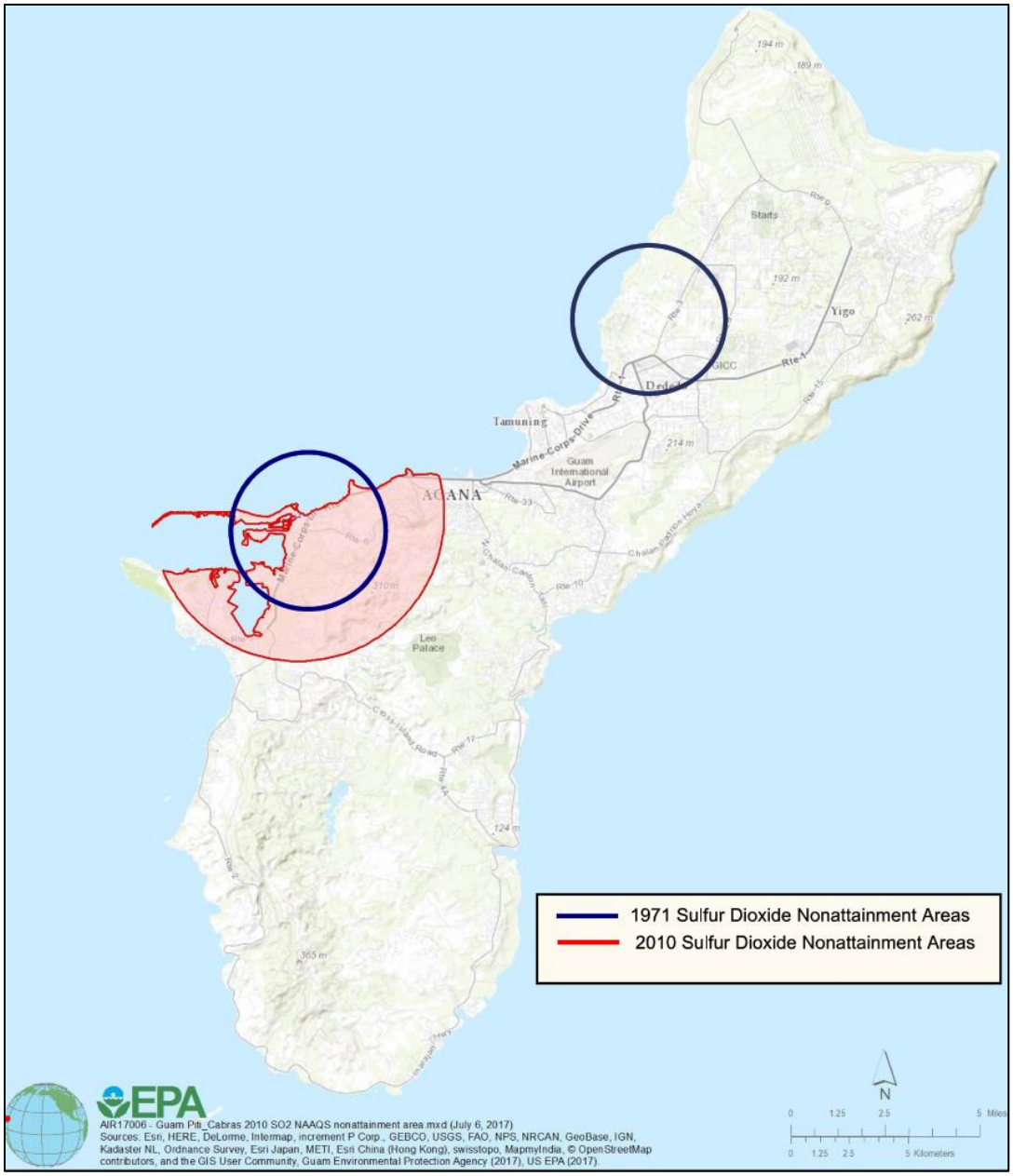


**Figure D-4: Guam Sulfur Dioxide Nonattainment Areas**

## D.5 Sensitive Receptors

The Study Area includes pierside locations in Apra Harbor, Guam, and Tinian and Saipan nearshore locations where public exposure to the increase in emissions could occur. Figure D-5 presents the sensitive receptors near Apra Harbor, which include public parks, William C. McCool Elementary and Middle School, Navy Gateway Inns and Suites, and Naval Base Guam Medical Branch Clinic on Guam. Figure D-6 and Figure D-7 present the sensitive receptors near the proposed activity areas on Saipan and Tinian.

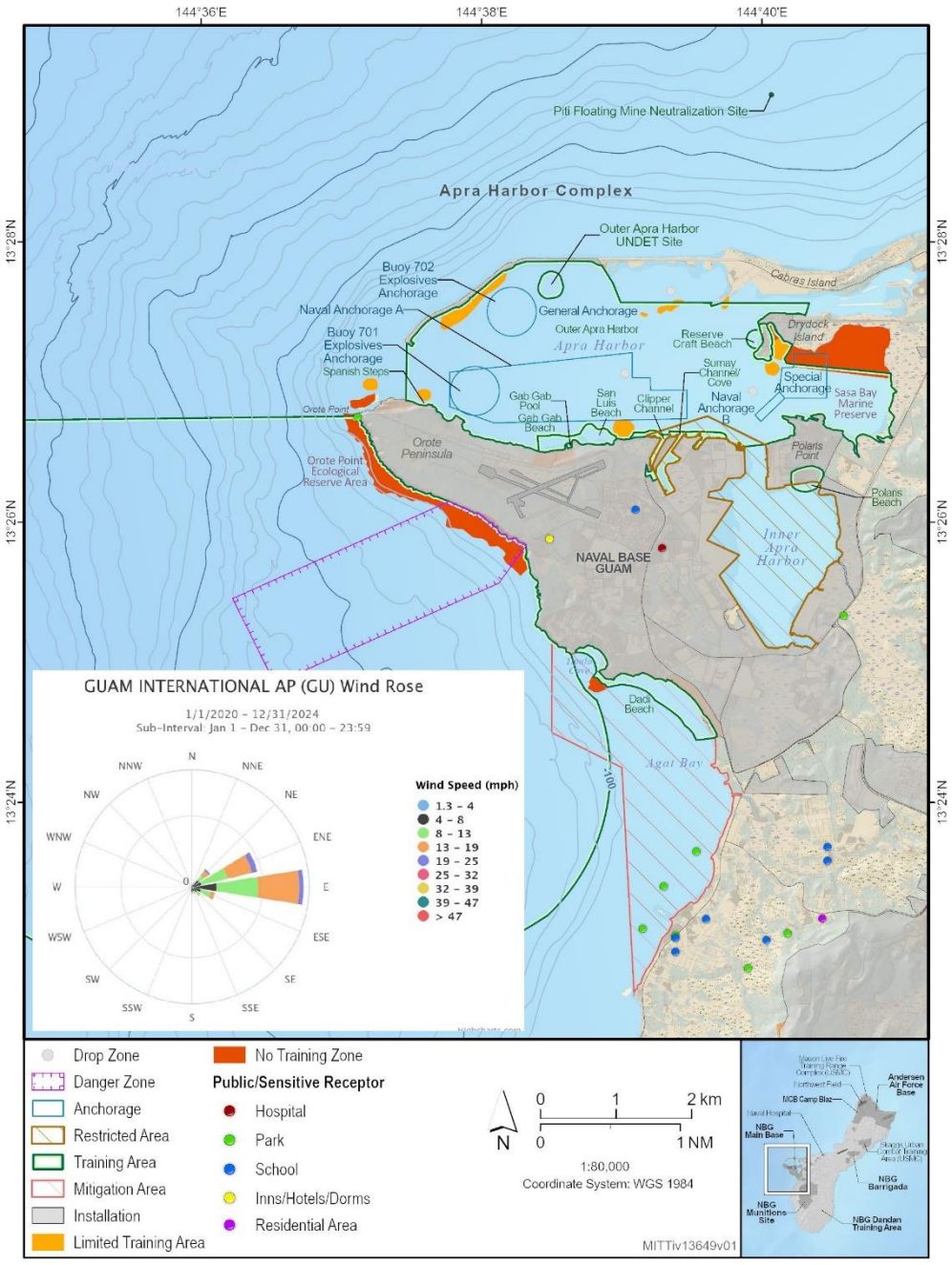


**Figure D-5: Sensitive Receptors Near Pierside Locations in Apra Harbor, Guam**

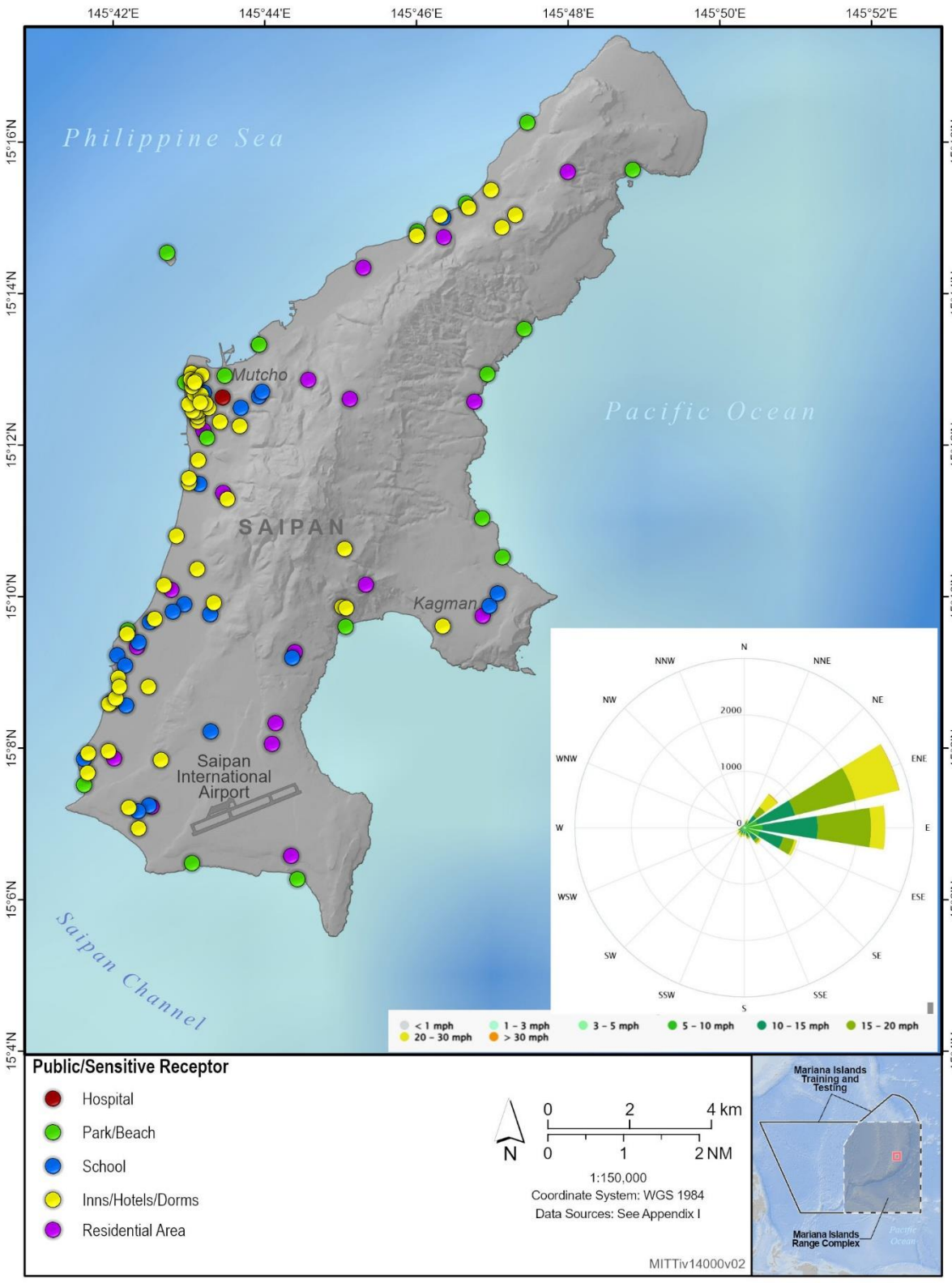


**Figure D-6: Sensitive Receptors Near Proposed Activity Areas, Saipan Island**

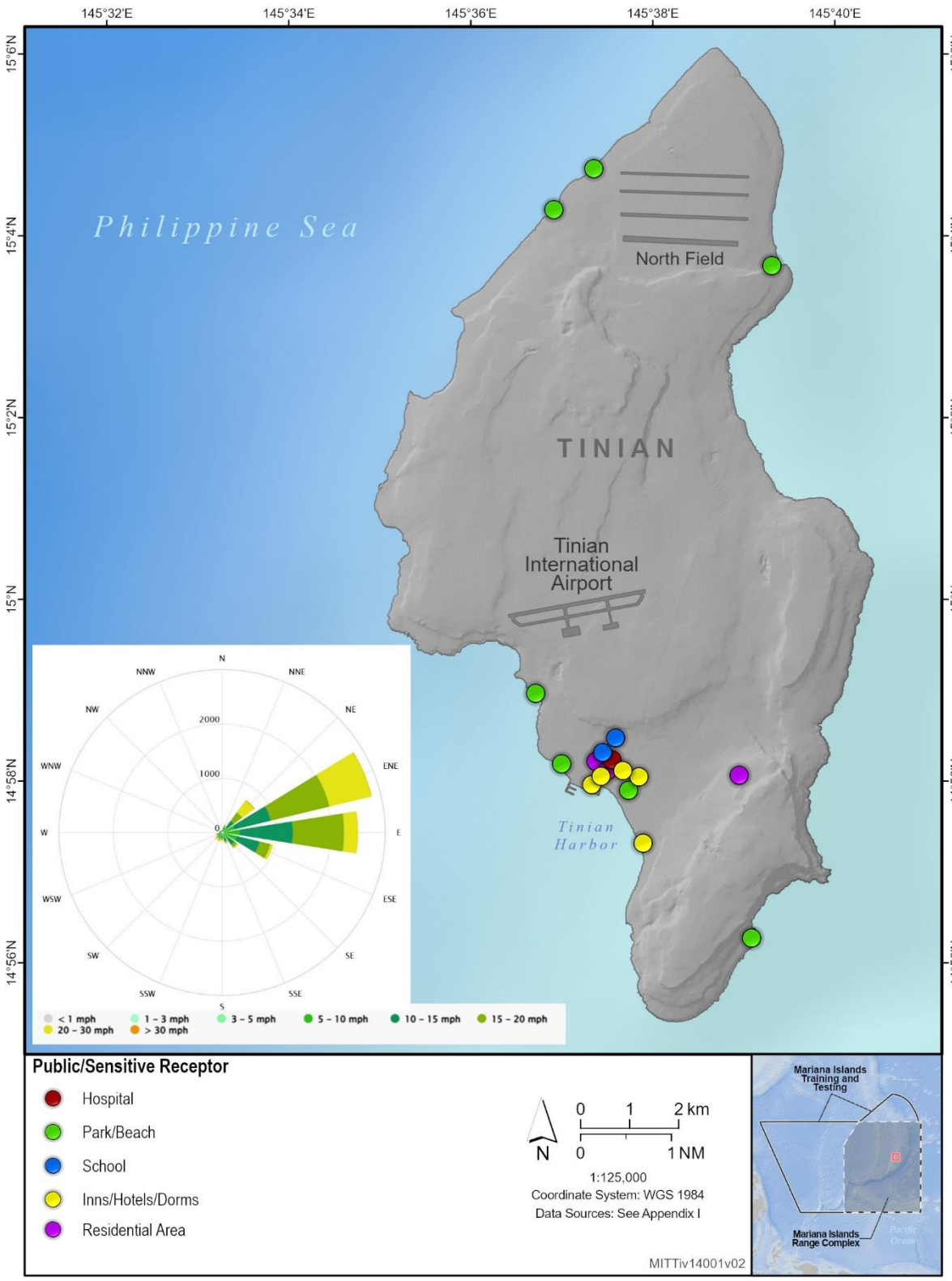


**Figure D-7: Sensitive Receptors Near Proposed Activity Areas, Tinian Island**

## D.6 Emissions Estimates Spreadsheets

Tables D-1 through D-7 provide proposed changes to training and testing activities, emissions factors, and example emissions summaries for aircraft, vessels, and munitions for Alternatives 1 and 2.

## Table D-1: Proposed Changes to Training Activities

| | | VESSELS | | | | | | | AIRCRAFT | | | | | | | | | Proposed Annual # of Events | | Difference in Annual # of Events | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Activity Distribution (%) | | | | | | | Distribution (%) | | | | | | | | |
| Category | Activity Name | Time to prepare for shore disconnect, startup and idle | Time to travel between shore location and range. | Time to prepare for shore connect - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Time to prepare for takeoff - startup/idle (hr) | Time to travel between shore location and range. | Time for after landing activities - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Location | Current Activities | ALT 1 | ALT 2 | ALT 1 | ALT 2 |
| Major Training Exercises – Large Integrated Anti-Submarine Warfare Training | Joint Multi-Strike Group Exercise | 2.25 | 1.75 | 2.25 | 80 | 0% | 0% | 100% | 0.65 | 0.65 | 0.25 | 8 | 0% | 0% | 100% | MIRC | 1 | 1 | 1 | 0 | 0 |
| Major Training Exercises – Large Integrated Anti-Submarine Warfare Training | Joint Expeditionary Exercise | 2.25 | 1.75 | 2.25 | 80 | 0% | 0% | 100% | 0.65 | 0.65 | 0.25 | 8 | 0% | 0% | 100% | MIRC | 1 | 0 | 0 | -1 | -1 |
| Small Integrated Anti-Submarine Warfare Training | Surface Warfare Advanced Tactical Training | 2.25 | 1.75 | 2.25 | 40 | 0% | 50% | 50% | 0.65 | 0.65 | 0.5 | 8 | 0% | 50% | 50% | MIRC | 3 | 1 | 1 | -2 | -2 |
| Small Coordinated Anti-Submarine Warfare Training | Independent Deployer Certification Exercise/Tailored Surface Warfare Training | 2.25 | 1.75 | 2.25 | 24 | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 36 | 0% | 0% | 100% | MIRC | 3 | 5 | 5 | 2 | 2 |
| Small Integrated Anti-Submarine Warfare Training | Small Integrated Anti-Submarine Warfare – NUWTAC/Multi-Sail | 2.25 | 1.75 | 2.25 | 40 | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 8 | 0% | 100% | 0% | MIRC | 3 | 7 | 7 | 4 | 4 |
| Medium Coordinated Anti-Submarine Warfare Training | Medium Coordinated Anti-Submarine Warfare | 2.25 | 1.75 | 2.25 | 80 | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 24 | 0% | 0% | 100% | MIRC | 3 | 5 | 5 | 2 | 2 |
| Air Warfare | Air Combat Maneuvers Guam | | | | | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 1 | 0% | 0% | 100% | MIRC | 4800 | 4800 | 4800 | 0 | 0 |
| Air Warfare | Air Combat Maneuvers CNMI | | | | | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 1 | 0% | 0% | 100% | MIRC | 1800 | 480 | 480 | -1320 | -1320 |
| Air Warfare | Air Combat Maneuvers Carrier based | 2.25 | 1.75 | 2.25 | 1 | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 1 | 0% | 0% | 100% | MIRC | 2300 | 2480 | 2480 | 180 | 180 |
| Air Warfare | Air Defense Exercise Carrier Based | | | | | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 1 | 0% | 0% | 100% | MIRC | 88 | 1110 | 1110 | 1022 | 1022 |
| Air Warfare | Air Defense Exercise GUAM | | | | | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 1 | 0% | 0% | 100% | MIRC | 12 | 12 | 12 | 0 | 0 |
| Air Warfare | Gunnery Exercise Air-to-Air Medium-Caliber Carrier Based | | | | | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 1 | 0% | 0% | 100% | MIRC | 18 | 24 | 24 | 6 | 6 |

| | | VESSELS | | | | | | | AIRCRAFT | | | | | | | | | Proposed Annual # of Events | | Difference in Annual # of Events | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Activity Distribution (%) | | | | | | | Distribution (%) | | | | | | | | |
| Category | Activity Name | Time to prepare for shore disconnect, startup, and idle | Time to travel between shore location and range. | Time to prepare for shore connect - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Time to prepare for takeoff - startup/idle (hr) | Time to travel between shore location and range. | Time for after landing activities - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Location | Current Activities | ALT 1 | ALT 2 | ALT 1 | ALT 2 |
| Air Warfare | Gunnery Exercise Air-to-Air Medium-Caliber Guam | | | | | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 1 | 0% | 0% | 100% | MIRC | 18 | 24 | 24 | 6 | 6 |
| Air Warfare | Gunnery Exercise Surface-to-Air Large-Caliber | | | | 2 | 0% | 0% | 100% | | | | | 0% | 0% | 100% | MIRC | 9 | 14 | 14 | 5 | 5 |
| Air Warfare | Gunnery Exercise Surface-to-Air Medium-Caliber | | | | 2 | 0% | 0% | 100% | | | | | 0% | 0% | 100% | MIRC | 19 | 23 | 23 | 4 | 4 |
| Air Warfare | Air Defense Exercise Carrier Based | | | | 1 | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 1 | 0% | 0% | 100% | MIRC | 12 | 12 | 12 | 0 | 0 |
| Air Warfare | Air Defense Exercise GUAM | | | | | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 1 | 0% | 0% | 100% | MIRC | 6 | 6 | 6 | 0 | 0 |
| Air Warfare | Missile Exercise Surface-to-Air | 2.25 | 1.75 | 2.25 | 2 | 0% | 0% | 100% | | | | | | | | MIRC | 27 | 8 | 8 | -19 | -19 |
| Amphibious Warfare | Amphibious Assault | 2.25 | 1.75 | 2.25 | 8 | 100.0% | 0.0% | 0.0% | 0.65 | 0.65 | 0.5 | 18 | 100% | 0% | 0% | CNMI | 4 | 20 | 20 | 16 | 16 |
| Amphibious Warfare | Amphibious Assault | 2.25 | 1.75 | 2.25 | 8 | 100.0% | 0.0% | 0.0% | 0.65 | 0.65 | 0.5 | 18 | 100% | 0% | 0% | Guam | 2 | 4 | 4 | 2 | 2 |
| Amphibious Warfare | Amphibious Raid | 2.25 | 1.75 | 2.25 | 6 | 100.0% | 0.0% | 0.0% | 0.65 | 0.65 | 0.5 | 12 | 100% | 0% | 0% | Guam | 2 | 4 | 5 | 2 | 3 |
| Amphibious Warfare | Amphibious Raid | 2.25 | 1.75 | 2.25 | 6 | 100.0% | 0.0% | 0.0% | 0.65 | 0.65 | 0.5 | 12 | 100% | 0% | 0% | Tinian | 1 | 4 | 5 | 3 | 4 |
| Amphibious Warfare | Amphibious Raid | 2.25 | 1.75 | 2.25 | 6 | 100.0% | 0.0% | 0.0% | 0.65 | 0.65 | 0.5 | 12 | 100% | 0% | 0% | Rota | 1 | 4 | 5 | 3 | 4 |
| Amphibious Warfare | Amphibious Vehicle Maneuvers/Rehearsals | 2.25 | 1.75 | 2.25 | 4 | 100.0% | 0.0% | 0.0% | | | | | | | | Apra Harbor | 0 | 16 | 16 | 16 | 16 |
| Amphibious Warfare | Amphibious Vehicle Maneuvers/Rehearsals | 2.25 | 1 | 1 | 4 | 100.0% | 0.0% | 0.0% | | | | | | | | MIRC | 12 | 12 | 12 | 0 | 0 |
| Amphibious Warfare | Unmanned Aerial Vehicle – Intelligence, Surveillance, and Reconnaissance | | | | | | | | 0.65 | 0.65 | 0.5 | 4 | 50% | 25% | 25% | MIRC | 100 | 432 | 432 | 332 | 332 |
| Amphibious Warfare | Naval Surface Fire Support Exercise – Land-Based Target | | | | 8 | 0% | 50% | 50% | | | | | | | | FDM | 15 | 5 | 5 | -10 | -10 |
| Amphibious Warfare | Non-Combat Amphibious Operation | 2.25 | 1.75 | 2.25 | 80 | 100.0% | 0.0% | 0.0% | 0.65 | 0.65 | 0.5 | 20 | 100.0% | 0.0% | 0.0% | Guam | 4 | 7 | 7 | 3 | 3 |
| Amphibious Warfare | Non-Combat Amphibious Operation | 2.25 | 1.75 | 2.25 | 80 | 100.0% | 0.0% | 0.0% | 0.65 | 0.65 | 0.5 | 20 | 100.0% | 0.0% | 0.0% | Tinian | 5 | 6 | 6 | 1 | 1 |
| Amphibious Warfare | Non-Combat Amphibious Operation | 2.25 | 1.75 | 2.25 | 80 | 100.0% | 0.0% | 0.0% | 0.65 | 0.65 | 0.5 | 20 | 100.0% | 0.0% | 0.0% | Rota | 1 | 2 | 2 | 1 | 1 |

| | | VESSELS | | | | | | | AIRCRAFT | | | | | | | | | Proposed Annual # of Events | | Difference in Annual # of Events | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Activity Distribution (%) | | | | | | | Distribution (%) | | | | | | | | |
| Category | Activity Name | Time to prepare for shore disconnect, startup, and idle | Time to travel between shore location and range. | Time to prepare for shore connect - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Time to prepare for takeoff - startup/idle (hr) | Time to travel between shore location and range. | Time for after landing activities - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Location | Current Activities | ALT 1 | ALT 2 | ALT 1 | ALT 2 |
| Amphibious Warfare | Marine Air Ground Task Force Exercise (Amphibious) – Battalion | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Amphibious Warfare | Special Purpose Marine Air Ground Task Force Exercise | | | | | | | | | | | | | | | | | | | 0 | 0 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Torpedo Exercise – Helicopter | | | | 4 | 0% | 0.0% | 100% | 0.65 | 0.65 | 0.5 | 4 | 0% | 0.0% | 100% | MIRC | 6 | 1 | 1 | -5 | -5 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Torpedo Exercise – Maritime Patrol Aircraft | | | | | | | | 0.65 | 0.65 | 0.5 | 6 | 0% | 0.0% | 100% | MIRC | 6 | 1 | 2 | -5 | -4 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Torpedo Exercise – Ship | | | | 2 | 0% | 0% | 100% | | | | | | | | MIRC | 6 | 8 | 8 | 2 | 2 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Torpedo Exercise – Submarine | | | | 2 | 0% | 0% | 100% | | | | | | | | MIRC | 4 | 2 | 2 | -2 | -2 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Tracking Exercise – Helicopter | 2.25 | 1 | 1 | 2 | 0% | 24% | 76% | 0.65 | 0.65 | 0.5 | 4 | 0% | 0% | 100% | MIRC | 7 | 10 | 10 | 3 | 3 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Tracking Exercise – Helicopter | 2.25 | 1 | 1 | 2 | 0% | 24% | 76% | 0.65 | 0.65 | 0.5 | 4 | 0% | 0% | 100% | Transit Corridor | 5 | 6 | 6 | 1 | 1 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Tracking Exercise – Maritime Patrol Aircraft | | | | | | | | 0.65 | 0.65 | 0.5 | 6 | 0% | 0% | 100% | MIRC | 36 | 60 | 60 | 24 | 24 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Tracking Exercise – Ship | 2.25 | 2.75 | 2.25 | 2 | 0% | 0% | 100% | | | | | | | | MIRC | 91 | 90 | 90 | -1 | -1 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Tracking Exercise – Submarine | 2.25 | 2.75 | 2.25 | 2 | 0% | 0% | 100% | | | | | | | | MIRC | 10 | 10 | 10 | 0 | 0 |

| | | VESSELS | | | | | | | AIRCRAFT | | | | | | | | | | Proposed Annual # of Events | | Difference in Annual # of Events | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Activity Distribution (%) | | | | | | | Distribution (%) | | | | | | | | | |
| Category | Activity Name | Time to prepare for shore disconnect, startup, and idle | Time to travel between shore location and range. | Time to prepare for shore connect - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Time to prepare for takeoff - startup/idle (hr) | Time to travel between shore location and range. | Time for after landing activities - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Location | Current Activities | ALT 1 | ALT 2 | ALT 1 | ALT 2 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Tracking Exercise – Submarine | | | | 2 | 0% | 0% | 100% | | | | | | | | Transit Corridor | 2 | 4 | 4 | 2 | 2 |
| Electronic Warfare | Counter Targeting Chaff Exercise – Aircraft | | | | | | | | | | | 2 | 0% | 0% | 100% | MIRC | 2200 | 1730 | 1730 | -470 | -470 |
| Electronic Warfare | Counter Targeting Chaff Exercise – Ship | | | | 4 | 0% | 0% | 100% | | | | | | | | MIRC | 60 | 10 | 10 | -50 | -50 |
| Electronic Warfare | Counter Targeting Flare Exercise | | | | | | | | | | | 2 | 0% | 0% | 100% | MIRC | 2200 | 1730 | 1730 | -470 | -470 |
| Electronic Warfare | Electronic Warfare Operations | 2.25 | 1.75 | 2.25 | 4 | 0% | 0% | 100% | | | | 2 | 0% | 0% | 100% | MIRC | 522 | 1160 | 1160 | 638 | 638 |
| Expeditionary Warfare | Dive and Salvage Operations | 2.25 | 1.75 | 2.25 | 1.0 | 100% | 0% | 0% | | | | | | | | MIRC | 0 | 125 | 125 | 125 | 125 |
| Expeditionary Warfare | Dive and Salvage Operations | 2.25 | 1.75 | 2.25 | 1.0 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 0 | 125 | 125 | 125 | 125 |
| Expeditionary Warfare | Underwater Construction Team Training | 2.25 | 1.75 | 2.25 | 12 | 100% | 0% | 0% | | | | | | | | MIRC | 0 | 25 | 25 | 25 | 25 |
| Expeditionary Warfare | Underwater Construction Team Training | 2.25 | 1.75 | 2.25 | 12 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 0 | 25 | 25 | 25 | 25 |
| Expeditionary Warfare | Personnel Insertion/ Extraction – Air | | | | 8 | 50% | 40% | 10% | 0.65 | 0.65 | 0.5 | 8 | 50% | 40% | 10% | Guam | 20 | 33 | 33 | 13 | 13 |
| Expeditionary Warfare | Personnel Insertion/ Extraction – Air | | | | 8 | 50% | 40% | 10% | 0.65 | 0.65 | 0.5 | 8 | 50% | 40% | 10% | Tinian | 20 | 33 | 33 | 13 | 13 |
| Expeditionary Warfare | Personnel Insertion/ Extraction – Air | | | | 8 | 50% | 40% | 10% | 0.65 | 0.65 | 0.5 | 8 | 50% | 40% | 10% | Rota | 20 | 33 | 33 | 13 | 13 |
| Expeditionary Warfare | Personnel Insertion/Extraction – Surface and Subsurface | 2.25 | 1.75 | 2.25 | 2 | 0% | 50% | 50% | | | | | | | | Guam | 46 | 71 | 71 | 25 | 25 |
| Expeditionary Warfare | Personnel Insertion/Extraction – Surface and Subsurface | 2.25 | 1.75 | 2.25 | 2 | 0% | 50% | 50% | | | | | | | | Tinian | 46 | 71 | 71 | 25 | 25 |
| Expeditionary Warfare | Personnel Insertion/Extraction – | 2.25 | 1.75 | 2.25 | 2 | 0% | 50% | 50% | | | | | | | | Rota | 46 | 71 | 71 | 25 | 25 |

| | | VESSELS | | | | | | | AIRCRAFT | | | | | | | | | Proposed Annual # of Events | | Difference in Annual # of Events | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Activity Distribution (%) | | | | | | | Distribution (%) | | | | | | | | |
| Category | Activity Name | Time to prepare for shore disconnect, startup, and idle | Time to travel between shore location and range. | Time to prepare for shore connect - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Time to prepare for takeoff - startup/idle (hr) | Time to travel between shore location and range. | Time for after landing activities - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Location | Current Activities | ALT 1 | ALT 2 | ALT 1 | ALT 2 |
| | Surface and Subsurface | | | | | | | | | | | | | | | | | | | | |
| Expeditionary Warfare | Personnel Insertion/ Extraction – Swimmer/Diver | 2.25 | 1.75 | 2.25 | 2 | 50% | 50% | 0% | | | | | | | | Guam | 36 | 18 | 13 | -18 | -23 |
| Expeditionary Warfare | Personnel Insertion/ Extraction – Swimmer/Diver | 2.25 | 1.75 | 2.25 | 2 | 50% | 50% | 0% | | | | | | | | Tinian | 36 | 18 | 13 | -18 | -23 |
| Expeditionary Warfare | Personnel Insertion/ Extraction – Swimmer/Diver | 2.25 | 1.75 | 2.25 | 2 | 50% | 50% | 0% | | | | | | | | Rota | 36 | 18 | 13 | -18 | -23 |
| Expeditionary Warfare | Port Damage Repair (No Dredging/No Pile Driving) | 2.25 | 1.75 | 2.25 | 8 | 100% | 0% | 0% | | | | | | | | MIRC | 0 | 25 | 25 | 25 | 25 |
| Expeditionary Warfare | Port Damage Repair (No Dredging/No Pile Driving) | 2.25 | 1.75 | 2.25 | 8 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 0 | 25 | 25 | 25 | 25 |
| Mine Warfare | Mine Countermeasure – Mine Detection | | | | | | | | 0.65 | 0.65 | 0.5 | 2 | 100% | 0% | 0% | MIRC | 4 | 8 | 8 | 4 | 4 |
| Mine Warfare | Airborne Mine Laying | | | | | | | | 0.65 | 0.65 | 0.5 | 1 | 0% | 50% | 50% | MIRC | 4 | 4 | 4 | 0 | 0 |
| Mine Warfare | Limpet Mine Neutralization System | | | | 4 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 30 | 30 | 30 | 0 | 0 |
| Mine Warfare | Limpet Mine Neutralization System | 2 | 1 | 1 | 4 | 100% | 0% | 0% | | | | | | | | Agat Bay | 30 | 30 | 30 | 0 | 0 |
| Mine Warfare | Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercise | 2.25 | 1.75 | 2.25 | 24 | 100% | 0% | 0% | 0.65 | 0.65 | 0.5 | 12 | 100% | 0% | 0% | Apra Harbor | 1 | 1 | 1 | 0 | 0 |
| Mine Warfare | Mine Countermeasures – Towed Mine Neutralization | 2.25 | 1.75 | 2.25 | 4 | 100% | 0% | 0% | 0.65 | 0.65 | 0.5 | 2 | 0% | 50% | 50% | CNMI | 4 | 8 | 8 | 4 | 4 |
| Mine Warfare | Mine Neutralization Explosive Ordnance Disposal | 2.25 | 1.75 | 2.25 | 2 | 100% | 0% | 0% | 0.65 | 0.65 | 0.5 | 2 | 100% | 0% | 0% | Guam | 20 | 20 | 20 | 0 | 0 |
| Mine Warfare | Surface Ship Object Detection | | | | 1 | 100% | 0% | 0% | | | | | | | | CNMI | 3 | 15 | 15 | 12 | 12 |

| | | VESSELS | | | | | | | AIRCRAFT | | | | | | | | | Proposed Annual # of Events | | Difference in Annual # of Events | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Activity Distribution (%) | | | | | | | Distribution (%) | | | | | | | | |
| Category | Activity Name | Time to prepare for shore disconnect, startup, and idle | Time to travel between shore location and range. | Time to prepare for shore connect - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Time to prepare for takeoff - startup/idle (hr) | Time to travel between shore location and range. | Time for after landing activities - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Location | Current Activities | ALT 1 | ALT 2 | ALT 1 | ALT 2 |
| Mine Warfare | Surface Ship Object Detection | | | | 1 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 3 | 15 | 15 | 12 | 12 |
| Mine Warfare | Underwater Demolition Qualification and Certification | 2.25 | 1.75 | 2.25 | 2 | 100% | 0% | 0% | 0.65 | 0.65 | 0.5 | 2 | 100% | 0% | 0% | Guam | 45 | 45 | 45 | 0 | 0 |
| Mine Warfare | Underwater Mine Countermeasure Raise, Tow, Beach, and Exploitation | 2.25 | 1.75 | 2.25 | 2 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 4 | 24 | 24 | 20 | 20 |
| Surface Warfare | Bombing Exercise Air-to-Surface | | | | | | | | 0.65 | 0.65 | 0.5 | 1.5 | 0% | 0% | 100% | MIRC | 37 | 39 | 39 | 2 | 2 |
| Surface Warfare | Fast Attack Craft and Fast Inshore Attack Craft | 2.25 | 1.75 | 2.25 | 4 | 0% | 50% | 50% | 0.65 | 0.65 | 0.5 | 4 | 0% | 50% | 50% | MIRC | 27 | 33 | 33 | 6 | 6 |
| Surface Warfare | Gunnery Exercise Air-to-Surface Medium Caliber | | | | | | | | 0.65 | 0.65 | 0.5 | 2 | 0% | 50% | 50% | MIRC | 120 | 130 | 130 | 10 | 10 |
| Surface Warfare | Gunnery Exercise Air-to-Surface Small Caliber | | | | | | | | 0.65 | 0.65 | 0.5 | 2 | 0% | 50% | 50% | MIRC | 321 | 418 | 418 | 97 | 97 |
| Surface Warfare | Gunnery Exercise Surface-to-Surface Boat Medium Caliber | 2.25 | 1.75 | 2.25 | 1 | 0% | 75% | 25% | | | | | | | | MIRC | 20 | 24 | 24 | 4 | 4 |
| Surface Warfare | Gunnery Exercise Surface-to-Surface Boat Small Caliber | 2.25 | 1.75 | 2.25 | 3 | 0% | 75% | 25% | | | | | | | | MIRC | 43 | 44 | 44 | 1 | 1 |
| Surface Warfare | Gunnery Exercise Surface-to-Surface Ship Large Caliber | | | | 3 | 0% | 0% | 100% | | | | | | | | MIRC | 253 | 255 | 255 | 2 | 2 |
| Surface Warfare | Gunnery Exercise Surface-to-Surface Ship Large Caliber | | | | 3 | 0% | 0% | 100% | | | | | | | | Transit Corridor | 2 | 2 | 2 | 0 | 0 |
| Surface Warfare | Gunnery Exercise Surface-to-Surface Ship Medium Caliber | | | | 3 | 0% | 0% | 100% | | | | | | | | MIRC | 117 | 150 | 150 | 33 | 33 |
| Surface Warfare | Gunnery Exercise Surface-to-Surface Ship Small Caliber | | | | 3 | 0% | 50% | 50% | | | | | | | | MIRC | 117 | 230 | 230 | 113 | 113 |

| | | VESSELS | | | | | | | AIRCRAFT | | | | | | | | | Proposed Annual # of Events | | Difference in Annual # of Events | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Activity Distribution (%) | | | | | | | Distribution (%) | | | | | | | | |
| Category | Activity Name | Time to prepare for shore disconnect, startup, and idle | Time to travel between shore location and range. | Time to prepare for shore connect - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Time to prepare for takeoff - startup/idle (hr) | Time to travel between shore location and range. | Time for after landing activities - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Location | Current Activities | ALT 1 | ALT 2 | ALT 1 | ALT 2 |
| Surface Warfare | Laser Targeting – Aircraft | | | | | | | | 0.65 | 0.65 | 0.5 | 2 | 0% | 0% | 100% | MIRC | 600 | 310 | 310 | -290 | -290 |
| Surface Warfare | Laser Targeting – Ship | | | | 2 | 0% | 25% | 75% | | | | | | | | MIRC | 600 | 5 | 5 | -595 | -595 |
| Surface Warfare | Maritime Security Operations | 2.25 | 1.75 | 2.25 | 8 | 100% | 0% | 0% | 0.65 | 0.65 | 0.5 | 2 | 100% | 0% | 0% | Apra Harbor | 20 | 70 | 70 | 50 | 50 |
| Surface Warfare | Maritime Security Operations | 2.25 | 1.75 | 2.25 | 8 | 25% | 25% | 50% | 0.65 | 0.65 | 0.5 | 2 | 0% | 50% | 50% | MIRC | 20 | 70 | 70 | 50 | 50 |
| Surface Warfare | Missile Exercise Air-to-Surface | | | | | | | | 0.65 | 0.65 | 0.5 | 2 | 0% | 0% | 100% | MIRC | 10 | 50 | 50 | 40 | 40 |
| Surface Warfare | Missile Exercise Air-to-Surface Rocket | | | | | | | | 0.65 | 0.65 | 0.5 | 2 | 0% | 0% | 100% | MIRC | 111 | 47 | 47 | -64 | -64 |
| Surface Warfare | Missile Exercise Surface-to-Surface | 2.25 | 1.75 | 2.25 | 3 | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 3 | 0% | 0% | 100% | MIRC | 28 | 9 | 9 | -19 | -19 |
| Surface Warfare | Sinking Exercise (SINKEX) | 2.25 | 1.75 | 2.25 | 16 | 0% | 0% | 100% | 0.65 | 0.65 | 0.5 | 16 | 0% | 0% | 100% | MIRC | 1 | 2 | 2 | 1 | 1 |
| Surface Warfare | Torpedo Exercise (Submarine-to-Surface) | | | | 8 | 0% | 0% | 100% | | | | | | | | MIRC | 0 | 5 | 5 | 5 | 5 |
| Surface Warfare | Small Boat Attack | 2.25 | 1.75 | 2.25 | 8 | 0% | 50% | 50% | | | | | | | | MIRC | 27 | 8 | 8 | -19 | -19 |
| Other Training Exercises | Direct Action (Tactical Air Control Party) | | | | | | | | 0.65 | 0.65 | 0.5 | 8 | 100% | 0% | 0% | FDM | 18 | 18 | 18 | 0 | 0 |
| Other Training Exercises | Submarine Navigation | | | | 2 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 4 | 25 | 25 | 21 | 21 |
| Other Training Exercises | Submarine Navigation | | | | 2 | 50% | 50% | 0% | | | | | | | | MIRC | 4 | 25 | 25 | 21 | 21 |
| Other Training Exercises | Precision Anchoring | | | | 8 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 9 | 10 | 10 | 1 | 1 |
| Other Training Exercises | Precision Anchoring | | | | 8 | 100% | 0% | 0% | | | | | | | | MIRC Anchorages | 9 | 10 | 10 | 1 | 1 |
| Other Training Exercises | Search and Rescue | 2.25 | 1.75 | 2.25 | 2 | 40% | 40% | 20% | 0.65 | 0.65 | 0.5 | 2 | 40% | 40% | 20% | MIRC | 45 | 52 | 52 | 7 | 7 |
| Other Training Exercises | Submarine Sonar Maintenance and Systems Checks | | | | 8 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 42 | 45 | 45 | 3 | 3 |
| Other Training Exercises | Submarine Sonar Maintenance and Systems Checks | 2.25 | 1.75 | 2.25 | 4 | 0% | 50% | 50% | | | | | | | | MIRC | 42 | 45 | 45 | 3 | 3 |
| Other Training Exercises | Submarine Sonar Maintenance and Systems Checks | | | | 4 | 0% | 0% | 100% | | | | | | | | Transit Corridor | 2 | 2 | 2 | 0 | 0 |

| | | VESSELS | | | | | | | AIRCRAFT | | | | | | | | | Proposed Annual # of Events | | Difference in Annual # of Events | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Activity Distribution (%) | | | | | | | Distribution (%) | | | | | | | | |
| Category | Activity Name | Time to prepare for shore disconnect, startup, and idle | Time to travel between shore location and range. | Time to prepare for shore connect - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Time to prepare for takeoff - startup/idle (hr) | Time to travel between shore location and range. | Time for after landing activities - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Location | Current Activities | ALT 1 | ALT 2 | ALT 1 | ALT 2 |
| Other Training Exercises | Surface Ship Sonar Maintenance and Systems Checks | | | | 8 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 20 | 24 | 24 | 4 | 4 |
| Other Training Exercises | Surface Ship Sonar Maintenance and Systems Checks | | | | 4 | 0% | 50% | 50% | | | | | | | | MIRC | 20 | 24 | 24 | 4 | 4 |
| Other Training Exercises | Surface Ship Sonar Maintenance and Systems Checks | | | | 4 | 0% | 0% | 100% | | | | | | | | Transit Corridor | 4 | 4 | 4 | 0 | 0 |
| Strike Warfare | Bombing Exercise Air-to-Ground | | | | | | | | 0.65 | 0.65 | 0.5 | 2 | 0% | 0% | 100% | FDM | 1500 | 1200 | 1200 | -300 | -300 |
| Strike Warfare | Bombing Exercise Air-to-Ground | | | | | | | | 0.65 | 0.65 | 0.5 | 2 | 0% | 0% | 100% | FDM | 800 | 790 | 790 | -10 | -10 |
| Strike Warfare | Gunnery Exercise Air-to-Ground | | | | | | | | 0.65 | 0.65 | 0.5 | 2 | 0% | 0% | 100% | FDM | 50 | 100 | 100 | 50 | 50 |
| Strike Warfare | Gunnery Exercise Air-to-Ground | | | | | | | | 0.65 | 0.65 | 0.5 | 2 | 0% | 0% | 100% | FDM | 46 | 80 | 80 | 34 | 34 |
| Strike Warfare | Missile Exercise Air-to-Ground | | | | | | | | 0.25 | 0.25 | 0.25 | 2 | 0% | 0% | 100% | FDM | 15 | 15 | 15 | 0 | 0 |
| Strike Warfare | Missile Exercise Air-to-Ground | | | | | | | | 0.25 | 0.25 | 0.25 | 2 | 0% | 0% | 100% | FDM | 100 | 130 | 130 | 30 | 30 |
| Other Training Exercises | Maritime Environmental Response | 2.25 | 1.75 | 2.25 | 8 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 0 | 1 | 1 | 1 | 1 |
| Other Training Exercises | Maritime Environmental Response | 2.25 | 1.75 | 2.25 | 8 | 33% | 33% | 34% | | | | | | | | MIRC | 0 | 1 | 1 | 1 | 1 |
| Other Training Exercises | Underwater Survey | 2.25 | 1.75 | 2.25 | 4 | 100% | 0% | 0% | | | | | | | | MIRC | 32 | 76 | 76 | 44 | 44 |
| Other Training Exercises | Unmanned Aerial System Training and Certification | | | | 4 | 0% | 50% | 50% | 0.65 | 0.65 | 0.5 | 6 | 0% | 50% | 50% | Guam | 476 | 278 | 278 | -198 | -198 |
| Other Training Exercises | Unmanned Aerial System Training and Certification only small boat, mostly in littorals/Apra. RHIBs from Guam, assume | 2.25 | 1.75 | 2.25 | 4 | 0% | 50% | 50% | 0.65 | 0.65 | 0.5 | 6 | 0% | 50% | 50% | Guam | 476 | 278 | 278 | -198 | -198 |

| | | VESSELS | | | | | | | AIRCRAFT | | | | | | | | | Proposed Annual # of Events | | Difference in Annual # of Events | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Activity Distribution (%) | | | | | | | Distribution (%) | | | | | | | | |
| Category | Activity Name | Time to prepare for shore disconnect, startup and idle | Time to travel between shore location and range. | Time to prepare for shore connect - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Time to prepare for takeoff - startup/idle (hr) | Time to travel between shore location and range. | Time for after landing activities - idle/shutdown (hr) | Time on Range (hr) | 0-3 nm from shore | 3-12 nm from Shore | >12 nm from Shore | Location | Current Activities | ALT 1 | ALT 2 | ALT 1 | ALT 2 |
| | all activity occurs near Guam | | | | | | | | | | | | | | | | | | | | |
| Other Training Exercises | Unmanned Underwater Vehicle Training – Certification and Development Exercises | 2.25 | 1.75 | 2.25 | 4 | 50% | 25% | 25% | 0.25 | 0.25 | 0.25 | 2 | 0% | 50% | 50% | MIRC | 64 | 70 | 70 | 6 | 6 |
| Other Training Exercises | Waterborne Training | 2.25 | 1.75 | 2.25 | 4 | 50% | 50% | 0% | | | | | | | | Guam | 0 | 65 | 75 | 65 | 75 |

## Table D-2: Proposed Changes to Testing Activities

| | | VESSELS | | | | | | | AIRCRAFT | | | | | | | | | Proposed Annual # of Events | | Difference in Annual # of Events | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Distribution (%) | | | | | | | Distribution (%) | | | | | | | | |
| Category | Activity Name | Time to prepare for shore disconnect - startup/idle (hr) | Time to travel between shore location and range, roundtrip (hr) | Time to prepare for shore connect - idle/shutdown (hr) | Time on Range (hr) | 0–3 nm from shore | 3–12 nm from Shore | >12 nm from Shore | Time to prepare for takeoff - startup/idle (hr) | Time to travel between shore location and range, roundtrip (hr) | Time for after landing activities - idle/shutdown (hr) | Time on Range (hr) | 0–3 nm from shore | 3–12 nm from Shore | >12 nm from Shore | Location | Current Activities | ALT 1 | ALT 2 | ALT 1 | ALT 2 |
| Air Warfare | Air Combat Maneuver Test | | | | | 0% | 0% | 100% | 0.65 | 0.65 | 0.25 | 1 | 0% | 0% | 100% | MIRC | 0 | 8 | 8 | 8 | 8 |
| Air Warfare | Intelligence, Surveillance, and Reconnaissance Test | | | | | | | | 0.65 | 0.65 | 0.25 | 6 | 0% | 0% | 100% | MIRC | 20 | 20 | 20 | 0 | 0 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Torpedo Test | | | | | | | | 0.65 | 0.65 | 0.25 | 6 | 0% | 100% | 0% | MIRC | 20 | 10 | 10 | -10 | -10 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Tracking Test (Rotary-Wing) | | | | | | | | 0.65 | 0.65 | 0.25 | 6 | 0% | 100% | 0% | MIRC | 26 | 5 | 5 | -21 | -21 |
| Anti-Submarine Warfare | Anti-Submarine Warfare Tracking Test (Fixed-Wing) | | | | | | | | 0.65 | 0.65 | 0.25 | 6 | 0% | 100% | 0% | MIRC | 26 | 3 | 3 | -23 | -23 |
| Anti-Submarine Warfare | At-Sea Sonar Testing | 2.25 | 1.75 | 2.25 | 2 | 0% | 0% | 100% | | | | | | | | MIRC | 7 | 12 | 12 | 5 | 5 |
| Anti-Submarine Warfare | Pierside Sonar Testing | 2.25 | 1.75 | 2.25 | 2 | 100% | 0% | 0% | | | | | | | | Apra Harbor | 0 | 12 | 12 | 12 | 12 |
| Mine Warfare | Mine Countermeasure and Neutralization Testing | 2.25 | 1.75 | 2.25 | 4 | 100% | 0% | 0% | 0.65 | 0.65 | 0.25 | 2 | 100% | 0% | 0.0% | Agat Bay | 3 | 3 | 3 | 0 | 0 |
| Surface Warfare | Air-to-Surface Missile Test | | | | | | | | 0.65 | 0.65 | 0.25 | 2 | 0% | 0% | 100% | MIRC | 4 | 7 | 7 | 3 | 3 |
| Vessel Evaluation | In-Port Maintenance Testing | 2.25 | 1.75 | 2.25 | 8 | 100% | 0.0% | 0.0% | | | | | | | | Guam | 0 | 12 | 12 | 12 | 12 |
| Vessel Evaluation | Submarine Sea Trials – Weapons System Testing | 2.25 | 1.75 | 2.25 | 2 | 0% | 0% | 100% | | | | | | | | MIRC | 1 | 1 | 1 | 0 | 0 |
| Vessel Evaluation | Undersea Warfare Testing | 2.25 | 1.75 | 2.25 | 2 | 0% | 0% | 100% | 0.65 | 0.65 | 0.25 | 2 | 0% | 0% | 100% | MIRC | 1 | 21 | 21 | 20 | 20 |
| Vessel Evaluation | Vessel Signature Evaluation | 2.25 | 1.75 | 2.25 | 2 | 100% | 0.0% | 0.0% | | | | | | | | Guam | 0 | 12 | 12 | 12 | 12 |
| Unmanned Systems | Unmanned Aerial System Testing | 2.25 | 1.75 | 2.25 | 4 | 100% | 0% | 0% | 0.65 | 0.65 | 0.25 | 6 | 100% | 0% | 0% | Guam | 0 | 2 | 2 | 2 | 2 |
| Unmanned Systems | Unmanned Aerial System Testing | 2.25 | 1.75 | 2.25 | 4 | 0% | 0% | 100% | 0.65 | 0.65 | 0.25 | 6 | 0% | 50% | 50% | MIRC | 0 | 2 | 2 | 2 | 2 |

| | | VESSELS | | | | | | | AIRCRAFT | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Distribution (%) | | | | | | | Distribution (%) | | | | | Proposed Annual # of Events | | Difference in Annual # of Events | |
| Category | Activity Name | Time to prepare for shore disconnect - startup/idle (hr) | Time to travel between shore location and range, roundtrip (hr) | Time to prepare for shore connect - idle/shutdown (hr) | Time on Range (hr) | 0–3 nm from shore | 3–12 nm from Shore | >12 nm from Shore | Time to prepare for takeoff - startup/idle (hr) | Time to travel between shore location and range, roundtrip (hr) | Time for after landing activities - idle/shutdown (hr) | Time on Range (hr) | 0–3 nm from shore | 3–12 nm from Shore | >12 nm from Shore | Location | Current Activities | ALT 1 | ALT 2 | ALT 1 | ALT 2 |
| Unmanned Systems | Unmanned Surface Vehicle System Testing | 2.25 | 1.75 | 2.25 | 4 | 0% | 50% | 50% | 0.65 | 0.65 | 0.25 | 2 | 0% | 50% | 50% | MIRC | 0 | 1 | 1 | 1 | 1 |
| Acoustic and Oceanographic Science and Technology | Acoustic and Oceanographic Research | 2.25 | 1.75 | 2.25 | 8 | 0.0% | 62% | 38% | 0.65 | 0.65 | 0.25 | 8 | 0% | 62.0% | 38.0% | MIRC | 1 | 3 | 3 | 2 | 2 |

## Table D-3: Aircraft Emission Factors

| Aircraft | Engine Model | Engines (#) | Fuel Flow (lb/hr) /Engine | Fuel Flow (lb/hr) /Total | Fuel Flow (gal/hr) | Mode | CO | NOx | HC | VOC | SOx | PM | CO2 | CO | NOx | VOC | SOx | PM | CO2 | Source of Emissions Indices Information |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AH-1W | T700-GE-401C (2) | 2 | 425.1 | 850.2 | 127 | Cruise | 10.54 | 5.55 | 0.56 | 0.64 | 0.37 | 4.20 | 3216.27 | 8.96 | 4.72 | 0.55 | 0.31 | 3.57 | 2,734 | AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table ES-2 and Table 2. |
| AH-1W | T700-GE-401C (2) | 2 | 238.6 | 477 | 71 | Warm up | 22.49 | 4.29 | 0.98 | 1.13 | 0.37 | 4.20 | 3162.07 | 10.73 | 2.05 | 0.54 | 0.18 | 2.00 | 1,509 | AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table 1 |
| AH-1W | T700-GE-401C (2) | 2 | 393.2 | 786 | 117 | Taxi Out | 11.70 | 9.66 | 1.55 | 1.78 | 0.37 | 4.20 | 3213.08 | 9.20 | 7.60 | 1.40 | 0.29 | 3.30 | 2,527 | |
| AH-1W | T700-GE-401C (2) | | | | | Warm up/Taxi Out | | | | | | | | 19.93 | 9.64 | 1.94 | 0.47 | 5.31 | 4035.71 | AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table 1 |
| AH-1W | T700-GE-401C (2) | 2 | 393 | 786 | 117 | Taxi in | 11.70 | 5.37 | 0.57 | 0.66 | 0.37 | 4.20 | 3213.08 | 9.20 | 4.22 | 0.52 | 0.29 | 3.30 | 2,527 | AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table 1 |
| AH-1W | T700-GE-401C (2) | 2 | 164 | 328 | 49 | shut down | 39.81 | 3.28 | 2.54 | 2.92 | 0.37 | 4.20 | 3059.84 | 13.06 | 1.08 | 0.96 | 0.12 | 1.38 | 1,004 | AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table 1 |
| AH-1W | T700-GE-401C (2) | | | | | Taxi in/shut down | | | | | | | | 22.26 | 5.30 | 1.47 | 0.41 | 4.68 | 3530.39 | AESO MEMORANDUM REPORT NO. 9824 Revision C, November 2015, Table 1 |
| AV-8B | F402-RR-408 (1) | 1 | 6381 | 6381 | 952 | approach | 7.70 | 8.60 | 0.54 | 0.62 | 0.37 | 2.07 | 3144.00 | 49.13 | 54.88 | 3.96 | 2.36 | 13.21 | 20,062 | AESO Memorandum Report No. 9913 Revision F, February 2019, Table 1 |
| AV-8B | F402-RR-408 (1) | 1 | 1137 | 1137 | 170 | Start/Warm-up | 106.30 | 1.80 | 19.66 | 22.61 | 0.37 | 2.18 | 2919.00 | 120.86 | 2.05 | 25.71 | 0.42 | 2.48 | 3,319 | AESO Memorandum Report No. 9913 Revision F, February 2019, Table 1 |
| AV-8B | F402-RR-408 (1) | 1 | 1137 | 1137 | 170 | Taxi out | 106.30 | 1.80 | 19.66 | 22.61 | 0.37 | 2.18 | 2919.00 | 120.86 | 2.05 | 25.71 | 0.42 | 2.48 | 3,319 | AESO Memorandum Report No. 9913 Revision F, February 2019, Table 1 |
| AV-8B | F402-RR-408 (1) | | | | | Start/Warm-up Taxi out | | | | | | | | 241.73 | 4.09 | 51.41 | 0.84 | 4.96 | 6637.81 | AESO Memorandum Report No. 9913 Revision F, February 2019, Table 1 |
| AV-8B | F402-RR-408 (1) | 1 | 1137 | 1137 | 170 | On Runway | 106.30 | 1.80 | 19.66 | 22.61 | 0.37 | 2.18 | 2919.00 | 120.86 | 2.05 | 25.71 | 0.42 | 2.48 | 3,319 | AESO Memorandum Report No. 9913 Revision F, February 2019 |
| AV-8B | F402-RR-408 (1) | 1 | 1137 | 1137 | 170 | Taxi-in/Shut down | 106.30 | 1.80 | 19.66 | 22.61 | 0.37 | 2.18 | 2919.00 | 120.86 | 2.05 | 25.71 | 0.42 | 2.48 | 3,319 | AESO Memorandum Report No. 9913 Revision F, February 2019 |
| AV-8B | F402-RR-408 (1) | | | | | On Runway Taxi-in/Shut down | | | | | | | | 241.73 | 4.09 | 51.41 | 0.84 | 4.96 | 6637.81 | AESO Memorandum Report No. 9913 Revision F, February 2019 |
| C-130 F/R/T | T56-A-16 Turboprop | 4 | 1125 | 4500 | 672 | circle | 2.07 | 8.16 | 0.47 | 0.54 | 0.37 | 3.97 | 3213.00 | 9.32 | 36.72 | 2.43 | 1.67 | 17.87 | 14,459 | AESO Memorandum Report No. 2000-09D, December 2015. |
| CH-53 | T64-GE-415 (3) | 3 | 1488 | 4464 | 666 | Cruise | 2.13 | 8.08 | 0.15 | 0.17 | 0.37 | 2.21 | 3221.35 | 9.51 | 36.07 | 0.77 | 1.65 | 9.87 | 14,380 | AESO Memorandum Report No. 9822 Revision E, November 2015 |
| CH-53 | T64-GE-415 (3) | 3 | 269 | 807 | 120 | Start up | 74.33 | 2.12 | 28.25 | 32.49 | 0.37 | 2.21 | 3059.84 | 59.98 | 1.71 | 26.22 | 0.30 | 1.78 | 2,469 | AESO Memorandum Report No. 9822 Revision E, November 2015 |
| CH-53 | T64-GE-415 (3) | 3 | 607 | 1821 | 272 | Warm up | 15.83 | 3.93 | 8.79 | 10.11 | 0.37 | 2.21 | 3185.32 | 28.83 | 7.16 | 18.41 | 0.67 | 4.02 | 5,800 | AESO Memorandum Report No. 9822 Revision E, November 2015 |
| CH-53 | T64-GE-415 (3) | 3 | 695 | 2085 | 311 | Taxi out | 12.24 | 7.94 | 6.55 | 7.53 | 0.37 | 2.21 | 3197.49 | 25.52 | 16.55 | 15.71 | 0.77 | 4.61 | 6,667 | AESO Memorandum Report No. 9822 Revision E, November 2015 |
| CH-53 | T64-GE-415 (3) | | | | | Start/Warm up/Taxi out | | | | | | | | 114.33 | 25.42 | 60.33 | 1.74 | 10.42 | 14936.53 | AESO Memorandum Report No. 9822 Revision E, November 2015 |
| CH-53 | T64-GE-415 (3) | 3 | 695 | 2085 | 311 | Taxi in | 12.24 | 4.42 | 6.55 | 7.53 | 0.37 | 2.21 | 3197.49 | 25.52 | 9.22 | 15.71 | 0.77 | 4.61 | 6,667 | AESO Memorandum Report No. 9822 Revision E, November 2015 |
| CH-53 | T64-GE-415 (3) | 3 | 269 | 807 | 120 | shut down | 74.33 | 2.12 | 28.25 | 32.49 | 0.37 | 2.21 | 3059.84 | 59.98 | 1.71 | 26.22 | 0.30 | 1.78 | 2,469 | AESO Memorandum Report No. 9822 Revision E, November 2015 |
| CH-53 | T64-GE-415 (3) | | | | | Taxi in/shut down | | | | | | | | 85.50 | 10.93 | 41.92 | 1.07 | 6.39 | 9136.06 | AESO Memorandum Report No. 9822 Revision E, November 2015 |

| Aircraft | Engine Model | Engines (#) | Fuel Flow (lb/hr) /Engine | Fuel Flow (lb/hr) /Total | Fuel Flow (gal/hr) | Mode | CO | NOx | HC | VOC | SOx | PM | CO2 | CO | NOx | VOC | SOx | PM | CO2 | Source of Emissions Indices Information |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH-60 | T700-GE-401C | 2 | 600 | 1200 | 179 | Cruise | 6.25 | 6.40 | 0.55 | 0.63 | 0.37 | 4.20 | 3221.36 | 7.50 | 7.68 | 0.76 | 0.44 | 5.04 | 3,865 | AESO Memorandum Report No. 9929 Revision D December 2019 , Table ES-2, VOC = THC x 1.15 |
| CH-60 | T700-GE-401C | 2 | 273.93 | 548 | 82 | Start/Warm up | 18.65 | 4.60 | 0.77 | 0.89 | 0.37 | 4.20 | 3182.96 | 10.22 | 2.52 | 0.49 | 0.20 | 2.30 | 1,744 | AESO Memorandum Report No. 9929 Revision D December 2019 , Table 1, VOC = THC x 1.15 |
| CH-60 | T700-GE-401C | 2 | 308.11 | 616 | 92 | Taxi out | 16.01 | 4.85 | 0.66 | 0.76 | 0.37 | 2.20 | 3196.08 | 9.87 | 2.99 | 0.47 | 0.23 | 1.36 | 1,969 | AESO Memorandum Report No. 9929 Revision D December 2019 , Table 1, VOC = THC x 1.15 |
| CH-60 | T700-GE-401C | | | | | Start/Warm up/Taxi out | | | | | | | | 20.08 | 5.51 | 0.95 | 0.43 | 3.66 | 3713.30 | AESO Memorandum Report No. 9929 Revision D December 2019 , Table 1, VOC = THC x 1.15 |
| CH-60 | T700-GE-401C | 2 | 308.11 | 616 | 92 | Taxi in/shut down | 16.01 | 4.85 | 0.66 | 0.76 | 0.37 | 2.20 | 3196.08 | 9.87 | 2.99 | 0.47 | 0.23 | 1.36 | 1,969 | AESO Memorandum Report No. 9929 Revision D December 2019 , Table 1, VOC = THC x 1.15 |
| EA-18G | F414-GE-400 (2) | 2 | 5169 | 10338 | 1543 | approach | 0.72 | 14.75 | 0.12 | 0.14 | 0.37 | 6.56 | 3191.30 | 7.44 | 152.49 | 1.43 | 3.83 | 67.82 | 32,992 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| EA-18G | F414-GE-400 (2) | 2 | 695 | 1390 | 207 | Start/Warm-up | 98.18 | 3.18 | 65.33 | 75.13 | 0.37 | 12.64 | 2973.00 | 136.47 | 4.42 | 104.43 | 0.51 | 17.57 | 4,132 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| EA-18G | F414-GE-400 (2) | 2 | 695 | 1390 | 207 | Taxi Out | 98.18 | 3.18 | 65.33 | 75.13 | 0.37 | 12.64 | 2973.00 | 136.47 | 4.42 | 104.43 | 0.51 | 17.57 | 4,132 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| EA-18G | F414-GE-400 (2) | | | | | Start/Warm-up/Taxi Out | | | | | | | | 272.94 | 8.84 | 208.86 | 1.03 | 35.14 | 8264.94 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| EA-18G | F414-GE-400 (2) | 2 | 695 | 1390 | 207 | On Runway | 98.18 | 3.18 | 65.33 | 75.13 | 0.37 | 12.64 | 2973.00 | 136.47 | 4.42 | 104.43 | 0.51 | 17.57 | 4,132 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| EA-18G | F414-GE-400 (2) | 2 | 695 | 1390 | 207 | Taxi in | 98.18 | 3.18 | 65.33 | 75.13 | 0.37 | 12.64 | 2973.00 | 136.47 | 4.42 | 104.43 | 0.51 | 17.57 | 4,132 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| EA-18G | F414-GE-400 (2) | | | | | On Runway/Taxi in | | | | | | | | 272.94 | 8.84 | 208.86 | 1.03 | 35.14 | 8264.94 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| F-15E | F100-PW-229 (2) | 2 | 3098 | 6196 | 925 | approach | 1.17 | 15.08 | na | 0.24 | 0.37 | 0.70 | 3200.00 | 7.25 | 93.44 | 1.49 | 2.29 | 4.34 | 19,827 | Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants |
| F-15E | F100-PW-229 (2) | 2 | 1087 | 2174 | 324 | Idle (Taxi) | 10.17 | 3.80 | | 0.45 | 0.37 | 0.67 | | 22.11 | 8.26 | 0.98 | 0.80 | 1.46 | | Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants |
| F-16 | F100-PW-100 | 1 | 2765 | 2765 | 413 | approach | 3.99 | 12.52 | | 1.06 | 0.37 | 1.57 | | 11.03 | 34.62 | 2.93 | 1.02 | 4.34 | | Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants |
| F-16 | F100-PW-100 | 1 | 1127 | 1127 | 168 | Idle (Taxi) | 49.58 | 4.64 | | 3.79 | 0.37 | 3.13 | | 55.88 | 5.23 | 4.27 | 0.42 | 3.53 | | Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants |
| F-22 | F119-PW-100 | 2 | 2740 | 5480 | 818 | approach | 7.92 | 6.59 | | 0.05 | 0.37 | 1.96 | 3156.00 | 43.40 | 36.11 | 0.27 | 2.03 | 10.74 | 17,295 | AESO Memorandum Report No. 2020-08, July 2020 |
| F-22 | F119-PW-100 | 2 | 1377 | 2754 | 411 | Taxi/Idle out Taxi/Idle in | 48.15 | 3.01 | | 1.67 | 0.37 | 2.42 | 3156.00 | 132.61 | 8.29 | 4.60 | 1.02 | 6.66 | 8,692 | AESO Memorandum Report No. 2020-08, July 2020, Table 1 |
| FA-18E/F | F414-GE-400 (2) | 2 | 5169 | 10338 | 1543 | approach | 0.72 | 14.75 | 0.12 | 0.14 | 0.37 | 6.56 | 3191.30 | 7.44 | 152.49 | 1.43 | 3.83 | 67.82 | 32,992 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| FA-18E/F | F414-GE-400 (2) | 2 | 695 | 1390 | 207 | Warm up | 98.18 | 3.18 | 65.33 | 75.13 | 0.37 | 12.64 | 2973.00 | 136.47 | 4.42 | 104.43 | 0.51 | 17.57 | 4,132 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| FA-18E/F | F414-GE-400 (2) | 2 | 695 | 1390 | 207 | Taxi Out | 98.18 | 3.18 | 65.33 | 75.13 | 0.37 | 12.64 | 2973.00 | 136.47 | 4.42 | 104.43 | 0.51 | 17.57 | 4,132 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| FA-18E/F | F414-GE-400 (2) | | | | | Warm up /Taxi Out | | | | | | | | 272.94 | 8.84 | 208.86 | 1.03 | 35.14 | 8264.94 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| FA-18E/F | F414-GE-400 (2) | 2 | 695 | 1390 | 207 | On Runway | 98.18 | 3.18 | 65.33 | 75.13 | 0.37 | 12.64 | 2973.00 | 136.47 | 4.42 | 104.43 | 0.51 | 17.57 | 4,132 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| FA-18E/F | F414-GE-400 (2) | 2 | 695 | 1390 | 207 | Taxi in | 98.18 | 3.18 | 65.33 | 75.13 | 0.37 | 12.64 | 2973.00 | 136.47 | 4.42 | 104.43 | 0.51 | 17.57 | 4,132 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |
| FA-18E/F | F414-GE-400 (2) | | | | | On Runway/Taxi in | | | | | | | | 272.94 | 8.84 | 208.86 | 1.03 | 35.14 | 8264.94 | AESO Memorandum Report No. 9815 I, June 2017, Table 5 |

| Aircraft | Engine Model | Engines (#) | Fuel Flow (lb/hr) /Engine | Fuel Flow (lb/hr) /Total | Fuel Flow (gal/hr) | Mode | CO | NOx | HC | VOC | SOx | PM | CO2 | CO | NOx | VOC | SOx | PM | CO2 | Source of Emissions Indices Information |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-35 (surrogate) | F119-PW-100 | 1 | 2740 | 2740 | 409 | approach | 7.92 | 6.59 | | 0.05 | 0.37 | 1.96 | 3156.00 | 21.70 | 18.06 | 0.14 | 1.01 | 5.37 | 8,647 | AESO Memorandum Report No. 2020-08, July 2020 |
| F-35 (surrogate) | F119-PW-100 | 1 | 1377 | 1377 | 206 | Taxi/Idle out Taxi/Idle in | 48.15 | 3.01 | | 1.67 | 0.37 | 2.42 | 3156.00 | 66.30 | 4.14 | 2.30 | 0.51 | 3.33 | 4,346 | AESO Memorandum Report No. 2020-08, July 2020, Table 1 |
| KC-135 | J57-P-22 | 4 | 1693 | 6772 | 1011 | approach | 23.51 | 2.95 | | 14.26 | 0.37 | 5.32 | | 159.21 | 19.98 | 96.57 | 2.51 | 36.03 | | Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants |
| KC-135 | J57-P-22 | 4 | 1087 | 4348 | 649 | Taxi/Idle out Taxi/Idle in | 59.25 | 2.48 | | 59.03 | 0.37 | 7.64 | | 257.62 | 10.78 | 256.66 | 1.61 | 33.22 | | Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants |
| Learjet | TFE731-2-2B | 2 | 532 | 1064 | 159 | approach | 22.38 | 5.90 | 4.26 | 4.90 | 0.37 | 0.09 | 3200.00 | 23.81 | 6.28 | 5.21 | 0.39 | 0.10 | 3,405 | Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants |
| Learjet | TFE731-2-2B | 2 | 190 | 380 | 57 | Taxi/Idle Out | 58.600 | 2.820 | | 23.050 | 0.370 | 0.130 | | 22.27 | 1.07 | 8.76 | 0.14 | 0.05 | | Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants |
| Learjet | TFE731-2-2B | 2 | 190 | 380 | 57 | Taxi In/ shut down | 58.60 | 2.82 | | 23.05 | 0.37 | 0.13 | | 22.27 | 1.07 | 8.76 | 0.14 | 0.05 | | Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants |
| MV-22 | T406-AD-400 | 2 | 1910 | 3820 | 570 | Cruise | 0.52 | 14.09 | 0.01 | 0.01 | 0.37 | 1.57 | 3209.16 | 1.99 | 53.82 | 0.04 | 1.41 | 6.00 | 12,259 | AESO Memorandum Report No. 9946 Revision G May 2017, Table ES-2, VOC = THC x 1.16 x 1.15 |
| MV-22 | T406-AD-400 | 2 | 360 | 720 | 107 | Start/Warm up | 8.90 | 4.09 | 0.10 | 0.12 | 0.37 | 1.57 | 3221.00 | 6.41 | 2.94 | 0.08 | 0.27 | 1.13 | 2,319 | AESO Memorandum Report No. 9946 Revision G May 2017, Table 2, VOC = THC x 1.16 x 1.15 |
| MV-22 | T406-AD-400 | 2 | 360 | 720 | 107 | Cool/Shut down | 8.90 | 4.09 | 0.10 | 0.12 | 0.37 | 1.57 | 3221.00 | 6.41 | 2.94 | 0.08 | 0.27 | 1.13 | 2,319 | AESO Memorandum Report No. 9946 Revision G May 2017, Table 2, VOC = THC x 1.16 x 1.15 |
| MQ-4C | AE3007H | 1 | 929 | 929 | 139 | Approach | 3.28 | 7.79 | | 0.74 | 0.37 | 0.07 | | 3.05 | 7.24 | 0.69 | 0.34 | 0.07 | | Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants |
| MQ-4C (Idle) | AE3007H | 1 | 389 | 389 | 58 | Idle | 17.35 | 3.83 | | 2.89 | 0.37 | 0.05 | | 6.75 | 1.49 | 1.12 | 0.14 | 0.02 | | Air Emissions Guide for Air Force Mobile Source, June 2024. Table 2-9. Aircraft Engine Emission Factors for Criteria Pollutants |
| P-8 MMA | Boeing 737-800 Series CFM56-7B27 | 2 | 2770 | 5540 | 827 | approach | 1.41 | 11.00 | 0.10 | 0.12 | 0.37 | 0.09 | 3161.00 | 7.81 | 60.94 | 0.64 | 2.05 | 0.49 | 17,512 | AESO Memorandum Report No. 2017-09, April 2017 |
| P-8 MMA | Boeing 737-800 Series CFM56-7B27 | 2 | 921 | 1842 | 275 | Warm up | 17.90 | 4.80 | 1.70 | 1.96 | 0.37 | 0.07 | 3161.00 | 32.97 | 8.84 | 3.60 | 0.68 | 0.13 | 5,823 | AESO Memorandum Report No. 2017-09, April 2017 |
| P-8 MMA | Boeing 737-800 Series CFM56-7B27 | 2 | 921 | 1842 | 275 | Taxi Out | 17.90 | 4.80 | 1.70 | 1.96 | 0.37 | 0.07 | 3161.00 | 32.97 | 8.84 | 3.60 | 0.68 | 0.13 | 5,823 | AESO Memorandum Report No. 2017-09, April 2017 |
| P-8 MMA | Boeing 737-800 Series CFM56-7B27 | | | | | Warm up /Taxi Out | | | | | | | | 65.94 | 17.68 | 7.20 | 1.36 | 0.25 | 11645.12 | AESO Memorandum Report No. 2017-09, April 2017 |
| P-8 MMA | Boeing 737-800 Series CFM56-7B27 | 2 | 4946 | 9892 | 1476 | On Runway | 0.53 | 4.80 | 0.08 | 0.09 | 0.37 | 0.163 | 3161.00 | 5.24 | 47.48 | 0.91 | 3.66 | 1.61 | 31,269 | AESO Memorandum Report No. 2017-09, April 2017 |
| P-8 MMA | Boeing 737-800 Series CFM56-7B27 | 2 | 921 | 1842 | 275 | Taxi in | 17.90 | 15.94 | 1.70 | 1.96 | 0.37 | 0.068 | 3161.00 | 32.97 | 29.36 | 3.60 | 0.68 | 0.13 | 5,823 | AESO Memorandum Report No. 2017-09, April 2017 |
| P-8 MMA | Boeing 737-800 Series CFM56-7B27 | | | | | On Runway/Taxi in | | | | | | | | 38.21 | 76.84 | 4.51 | 4.34 | 1.74 | 37091.17 | AESO Memorandum Report No. 2017-09, April 2017 |
| SH-60 | T700-GE-401C (2) | 2 | 600 | 1200 | 179 | Cruise | 6.25 | 6.40 | 0.55 | 0.63 | 0.37 | 4.20 | 3221.36 | 7.50 | 7.68 | 0.76 | 0.44 | 5.04 | 3,866 | AESO Memorandum Report No. 9929, Revision B, January |
| SH-60 | T700-GE-401C | 2 | 273.93 | 548 | 82 | Start/Warm up | 18.65 | 4.60 | 0.77 | 0.89 | 0.37 | 4.20 | 3182.96 | 10.22 | 2.52 | 0.49 | 0.20 | 2.30 | 1,744 | AESO Memorandum Report No. 9929 Revision D |
| SH-60 | T700-GE-401C | 2 | 308.11 | 616 | 92 | Taxi out | 16.01 | 4.85 | 0.66 | 0.76 | 0.37 | 4.20 | 3196.08 | 9.87 | 2.99 | 0.47 | 0.23 | 2.59 | 1,969 | AESO Memorandum Report No. 9929 Revision D |
| SH-60 | T700-GE-401C | | | | | Start/Warm up/Taxi out | | | | | | | | 20.08 | 5.51 | 0.95 | 0.43 | 4.89 | 3713.30 | AESO Memorandum Report No. 9929 Revision D December 2019 , Table 1, VOC = THC x 1.15 |
| SH-60 | T700-GE-401C (2) | 2 | 308 | 616 | 92 | Taxi in/shut down | 16.01 | 4.85 | 0.66 | 0.76 | 0.37 | 4.20 | 3196.08 | 9.87 | 2.99 | 0.47 | 0.23 | 2.59 | 1,969 | AESO Memorandum Report No. 9929 Revision D, December 2019 ,Table 1, VOC = THC x 1.15 |

| | | | | | | | Emissions (lb/op) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Engines (#) | Fuel Flow (lb/op) | | Fuel Flow (gal/op) | Mode | CO | NOx | HC | VOC | SOx | PM | CO2 | Source of Emissions Indices Information |
| F-35 | F135-PW-400 | 1 | 1057 | | 158 | Military Takeoff | 12.09 | 8.42 | 0.02 | 0.02 | 0.39 | 0.13 | 3336.76 | AESO Memorandum Report No. 2017-18 Revision A, December 2017, Table 1, F-35C Variant |
| F-35 | F135-PW-400 | 1 | 1220 | | 182 | Straight In Arrival | 13.52 | 6.43 | 0.02 | 0.023 | 0.45 | 0.15 | 3849.45 | AESO Memorandum Report No. 2017-18 Revision A, December 2017, Table 1, F-35C Variant |
| F-35 | F135-PW-400 | 1 | 629 | | 94 | Touch and Go - Carrier Pattern | 0.47 | 9.96 | 0.003 | 0.003 | 0.23 | 0.08 | 1986.01 | AESO Memorandum Report No. 2017-18 Revision A, December 2017, Table 1, F-35C Variant |
| | | | | | | Sum | 26.08 | 24.81 | 0.04 | 0.05 | 1.07 | 0.36 | 9172.22 | |

## Table D-4: Vessel Emission Factors

| Vessel | | VESSEL SPECIFICATIONS | | | | EMISSIONS FACTORS (LB/HR) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Propulsion | Output (HP) | No. | Max Power (HP) | CO | NOx | HC | SOx | SOx Adjusted for JP-5 | PM10 | PM2.5 | CO2 | Fuel Consumption at Speed (gal/hr) | CO2, LB/HR | Reference for Fuel Consumption Rate |
| Cruiser | CG-72 Underway | GE LM 2500 | 21,500 | 4 | 86,000 | 61.51 | 79.58 | 4.32 | 0.23 | 2.80 | 0.997 | 0.997 | 24,188 | 1159.20 | 24,188 | Fuel flow rate calculated based on the SOx emission |
| | CG- 72 RW | | | | | 27.73 | 285.54 | 2.46 | 0.47 | 5.64 | 4.38 | 4.38 | 69,839 | 2338.31 | 69,839 | |
| | CG- 72 Not Underway | | | | | 1.54 | 10.05 | 0.28 | 0.02 | 0.18 | 0.10 | 0.10 | 3,057 | 74.63 | 3,057 | |
| Destroyer | DDG-100 Underway | GE LM 2500 | 21,500 | 4 | 86,000 | 59.72 | 114.52 | 4.01 | 0.27 | 3.19 | 0.14 | 0.14 | 27,565 | 1323.38 | 27,565 | Fuel flow rate calculated based on the SOx emission |
| | DDG-100 - RW | | | | | 30.57 | 374.80 | 2.39 | 0.58 | 6.90 | 0.54 | 0.54 | 85,141 | 2860.70 | 85,141 | |
| | DDG-100 Not Underway | | | | | 0.36 | 25.65 | 0.04 | 0.02 | 0.22 | 0.12 | 0.12 | 3,669 | 89.55 | 3,669 | |
| T-AOE | T-AOE-6 Underway | GE LM 2500 | 26,250 | 4 | 105,000 | 109.76 | 311.31 | 10.60 | 0.36 | 4.32 | 3.43 | 3.43 | 67,945 | 1791.04 | 67,945 | Fuel flow rate calculated based on the SOx emission factor |
| | T-AOE- - RW | | | | | 35.08 | 445.24 | 5.85 | 0.57 | 6.88 | 5.32 | 5.32 | 81,478 | 2850.75 | 81,478 | |
| | T-AOE-6 Not Underway | | | | | 2.61 | 60.87 | 1.77 | 0.02 | 0.20 | 0.10 | 0.10 | 1,838 | 84.58 | 1,838 | |
| USCG Cutter WHEC715, 378 feet - Hamilton Class | USCG | Fairbanks Morse T88-1-8, 3,600 hp | 3600 | 2 | 7200 | 5.74 | 57.91 | 0.88 | 0.078 | 0.94 | 0.21 | 0.21 | 8,354 | 371.13 | 8,354 | Fuel flow rate calculated based on the SOx emission factor |
| Amphibious Assault Ship - Tarawa | LHA-6 Underway | Steam Combustion Engineering | | 3 | | 8.38 | 277.87 | 14.48 | 0.29 | 3.43 | 4.94 | 4.94 | 35,922 | 1422.89 | 35922.08 | |
| | LHA-6 -RW | | | | | 18.73 | 199.99 | 15.15 | 0.21 | 2.46 | 3.38 | 3.38 | 28,059 | 1019.90 | 28059.16 | |
| | LHA-6 Not Underway | | | | | 5.38 | 243.95 | 7.51 | 0.27 | 3.24 | 4.94 | 4.94 | 33,863 | 1343.28 | 33863.00 | |
| Landing Helicopter Dock | LHD-2 Underway | ALCO 16-251C | 2,800 | 2 | 5,600 | 8.08 | 47.83 | 5.77 | 0.41 | 4.87 | 28.58 | 28.58 | 47,633 | 2019.90 | 47,633 | Fuel flow rate calculated based on the SOx emission factor |
| | LHD-2 - RW | | | | | 7.66 | 45.12 | 5.72 | 0.41 | 4.86 | 28.55 | 28.55 | 47,490 | 2014.93 | 47,490 | |
| | LHD-2 Not Underway | | | | | 2.93 | 16.25 | 2.20 | 0.16 | 1.87 | 10.98 | 10.98 | 18,261 | 776.12 | 18,261 | |

| Vessel | | VESSEL SPECIFICATIONS | | | | EMISSIONS FACTORS (LB/HR) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Propulsion | Output (HP) | No. | Max Power (HP) | CO | NOx | HC | SOx | SOx Adjusted for JP-5 | PM10 | PM2.5 | CO2 | Fuel Consumption at Speed (gal/hr) | CO2, LB/HR | Reference for Fuel Consumption Rate |
| Amphibious Transport Dock | LPD-17 Underway | turbocharged marine Colt-Pielstick Diesels | | | 41,600 | 31.61 | 272.28 | 16.86 | 0.16 | 1.92 | 1.36 | 1.36 | 16,767.15 | 796.02 | 16767.15 | Navy database |
| | LPD-17 - RW | | | | | 28.08 | 263.75 | 14.95 | 0.14 | 1.69 | 1.12 | 1.12 | 15,025.58 | 701.49 | 15025.58 | |
| | LPD-17 Not Underway | | | | | 2.57 | 31.80 | 1.74 | 0.02 | 0.20 | 0.10 | 0.10 | 1,814.00 | 84.58 | 1814.00 | |
| Landing Craft, Air Cushion | LCAC-91 | TF40B | 3955 | 4 | | 18.32 | 114.54 | 3.49 | 0.16 | 1.97 | 2.33 | 2.33 | 20,693.35 | 815.92 | 20693.35 | Navy database |
| Mine Counter Measures | MCM -14 | ID36SS6V-AM(M) | 600 | 4 | 2400 | 3.49 | 28.97 | 2.61 | 0.02 | 0.18 | 0.33 | 0.33 | 1,781 | 74.63 | 1,781 | Fuel flow rate calculated based on the SOx emission |
| | MCM - RW | | | | | 4.17 | 35.05 | 3.35 | 0.02 | 0.22 | 0.36 | 0.36 | 2,174 | 89.55 | 2,174 | |
| | MCM Not Underway | | | | | 0.59 | 5.09 | 0.63 | 0.00 | 0.04 | 0.06 | 0.06 | 378 | 14.93 | 378 | Fuel flow rate calculated based on the SOx emission factor |
| Landing Craft Utility | LCU | 12V-71 7122-7000 | 425 | 2 | | 5.06 | 15.704 | 1.274 | 0.01 | 0.11 | 0.604 | 0.60 | 923.57 | 44.78 | 923.57 | |
| | AAV-2 (used for ACV) | 400 hp | | | | 0.76 | 6.22 | 0.82 | 0.01 | 0.16 | 0.26 | 0.25 | 1389.56 | 67.00 | 1389.56 | Sox emission factor, in lb/hr, was calculated based on the fuel flow rate and ULS fuel sulfur content. |
| | PC-14 | | | | | 37.357 | 74.18 | 6.02 | 0.07 | 0.84 | 1.397 | 1.36 | 7676.62 | 348.26 | 7676.62 | |
| | PC-14-RW | | | | | 43.153 | 78.36 | 7.22 | 0.08 | 0.90 | 1.466 | 1.42 | 8054.32 | 373.13 | 8054.32 | |
| | PB | | | | | 42.417 | 81.81 | 1.88 | 0.05 | 0.64 | 3.327 | 3.23 | 6172.34 | 263.68 | 6172.34 | |
| | MK V-2 | 2,285 hp | | | | 3.86 | 29.49 | 0.99 | 4.73 | 56.76 | 0.40 | 0.40 | | 23532.34 | 14 | |
| Rigid Inflatable Boat | RIB-4 | QSB5.9M TIER 2 | 230 | 1 | 230 | 1.88 | 2.677 | 0.062 | 0.00 | 0.02 | 0.047 | 0.047 | 265.182 | 9.95 | 265.18 | Navy database |
| | CRRC-5 | | | | | 0.2242 | 0.9538 | 0.0128 | 0.00 | 0.01 | 0.0289 | 0.03 | 87.23 | 2.49 | 87.23 | Atlantic Fleet Training and Testing Final EIS/OEIS, September 2018 |
| | AE-2 | | | | | 20.17 | 20.93 | 0.99 | 5.97 | 71.64 | 1.57 | 1.57 | | 29701.49 | | |
| | LCS -1 Underway | Rolls-Royce MT30 36 | 48000 | 2 | 96000 | 46.14 | 186.77 | 3.19 | 0.21 | 2.54 | 0.41 | 0.41 | 25,512 | 1054.73 | 25,512 | Fuel flow rate calculated based on the SOx emission factor |
| | LCS - RW | | | | | 79.12 | 152.60 | 6.12 | 0.10 | 1.19 | 0.62 | 0.62 | 11,116 | 492.54 | 11,116 | |
| | LCS -1 Not Underway | | | | | 4.59 | 8.86 | 0.20 | 0.01 | 0.07 | 0.36 | 0.36 | 647 | 29.85 | 647 | |

| Vessel | | VESSEL SPECIFICATIONS | | | | EMISSIONS FACTORS (LB/HR) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Propulsion | Output (HP) | No. | Max Power (HP) | CO | NOx | HC | SOx | SOx Adjusted for JP-5 | PM10 | PM2.5 | CO2 | Fuel Consumption at Speed (gal/hr) | CO2, LB/HR | Reference for Fuel Consumption Rate |
| | LSD-52 Underway | | | | | 21.25 | 334.51 | 10.84 | 0.11 | 1.26 | 0.91 | 0.91 | 16263.96 | 522.39 | 16,264 | |
| | LSD-52-RW | | | | | 40.02 | 604.28 | 20.43 | 0.19 | 2.33 | 1.68 | 1.68 | 21,126 | 965.17 | 21,126 | |
| | LSD-52 Not Underway | | | | | 1.27 | 39.79 | 0.85 | 0.01 | 0.12 | 0.09 | 0.09 | 1,407 | 49.75 | 1,407 | |
| | SSN Underway | | | | | 3.24 | 2.39 | 0.17 | 0.00 | 0.01 | 0.01 | 0.01 | 112.62 | 4.98 | 112.62 | |
| | SSN - RW | | | | | 0.32 | 0.23 | 0.02 | 0.00 | 0.01 | 0.001 | 0.00 | 11.06 | 4.98 | 11.06 | |
| | SSN Not Underway | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | CVN-74 Underway | | | | | 1.23 | 16.73 | 0.31 | 0.01 | 0.07 | 0.05 | 0.05 | 683.62 | 29.85 | 683.62 | Fuel flow rate calculated based on the SOx emission |
| | CVN - RW | | | | | 0.12 | 1.65 | 0.03 | 0.00 | 0.01 | 0.005 | 0.005 | 67.61 | 4.98 | 67.61 | |
| | CVN-74 Not Underway | | | | | 0.03 | 0.41 | 0.01 | 0.00 | 0.00 | 0.06 | 0.06 | 17.00 | 0.000 | 17.00 | Fuel flow rate calculated based on the SOx emission |

Notes:

1. Navy and MSC Marine Engine Fuel Consumption & Emission Calculator was used to update the emission factors.
2. All $SO_x$ emission factors are based on F-76 (Marine Diesel) with a sulfur content of 0.0015%.
3. RW = Restricted Waters

| | | |
|---|---|---|
| Typical JP-5 sulfur content | 0.018% | Source: AESO Memorandum Report No. 2012-01 Revision H, Table 1 |
| Adjust ment for sulfur conten | 12 | |
| Average brake specific fuel | 7000 | btu/hp |
| diesel heating value | 19,400 | btu/lb |
| Average brake specific fuel consumption | 0.36 | lb/hp |
| Average diesel density | 7.00 | lb/gal |
| Average brake specific fuel consumption | 0.052 | gal/hp |
| Diesel Sulfur Content | 0.0015% | |

# Table D-5: Munitions Emission Factors

| Munitions Information | | | | | | Emission Factor (lb/item) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Munition Type | Munition | Component | Net Explosive Weight (lb NEW) | Reference | Emission Factor Assumptions and Comments | CO | $NO_x$ | VOC | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $CO_2$ |
| **BOMB** | MK82 INERT | spotting charge | 3 | Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018 | Assume Spotting Charge | 0.26 | | | | | | |
| **BOMB** | MK82 HE | | | Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018 | Calculate for 192 lb of PEP. 80% TNT, 20% Aluminum; TNT EF x 80% used; Data available in TR-83-240. | 60.00 | | | | | | |
| **BOMB** | MK84 | | | MITT Phase III | | 140.00 | | | | | | |
| **C4** | | | 1 | Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018 | | 0.02625 | 0.007875 | | 0.02625 | 0.01875 | | |
| **LRG PROJ** | 155MM ILL | | 6 | AP-42 Chapter 15, Table 15.4.1-1 EMISSION FACTORS FOR THE USE OF DODIC D505, M485A2 155-MM ILLUMINATION ROUND (PROJECTILE) | | 0.026 | 0.094 | 0.0015 | 3 | | 0.0027 | 1.8 |
| **LRG PROJ** | 5.56 | | | | | 1.60E-03 | 8.50E-05 | | 3.90E-05 | 2.80E-05 | | 8.70E-04 |
| **MED PROJ** | 30MM | | 0.03 | AP 42, Chapter 15, Table 15.2.1-1 EMISSION FACTORS FOR THE USE OF DODIC B129, M789 30-MM HIGH EXPLOSIVE DUAL PURPOSE | | 0.00086 | 0.0002 | | 0.0039 | 0.0025 | 0 | 0.0044 |
| **SML PROJ** | 7.62 | | | | | 2.30E-03 | 9.70E-05 | | 5.10E-05 | 3.80E-05 | | 1.20E-03 |
| **SMOKE POT** | ABC-M5 30-POUND HC SMOKE POT | | 1.10 | AP 42, Chapter 15, Table 15.7.6-1, EMISSION FACTORS FOR THE USE OF DODIC K866, ABC-M5 30-POUND HC SMOKE POT | Net Explosive Weight for Smokey Sam is from Hazard Classification of United States Military Explosives and Munitions, Revision 15, June 2012 | 0.0275 | 0.0000924 | 0.000594 | 1.1 | 0.616 | 0.000154 | 0.0165 |
| **MISSILE** | AIM-7 | Fired well above 3,000 ft | | Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018 | | | | | | | | |
| **MISSILE** | AGM-84 | | 215 | AP 42, Chapter 15, Table 15.9.1-1, DODIC M023, M112 Demolition Block Charge | Assume similar to C-4 emissions. Net Explosive Weight for AGM -84 is from Hazard Classification of United States Military Explosives and Munitions, Revision 15, June 2012 | 4.515 | 1.3545 | | 4.515 | 3.225 | 0.0258 | 135.45 |
| **MISSILE** | AGM-114B | | | | | 0.7224 | 0.21672 | 0 | 0.7224 | 0.516 | 0.004128 | |
| **MISSILE** | AGM-65 Maverick | | | | | 2.1 | 0.63 | 0 | 2.1 | 1.5 | 0.012 | |
| **MISSILE** | AGM-84 | | | | | 4.515 | 1.3545 | 0 | 4.515 | 3.225 | 0.0258 | |
| **MISSILE** | AGM-88 HARM | | | | | 1.008 | 0.3024 | 0 | 1.008 | 0.72 | 0.00576 | |
| **MISSILE** | SM-3 | | | | | 630 | | | 1200 | 1200 | | 69.6 |
| **Rocket** | 2.75" RKT HE | warhead | | Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018 | | 0.93 | 0.0056 | | 0.4 | 0.29 | | 5.5 |
| **Rocket** | 2.75" RKT Inert | INERT Warhead | Neg. | Hawaii-Southern California Training and Testing Final EIS/OEIS, October 2018 | | Negligible emissions | | | | | | |
| **TORPEDO** | MK30 | No emissions | | | | | | | | | | |
| | MK46 | No emissions | | | | | | | | | | |
| | MK54 | No emissions | | | | | | | | | | |

# Table D-6: ALT 1 – Summary of Emission Changes

**Total Change in Annual Emissions for At-Sea and FDM Training and Testing Activities, Alternative 1**

| Source | Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -71.10 | 181.61 | -54.46 | 5.30 | 20.88 | 20.88 |
| Vessel | 72.36 | 324.73 | 16.95 | 6.01 | 10.95 | 10.92 |
| Munitions | -52.07 | -0.02 | 0.00 | 0.00 | -0.17 | -0.12 |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.000496 | 0.000192 | 0.0004 | 0.0004 |
| Total Change in Emissions, TPY | -50.79 | 506.35 | -37.51 | 11.31 | 31.66 | 31.68 |

**Change in Annual Emissions for Training and Testing Activities Within 3 Nautical Miles, Guam, Alternative 1**

| Source | Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -19.80 | 45.97 | -1.78 | 1.31 | 8.01 | 8.01 |
| Vessel | 24.42 | 171.64 | 9.17 | 2.86 | 7.18 | 7.16 |
| Munitions | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.0005 | 0.0002 | 0.0004 | 0.0004 |
| Total Change in Emissions, TPY | 4.64 | 217.64 | 7.39 | 4.17 | 15.20 | 15.18 |
| *de minimis* threshold | N/A | N/A | N/A | 100 | N/A | N/A |
| **Exceeds threshold?** | **No** | **No** | **No** | **No** | **No** | **No** |

**Change in Annual Emissions for At-Sea and FDM Training and Testing Activities Within 12 Nautical Miles, Alternative 1**

| Source | Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -455.80 | 172.66 | -317.19 | 3.94 | -22.15 | -22.15 |
| Vessel | 5.73 | 226.41 | 13.99 | 2.64 | 12.42 | 12.40 |
| Munitions | | | | | | |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.0005 | 0.0002 | 0.0004 | 0.0004 |
| Total Change in Emissions, TPY | -450.06 | 399.09 | -303.19 | 6.57 | -9.73 | -9.75 |

**Change in Annual Emissions for At-Sea and FDM Training and Testing Activities Greater Than 12 Nautical Miles, Alternative 1**

| Source | Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | 384.70 | 8.96 | 262.73 | 1.36 | 43.04 | 43.04 |
| Vessel | 66.64 | 98.32 | 2.96 | 3.37 | -1.48 | -1.48 |
| Munitions | -52.07 | -0.02 | 0.00 | 0.00 | -0.17 | -0.12 |
| Range Modernization and Sustainment | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Change in Emissions, TPY | 399.3 | 107.3 | 265.7 | 4.7 | 41.4 | 41.4 |

# Table D-7: ALT 2 – Summary of Emission Changes

**Total Change in Annual Emissions for At-Sea and FDM Training and Testing Activities, Alternative 2**

| Source | Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -71.10 | 181.61 | -54.46 | 5.30 | 20.88 | 20.88 |
| Vessel | 72.36 | 324.73 | 16.95 | 6.01 | 10.95 | 10.92 |
| Munitions | -48.76 | -0.01 | 0.00 | 0.00 | 0.05 | 0.04 |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.000496 | 0.000192 | 0.0004 | 0.0004 |
| Total Change in Emissions, TPY | -47.48 | 506.36 | -37.51 | 11.31 | 31.88 | 31.84 |

**Change in Annual Emissions for Training and Testing Activities Within 3 Nautical Miles, Guam, Alternative 2**

| Source | Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -19.80 | 45.97 | -1.78 | 1.31 | 8.01 | 8.01 |
| Vessel | 24.42 | 171.64 | 9.17 | 2.86 | 7.18 | 7.16 |
| Munitions | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.0005 | 0.0002 | 0.0004 | 0.0004 |
| Total Change in Emissions, TPY | 4.64 | 217.64 | 7.39 | 4.17 | 15.20 | 15.18 |
| *de minimis* threshold | N/A | N/A | N/A | 100 | N/A | N/A |
| **Exceeds threshold?** | **No** | **No** | **No** | **No** | **No** | **No** |

**Change in Annual Emissions for At-Sea and FDM Training and Testing Activities Within 12 Nautical Miles, Alternative 2**

| Source | Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | -455.80 | 172.66 | -317.19 | 3.94 | -22.15 | -22.15 |
| Vessel | 5.73 | 226.41 | 13.99 | 2.64 | 12.42 | 12.40 |
| Munitions | | | | | | |
| Range Modernization and Sustainment | 0.015 | 0.021 | 0.0005 | 0.0002 | 0.0004 | 0.0004 |
| Total Change in Emissions, TPY | -450.06 | 399.09 | -303.19 | 6.57 | -9.73 | -9.75 |

**Change in Annual Emissions for At-Sea and FDM Training and Testing Activities Greater Than 12 Nautical Miles, Alternative 2**

| Source | Emissions by Air Pollutant (TPY) | | | | | |
|---|---|---|---|---|---|---|
| | CO | $NO_X$ | VOC | $SO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| Aircraft | 384.70 | 8.96 | 262.73 | 1.36 | 43.04 | 43.04 |
| Vessel | 66.64 | 98.32 | 2.96 | 3.37 | -1.48 | -1.48 |
| Munitions | -48.76 | -0.01 | 0.00 | 0.00 | 0.05 | 0.04 |
| Range Modernization and Sustainment | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Change in Emissions, TPY | 402.6 | 107.3 | 265.7 | 4.7 | 41.6 | 41.6 |

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**ATTACHMENT**

## Record of Non-Applicability for Clean Air Act Conformity

The Proposed Action falls under the Record of Non-Applicability (RONA) category and is documented with this RONA.

**Introduction**

The United States Environmental Protection Agency (USEPA) published Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule, in November 30, 1993, Federal Register (40 Code of Federal Regulations [CFR] Parts 6, 51, and 93). On April 5, 2010, the USEPA finalized revisions to the General Conformity Rule (75 Federal Register 17253–17279).

Federal regulations state that "no department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve any activity that does not conform to an applicable State Implementation Plan." It is the responsibility of the federal agency to determine whether a federal action conforms to the applicable State Implementation Plan before the action is taken (40 CFR Part 51.850[a]).

Federal actions may be exempt from conformity determinations if their emissions do not exceed designated *de minimis* levels for the criteria pollutants of nonattainment or maintenance in the areas of the federal action (40 CFR Part 51.853[b]).

**Proposed Action**

Action Proponent: Department of the Navy (Navy)

Proposed Action Name: Mariana Islands Training and Testing (MITT) Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (SEIS/OEIS)

Date RONA Prepared: January 23, 2026

RONA Prepared by: ManTech International

Proposed Action and Emissions Summary:

The U.S. Department of the Navy (including both the Navy and the U.S. Marine Corps), as the lead agency, jointly with the U.S. Coast Guard, the Army, and the U.S. Air Force, proposes to continue to conduct training activities (hereinafter referred to as "training"); research, development, testing, and evaluation activities (hereinafter referred to as "testing"); and modernization and sustainment of ranges in the MITT Study area. This analysis is a supplement to the 2015 EIS/OEIS and Record of Decision (ROD) and the 2020 SEIS/OEIS and ROD, pursuant to the guidance of 40 CFR section 1502.9(c) (2019). A General Conformity Evaluation is triggered for the Proposed Action because some of the proposed activities occur within the Guam nonattainment areas for the sulfur dioxide ($SO_2$) National Ambient Air Quality Standards. Table 1 presents the estimated emissions within these areas for Alternative 1 (Preferred Alternative) and compares the emissions to the applicable General Conformity Rule *de minimis* threshold. As shown, the total emissions are well below all applicable thresholds. As such, a conformity determination is not required for the Proposed Action.

**Table 1: Estimated Increase in Emissions within the Guam $SO_2$ Nonattainment Areas[1]**

| Source | $SO_X$[1] Emissions Increase (TPY) |
|---|---|
| Aircraft | 1.31 |
| Vessel | 2.86 |
| Munitions | 0.00 |
| Range Modernization and Sustainment | <0.001 |
| Total Change in Emissions, TPY | 4.17 |
| *de minimis* threshold | 100 |
| **Exceeds threshold?** | **No** |

[1] Sulfur oxides ($SO_x$) are a broader category that includes sulfur dioxide ($SO_2$) and other sulfur-oxygen compounds. For this analysis, the *de minimis level for* $SO_2$ is conservatively compared to $SO_x$ emissions.

**Proposed Action Exemptions**

The Proposed Action is exempt from the General Conformity Rule requirements, based on the determination that the emissions are well below the *de minimis* level for all applicable pollutants.

**Emissions Evaluation Conclusion**

The Department of the Navy concludes the *de minimis* level for $SO_2$ would not be exceeded as a result of implementing the Proposed Action. The emissions data supporting that conclusion are shown in Table 1. The calculations, methodology, data, and references are contained in the Air Quality Impact Study presented in Appendix D of the SEIS/OEIS. Therefore, the Department of Navy concludes that further formal Conformity Determination procedures are not required, resulting in this RONA.

**RONA Approval**

Signature:_____

Name / Rank:_____

Date:_____

Position:_____

# Appendix E Description of Range and Systems

# Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Mariana Islands Training and Testing

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There are no tables in this appendix.

# APPENDIX E DESCRIPTION OF RANGE AND SYSTEMS

The Action Proponents have been conducting military readiness activities throughout the in-water areas around the Mariana Islands and off the coasts of Guam and the Commonwealth of the Northern Mariana Islands for decades. The tempo and types of training and testing activities have fluctuated within the Mariana Islands Training and Testing (MITT) Study Area (Study Area) due to changing requirements, the introduction of new technologies, the dynamic nature of international activities, advances in warfighting doctrine and procedures, and force structure changes. Such developments have influenced the frequency, duration, intensity, and location of required training and testing.

## E.1 Description of the Mariana Islands Training and Testing Study Area

The Study Area includes the at-sea and Farallon de Medinilla (FDM) components of the Mariana Islands Range Complex (MIRC), the additional areas on the high seas north and west of the MIRC in the Pacific Ocean and Philippine Sea, a transit corridor between the MIRC and the Hawaii Range Complex, and pierside and harbor locations on Guam and Apra Harbor. The transit corridor is a direct route in established shipping lanes across the high seas for Navy ships transiting between the MIRC and the Hawaii Range Complex. As was done in the 2020 Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (SEIS/OEIS), the only land component associated with the Proposed Action for this Draft SEIS/OEIS is FDM. For more information on the MITT Study Area, see Section 2.1 in the previous MITT analyses.

### E.1.1 Description of the Mariana Islands Range Complex

The MIRC includes ocean surface and subsurface areas, special use airspace (SUA), and land training areas (only FDM is considered in this analysis). These areas extend from the waters south of Guam to north of Pagan (Commonwealth of Northern Mariana Islands), and from the Pacific Ocean east of the Mariana Islands to the Philippine Sea to the west, encompassing 501,873 square nautical miles ($NM^2$) of open ocean (Figure 1.1-1).

#### E.1.1.1 Special Use Airspace and Air Traffic Controlled Assigned Airspace

The MIRC includes approximately 40,000 $NM^2$ of SUA (airspace of defined dimensions where activities must be confined because of their nature, or where limitations may be imposed upon aircraft operations that are not part of those activities) (Federal Aviation Administration, 2024). The MIRC features restricted areas, military operations areas, and warning areas. As depicted in Figure E-1, the airspace is almost entirely over the ocean and includes the following:

- Warning Areas (W) W-517 and W-12 (approximately 11,800 $NM^2$ of SUA, Figure 2.1-1), W-11 (A/B) (approximately 10,500 $NM^2$ of SUA), and W-13 (A/B/C) (approximately 18,000 $NM^2$ of SUA).
- Restricted Area Airspace (R) over or near land areas within the MIRC includes approximately 2,463 $NM^2$ of SUA and is comprised of restricted areas R-7201 and R-7201A, which extends in a 3- and 12-nautical-mile (NM) radius, respectively, around FDM (Figure E-2).

#### E.1.1.2 Sea and Undersea Space

The MIRC includes the sea and undersea space from the ocean surface to the ocean floor. The MIRC also consists of designated sea and undersea training and testing areas, which include designated drop zones, underwater demolition and floating mine safety zones, danger zones associated with live-fire ranges, and training areas associated with military controlled beaches, harbors, and littoral areas.

W-517, W-12, W-11, and W-13 (see Figure E-1) are designated as SUA where access to the sea space underneath may be affected during potentially hazardous training and testing activities. Portions of the Marianas Trench Marine National Monument, established in January 2009 by Presidential Proclamation under the authority of the Antiquities Act (16 United States Code sections 431–433), lie within the MIRC and under all MIRC Warning Areas. However, the activities and exercises of the Armed Forces (including those carried out by the U.S. Coast Guard) have been excluded from the prohibitions within the Monument, as outlined in the 2009 Presidential Proclamation.

### E.1.2 Description of the Ocean Operating Areas Outside the Bounds of the Mariana Islands Range Complex

In addition to the MIRC, the Study Area includes waters to the north and west of the MIRC in the Philippine Sea, as depicted in Figure 1.1-1.

### E.1.3 Description of the Pierside Locations and Apra Harbor

The Study Area includes pierside locations in Apra Harbor, Guam. For purposes of this Draft SEIS/OEIS, pierside locations include channels and routes to and from the Navy port in Apra Harbor Naval Complex, and associated wharves and facilities within the Navy port (Figure 2.1-2).

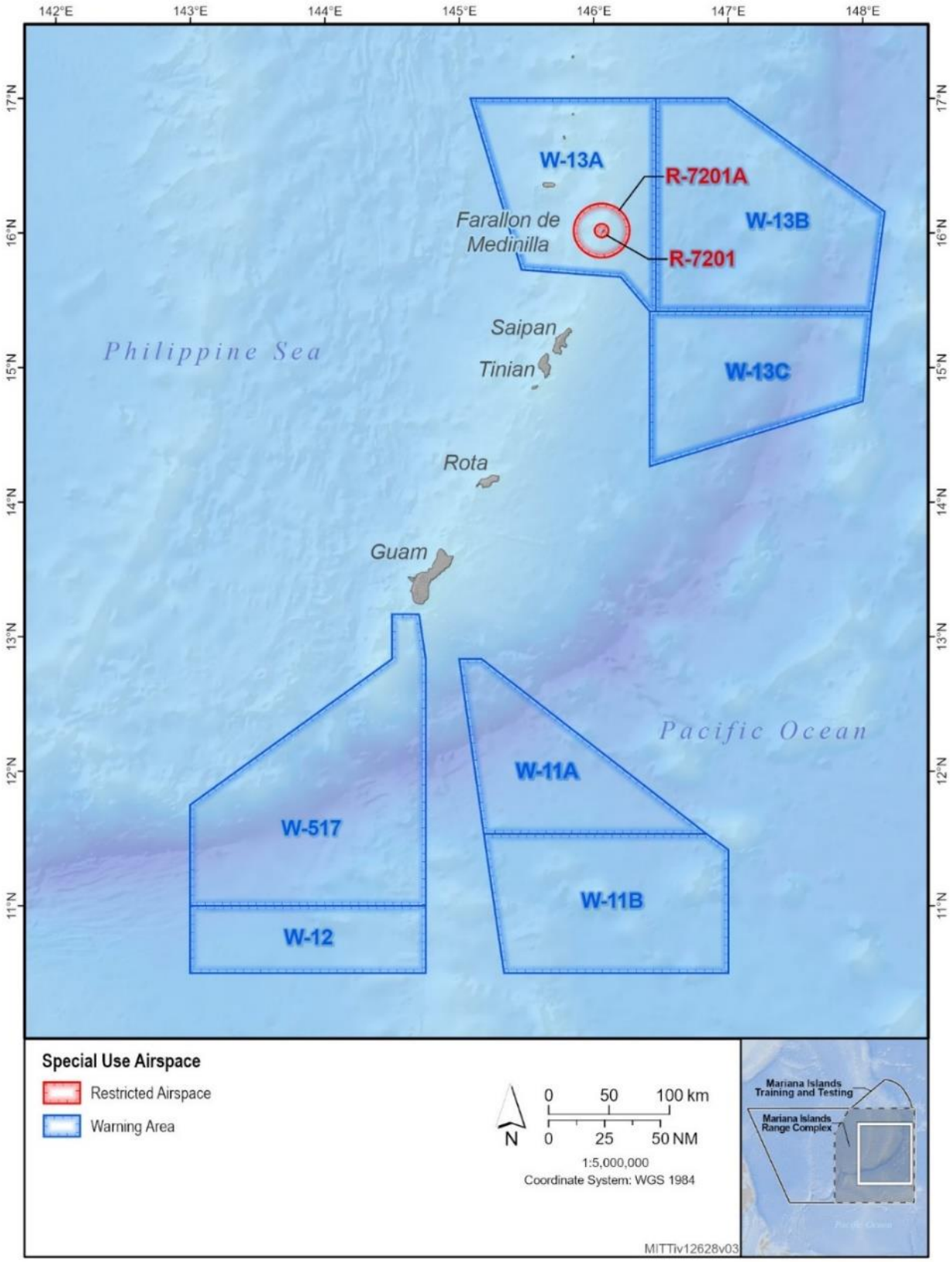


**Figure E-1: Mariana Islands Range Complex Airspace**

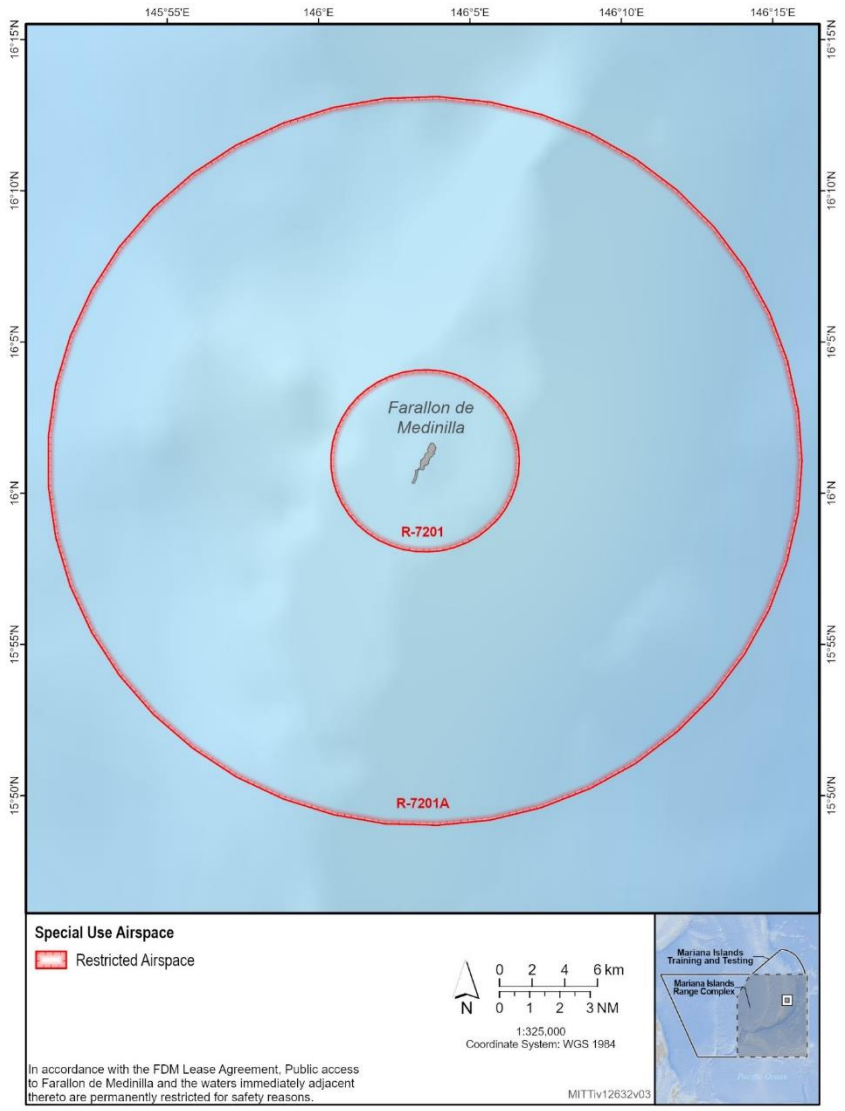


**Figure E-2: Farallon de Medinilla Restricted Airspace 7201 and 7201A**

## E.2 Description of Sonar, Munitions, Targets, and Other Systems Employed in the Mariana Islands Training and Testing Activities

The Navy uses a variety of sensors, platforms, weapons, and other devices, including ones used to ensure the safety of military personnel, to meet its mission. Training and testing with these systems may have the potential to introduce acoustic (sound) energy and expended materials into the environment. The environmental impact of these activities was analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of this Draft SEIS/OEIS. This appendix presents and organizes sonar systems, munitions, targets, and other systems, including unmanned systems, in a manner intended to facilitate understanding of both the activities that use them and the analysis of their environmental effects, described in Chapter 3 of this Draft SEIS/OEIS. The use of unmanned systems throughout all warfare areas has increased since the previous MITT analyses and is reflected in this Draft SEIS/OEIS. Because of the prevalence of unmanned systems use, the terms “aircraft” and “vessels” can also refer to their unmanned

variants: unmanned aircraft systems (UASs), unmanned surface vessels (USVs), and unmanned underwater vehicles.

### E.2.1 Sonar Systems and Other Acoustic Sources

**Sonar.** Sonar, originally an acronym for "SOund Navigation And Ranging," is a technique that uses underwater sound to navigate, communicate, or detect underwater objects (the term sonar is also used for the equipment used to generate and receive sound). There are two basic types of sonar: active and passive.

Active sonar emits sound waves that travel through the water, reflect off objects, and return to a receiver. Sonar is used to determine the distance to an underwater object by calculating the speed of sound in water and the time for the sound wave to travel to the object and back. For example, active sonar systems are used to track targets or to aid in vessel navigation by identifying known ocean floor features. Some whales, dolphins, and bats use echolocation, a similar technique, to identify their surroundings and to locate prey.

Passive sonar uses listening equipment, such as underwater microphones (hydrophones) and receiving sensors on ships, submarines, aircraft, or autonomous vehicles, to pick up underwater sounds. The advantage of passive sonar is that it places no sound in the water, and thus does not reveal the location of the listening vessel. Passive sonar can indicate the presence, character, and direction noise-producing objects like ships and submarines; however, passive sonar is increasingly ineffective as modern submarines become quieter. Passive sonar has no potential acoustic effect on the environment, and therefore is not discussed further or analyzed within this Draft SEIS/OEIS.

All sounds, including sonar, are categorized by frequency. For this Draft SEIS/OEIS, active sonar is categorized into four frequency ranges: low-frequency,[1] mid-frequency, high-frequency, and very high-frequency.

- Low-frequency active sonar emits sounds at frequencies less than 1 kilohertz (kHz). Low-frequency active sonar is useful for detecting objects at great distances because low-frequency sounds do not dissipate as rapidly as higher frequency sounds.
- Mid-frequency active sonar emits sounds at frequencies from 1 to 10 kHz. Mid-frequency active sonar is the Navy's primary tool for detecting and identifying submarines. Active sonar in this frequency range provides a valuable combination of range and target accuracy.
- High-frequency active sonar emits sounds at frequencies greater than 10 kHz, up to 100 kHz. High-frequency sounds dissipate rapidly and have a small effective range; however, high-frequency sounds provide higher resolution of objects and are useful at detecting and identifying smaller objects such as sea mines.

[1] Surveillance Towed Array Sensor System (SURTASS) Low-Frequency Active (LFA) sonar, which may be used in the Study Area, is not among the sources analyzed in this document. The potential environmental effects from use of SURTASS LFA sonar are analyzed in a separate National Environmental Policy Act document. SURTASS was considered in the analysis of cumulative impacts in this Draft SEIS/OEIS.

- Very high-frequency sources are those that operate above 100 kHz but below 200 kHz[2].

Modern sonar technology includes a variety of sonar sensor and processing systems. In concept, the simplest active sonar emits sound waves, or "pings," sent out in multiple directions; the sound waves then reflect off of the target object in multiple directions (Figure E-3). The sonar source calculates the time it takes for reflected sound waves to return; this calculation determines the distance to the target object. More sophisticated active sonars emit a ping and then rapidly scan or listen to the sound waves in a specific area. This provides both distance to the target and directional information. Even more advanced sonars use multiple receivers to listen to echoes from several directions simultaneously and provide efficient detection of both direction and distance. It should be noted that active sonar is rarely used continuously throughout the listed activities. In addition, when sonar is in use, the sonar "pings" occur at intervals, referred to as a duty cycle, and the signals themselves are very short in duration. For example, a sonar that emits a 1-second ping every 10 seconds has a 10 percent duty cycle.

The Navy utilizes sonar systems and other acoustic sensors in support of a variety of mission requirements. Primary uses include detection of and defense against submarines (anti-submarine warfare) and mines (mine warfare), safe navigation and effective communications, and oceanographic surveys. Specific examples of how sonar systems are used for Navy activities are discussed in the following sections.

Activity tables in Section A.3 (Training Activities) and Section A.4 (Testing Activities) of Appendix A (Military Readiness Activities Descriptions) list sonar bin categories that include specific bins assessed for take of protected species under that activity. Bins are also discussed and defined in Section 3.0.1.1.1 (Acoustic Stressors) of this Draft SEIS/OEIS. Various activities may also use *de minimis* sound sources that are not expected to result in take of protected species.

[2] Frequencies above 200 kHz are not categorized because they are above the hearing threshold of most marine species.

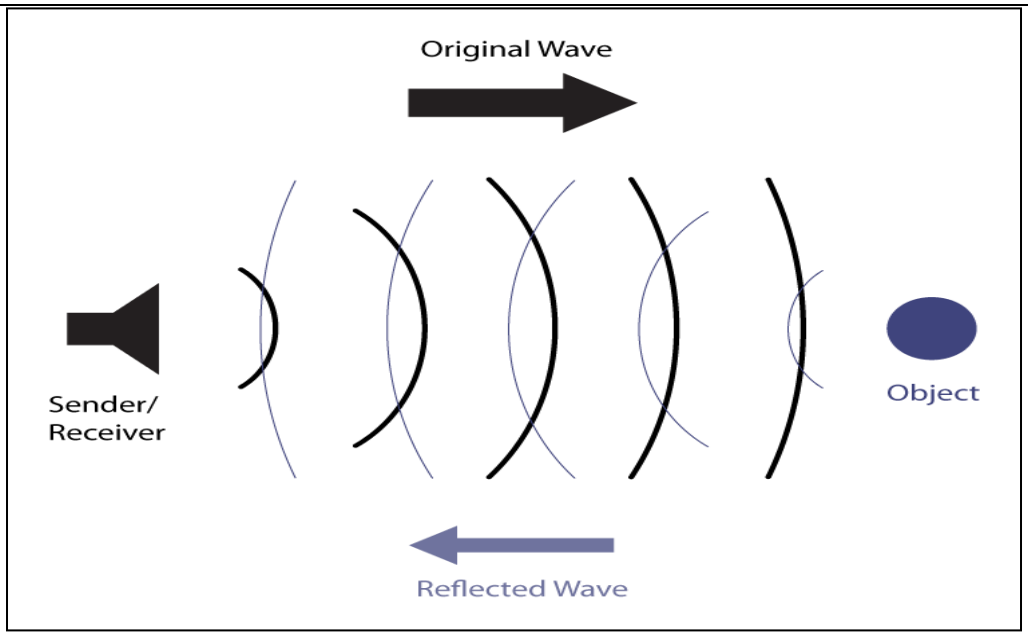


**Figure E-3: Principle of an Active Sonar**

**Anti-Submarine Warfare.** Systems used in anti-submarine warfare include sonars, torpedoes, and acoustic countermeasure devices. These systems are employed from a variety of platforms (surface ships, submarines, rotary-wing aircraft, fixed-wing aircraft, and unmanned vehicles). Surface ships conducting anti-submarine warfare are typically equipped with hull-mounted sonar (passive and active) for the detection of submarines (or submarine targets during training and testing activities). Aircraft use dipping sonar or sonobuoys (passive and active) to locate submarines (or targets). Fixed-wing aircraft deploy both active and passive expendable sonobuoys to assist in detecting and tracking submarines (or targets). Submarines are equipped with hull-mounted sonars to detect, localize, and track other submarines and surface ships. Submarines primarily use passive sonar; active sonar is used mostly for navigation. There are also unmanned vehicles currently being developed to deploy anti-submarine warfare systems.

Anti-submarine warfare activities often use mid-frequency (1 to 10 kHz) active sonar, though low-frequency and high-frequency active sonar systems are also used for specialized purposes. Typical active sonar systems and acoustic sensors used during anti-submarine warfare sonar training and testing activities include the following:

**Surface Ship Sonar Systems:** A variety of surface ships operate hull-mounted or towed mid-frequency active sonar during training and testing activities (Figure E-4). Typically, only cruisers and destroyers have surface ship sonar systems. Unmanned surface vessels can also include sonar systems, such as a towed sonar system.

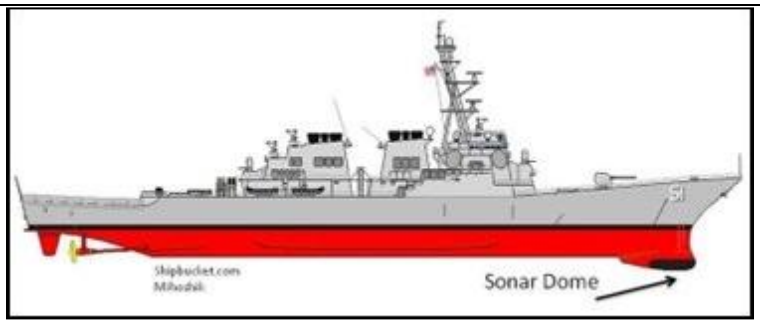


**Figure E-4: Guided Missile Destroyer with a Hull-Mounted Sonar**

**Submarine Sonar Systems:** Submarines are equipped with hull-mounted mid-frequency and high-frequency active sonar (Figure E-5) used to detect and target enemy submarines and surface ships. A submarine's mission relies on its stealth; therefore, a submarine uses its active sonar sparingly because each sound emission gives away the submarine's location.

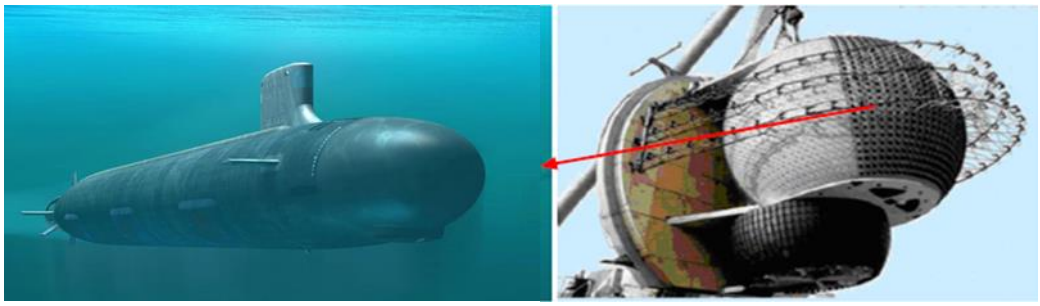

**Figure E-5: Submarine Active Sonar Array**

**Aircraft Sonar Systems:** Aircraft sonar systems include sonobuoys and dipping sonars.

- **Sonobuoys:** Active sonobuoys are expendable devices that contain a data transmitter and a hydrophone. The sounds collected by the sonobuoy are transmitted back to the operator (aboard ship or aircraft) for analysis. Sonobuoys allow for short and long-range detection of surface ships and submarines. These systems are deployed by ship or aircraft (Figure E-6).

**Figure E-6: Loading a Sonobuoy in an Aircraft**

- **Dipping Sonars:** Dipping sonars are recoverable devices lowered into the water via cable from low-flying aircraft (Figure E-7). The sonar detects underwater targets and determines the distance and movement of the target relative to the position of the aircraft.

**Figure E-7: Helicopter Deploying Dipping Sonar**

**Exercise Torpedoes:** Some torpedoes used in training and testing activities may transmit active sonar signals. Surface ships, aircraft, and submarines primarily use torpedoes in anti-submarine warfare (Figure E-8). Recoverable, non-explosive torpedoes, categorized as either lightweight or heavyweight, are used during training and testing. Torpedoes operate autonomously, or in the case of heavyweight torpedoes, use a guidance system to operate the torpedo remotely through an attached wire (guidance wire). The autonomous guidance systems operate either passively (listening for sounds generated by the target) or actively (pinging to search for the target). Torpedo training in the Study Area is mostly simulated—solid masses that approximate the weight and shape of a torpedo are fired, rather than fully functional torpedoes. Testing in the Study Area mostly uses fully functional exercise torpedoes.

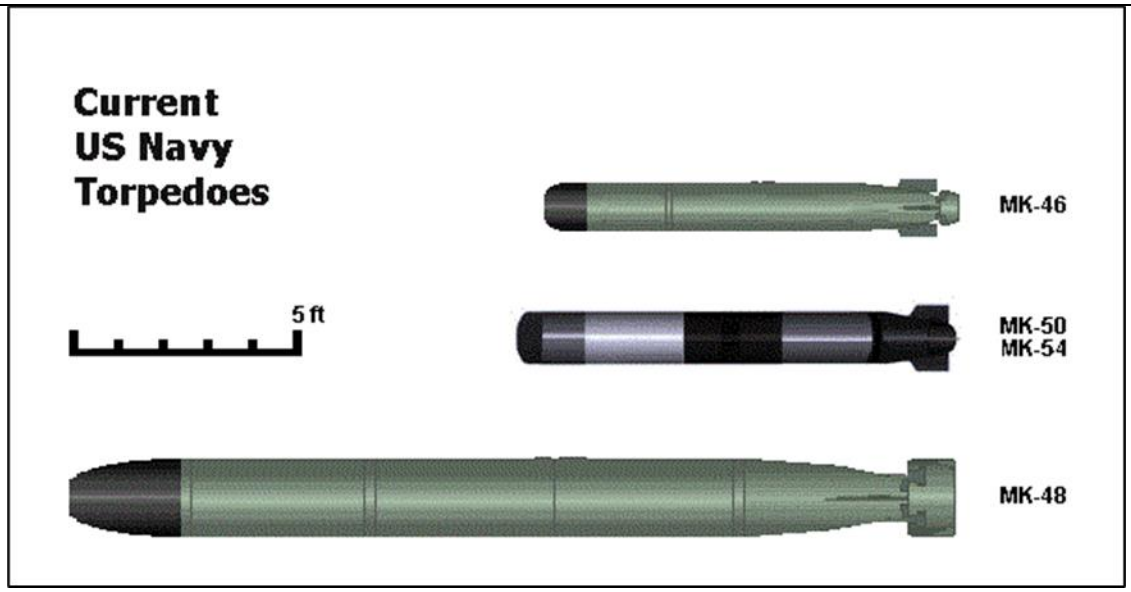


**Figure E-8: Current United States Navy Torpedoes**

**Anti-Submarine Warfare Targets:** Anti-submarine warfare training targets are autonomous undersea vehicles used to simulate target submarines (Figure E-9). The training targets are equipped with one or more of the following devices: (1) acoustic projectors emitting sounds to simulate submarine acoustic signatures, (2) echo repeaters to simulate the characteristics of the echo of a sonar signal reflected from a submarine, and (3) magnetic sources that mimic those of a submarine.

**Figure E-9: Anti-Submarine Warfare Target**

**Mine Warfare.** Mine warfare training and testing activities use a variety of different sonar systems that are typically high frequency (greater than 10 kHz) and very high frequency (greater than 100 kHz). These sonar systems are used to detect, locate, and characterize moored and bottom mines (Figure E-10). The majority of mine warfare sonar sensors can be deployed by more than one platform (e.g., helicopter, unmanned underwater and surface vehicle, or surface ship) and may be interchangeable among platforms. Surface ships and submarines use sonar to detect mines and objects.

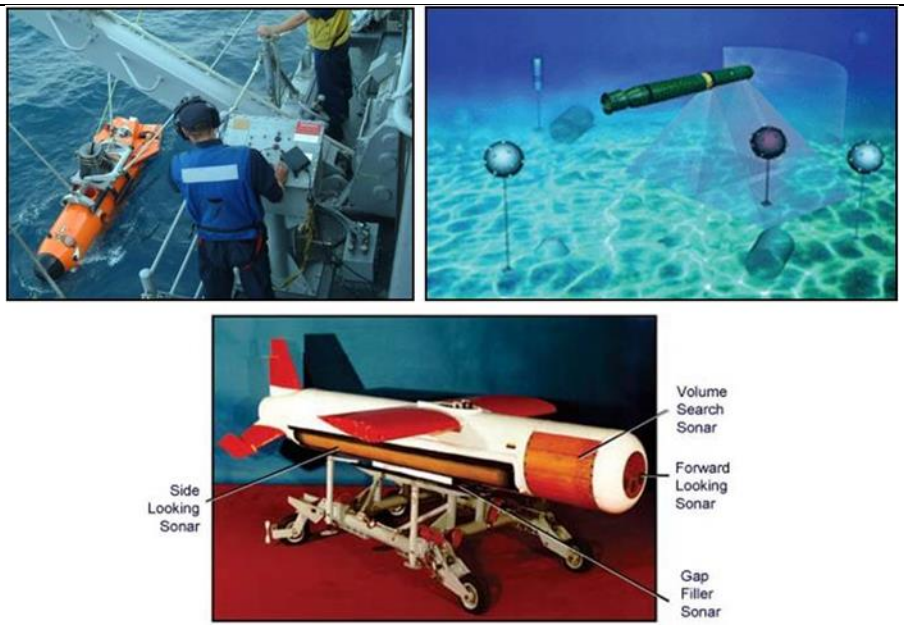


**Figure E-10: Mine Warfare Systems**
*(Source: Graphic on upper right side from Lockheed Martin)*

**Safety, Navigation, Communications, and Oceanographic Systems.** Naval ships, submarines, and unmanned surface and subsurface vehicles rely on equipment and instrumentation that use active sonar during both routine operations and training and testing activities. Sonar systems are used to gauge water depth; detect and map objects, navigational hazards, and the ocean floor; and transmit communication signals.

**Other Acoustic Systems.** The Navy uses a variety of other acoustic sensors to protect ships anchored or at the pier, as well as shore facilities. These systems, both active and passive, detect potentially hostile swimmers, broadcast warnings to alert Navy divers of potential hazards, and gather information regarding ocean characteristics (ocean currents and wave measurements). They are generally stationary systems in Navy harbors and piers. Navy marine mammals (Atlantic bottlenose dolphins [*Tursiops truncatus*]) are also used to detect hostile swimmers around Navy facilities. A trained animal is deployed under behavioral control of a handler to find an intruding swimmer. Upon finding the "target" of the search, the animal returns to the boat and alerts the animal handlers, and the animals are given a localization marker or leg cuff that they attach to the intruder. Swimmers that have been marked with a leg cuff are reeled in by security support boat personnel via a line attached to the cuff. In addition, the Navy's research and acquisition community uses sensors for a variety of tests, including tracking during testing activities and collecting data for test analysis.

### E.2.2 Munitions

Most ordnance and munitions used during training and testing activities fall into three basic categories: projectiles, missiles, and bombs. Ordnance can be further defined by their net explosive weight, which is a measure of defining the explosive force of a munition without considering features such as the packaging, casings, or bullets. Net explosive weight is the trinitrotoluene (TNT) equivalent of energetic material, which is the standard measure of

strength of bombs and other explosives. For example, a 2,000-pound (lb.) bomb may have anywhere from 600 to 1,000 lb. of net explosive weight.

**Projectiles.** Projectiles are fired during gunnery and testing activities from a variety of weapons, including pistols and rifles to large-caliber, turret-mounted guns on the decks of Navy ships and mounted gun systems from aircraft. Projectiles can be either high-explosive munitions (e.g., certain gun shells), or non-explosive practice munitions (e.g., rifle/pistol bullets). Explosive rounds can be fused to either explode on impact or in the air (i.e., just prior to impact). Projectiles are broken down into three basic categories in this Draft SEIS/OEIS:

- **Small-Caliber Projectiles:** These projectiles are up to and including .50-caliber (approximately 1/2 inch [in.] diameter). Small-caliber projectiles (e.g., bullets), are primarily fired from pistols, rifles, and machine guns (i.e., small arms) and mostly during training activities for an individual Sailor to become and remain proficient (Figure E-11).

**Figure E-11: Shipboard Small Arms Training**

- **Medium-Caliber Projectiles:** These projectiles are larger than .50-caliber, but smaller than 57 millimeter (mm) (approximately 2-1/4 in. diameter). The most common size medium-caliber projectiles are 20 mm, 25 mm, and 40 mm. Medium-caliber projectiles are fired from machine guns operated by one to two crewman and mounted on the deck of a ship, wing-mounted guns on aircraft, and fully automated guns mounted on ships for defense against missile attack (Figure E-12). Medium-caliber projectiles also include 40 mm grenades, which can be fired from hand-held grenade launchers or crew-served deck-mounted guns. Medium-caliber projectiles can be non-explosive practice munitions or high-explosive projectiles. High-explosive projectiles are usually fused to detonate on impact; however, advanced high-explosive projectiles can detonate based on time, distance, or proximity to a target.

**Figure E-12: Shipboard Medium-Caliber Guns**

- **Large-Caliber Projectiles:** These includes projectiles 57 mm and larger. The largest projectile currently in service has a 5 in. diameter. The most widely used large-caliber projectiles are 57 mm and 5 in. (Figure E-13). The most common 5 in. projectile is approximately 26 in. long and weighs 70 lb. Large-caliber projectiles are fired exclusively from turret-mounted guns located on ship decks and can be used to fire on surface ships and boats, in defense against missiles and aircraft, and against land-based targets. Large-caliber projectiles can be non-explosive practice munitions or high-explosive munitions. High-explosive projectiles can detonate on impact or in the air.

**Figure E-13: Shipboard Large-Caliber Guns and Projectiles**

**Missiles and Rockets.** Missiles are rocket- or jet-propelled munitions used to attack ships, aircraft, and land-based targets, as well as defend ships against other missiles. Guidance systems and advanced fusing technology ensure that missiles reliably impact on or detonate near their intended target. Missiles are categorized according to their intended target, as described below, and can be further classified according to net explosive weight. Rockets are included within the category of missiles.

- **Air Missiles:** Air missiles are fired from ships and aircraft against enemy aircraft and incoming missiles (Figure E-14). Air missiles are configured to explode in the air near, or on impact with their intended target. Missiles are the primary ship-based defense against incoming missiles.

**Figure E-14: Rolling Airframe Missile and Air-to-Air Missile**

- **Surface Missiles:** Surface missiles are fired from aircraft, ships, and submarines against surface ships (Figure E-15). Surface missiles are typically configured to detonate on impact or just above the intended target.

**Figure E-15: Surface Missile Fired from Rotary-wing Aircraft**

- **Strike Missiles:** Strike missiles are fired from aircraft, ships, and submarines against land-based targets. Strike missiles are typically configured to detonate on impact or near their intended target. An anti-radiation missile, used to destroy enemy radar sites, is an example of a strike missile used during at-sea training, and is fired at a floating sea-borne target that replicates a land-based radar site.

**Bombs.** Bombs are unpowered munitions dropped from aircraft on land and water targets. The majority of bombs used during training and testing in the Study Area are non-explosive. However, explosive munitions are occasionally used for proficiency inspections and testing requirements. Bombs fall into two categories: general-purpose bombs and subscale practice bombs. Similar to missiles, bombs are further classified according to their net explosive weights.

- **General-Purpose Bombs:** General-purpose bombs consist of precision-guided and unguided full-scale bombs, ranging in size from 250 to 2,000 lb. (Figure E-16). Common bomb nomenclature used includes MK 80 series, which is the Navy's standard model; Guided Bomb Units and Joint Direct Attack Munitions, which are precision-guided (including laser-guided) bombs; and the Joint Standoff weapon, which is a long-range

"glider" precision weapon. General-purpose bombs can be either non-explosive practice munitions or high-explosive munitions.

**Figure E-16: Aircraft Bomb Release and Loading General Purpose Bombs**

- **Subscale Bombs:** Subscale bombs (Figure E-17) are non-explosive practice munitions containing a spotting (smoke) charge to aid in scoring the accuracy of hitting the target during training and testing activities. Common subscale bombs are 25 lb. and less and are steel constructed. Laser-guided training rounds are another variation of a subscale practice bomb. They weigh approximately 100 lb. and are cost-effective, non-explosive weapons used in training aircrew in laser-guided weapons employment.

**Figure E-17: Subscale Bombs for Training**

**Other Munitions.** There are other munitions used in naval at-sea training and testing activities that do not fit into one of the above categories, and are discussed below:

- **Demolition Charges:** Divers place explosive charges in the marine environment during some training and testing activities. These activities may include the use of timed charges, in which the charge is placed, a timer is started, and the charge detonates at the set time. Munitions of up to, and sometimes exceeding, 20 lb. max blocks of composition 4 (C-4) plastic explosive, with the necessary detonators and cords, are used to support mine neutralization, demolition, and other warfare activities. All demolition charges are further classified according to the net explosive weight of the charge.

- **Torpedoes:** Explosive torpedoes are required in some training and testing activities. Torpedoes are described as either lightweight or heavyweight and are further categorized according to the net explosive weight.
- **Mines:** Naval mines are deposited and left in place until triggered by the approach of an enemy ship or are destroyed or removed. Naval mines can be laid by purpose-built minelayers, other ships, submarines, or airplanes.
- **Loitering Munitions:** UAS or USV weapons designed for remotely controlled or autonomous operation, with long dwell times and precision targeting. Loitering munitions are designed as non-recoverable unmanned vehicles with explosive charges built in that can be launched from land or at sea, typically by small boats or ships. During terminal phase, after a target has been identified, the loitering munition acts similarly to a bomb or missile to destroy or incapacitate its target.

### E.2.3 Targets

Training and testing require an assortment of realistic and challenging targets. Targets vary from items as simple and ordinary as an empty steel drum used for small-caliber weapons training and testing from the deck of a ship, to sophisticated, unmanned aerial drones used in air defense training and testing. For this Draft SEIS/OEIS, targets are organized by warfare area.

**Air Warfare Targets:** Air warfare targets, tow target systems, and aerial targets, are used in training and testing activities that involve detecting, tracking, defending against, and attacking enemy missiles and aircraft. Aerial tow target systems include textile (nylon banner) and rigid (fiberglass shapes) towed targets used for gunnery activities. Aerial targets include expendable rocket powered missiles and recoverable radio-controlled drones used for gunnery and missile activities (Figure E-18, Figure E-19, and Figure E-20). Parachute flares are used as air-to-air missile targets. Manned high-performance aircraft may be used as targets—to test ship and aircraft defensive systems and procedures—without the actual firing of munitions.

**Figure E-18: Deployment and Recovery of Air Warfare Targets**

**Figure E-19: Aerial Target**

**Figure E-20: Illuminating Flare (Aerial Target)**

**Surface Warfare Targets:** Stationary and towed targets are used as surface warfare targets during gunnery activities. Targets include floating steel drums, inflatable shapes or target balloons (e.g., Killer Tomato™) (Figure E-21), and towed sleds. Remote-controlled, high-speed targets, such as jet skis and motorboats, are also used (Figure E-22).

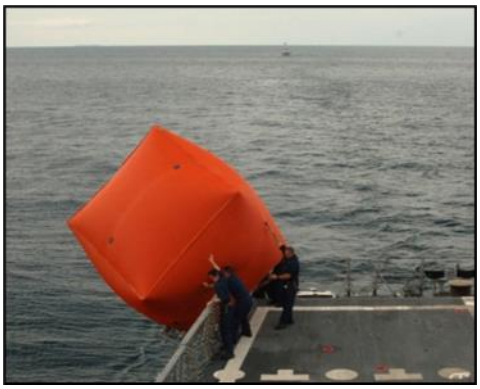

**Figure E-21: Deploying a "Killer Tomato™" Floating Target**

**Figure E-22: Ship Deployable Surface Target and High-Speed Maneuverable Seaborne Target**

**Anti-Submarine Warfare Targets:** Anti-submarine warfare uses multiple types of targets, including the following:

- **Submarines:** Submarines may act as tracking and detection targets during training and testing activities.
- **Motorized Autonomous Targets:** Motorized autonomous targets simulate the acoustic and magnetic characteristics of a submarine, providing realism for activities when a submarine is not available. These mobile targets resemble torpedoes, with some models designed for recovery and reuse, while other models are expendable.
- **Stationary Artificial Targets:** Stationary targets either resemble submarine hulls or are simulated systems with acoustic properties of enemy submarines. These targets either rest on the seafloor or are suspended at varying depths in the water column.

### E.2.4 Defensive Countermeasures

Naval forces depend on effective defensive countermeasures to protect against missile and torpedo attack. Defensive countermeasures are devices designed to confuse, distract, and confound precision-guided munitions. Defensive countermeasures fall into five basic categories:

- **Chaff:** Chaff consists of reflective, aluminum-coated glass fibers used to obscure ships and aircraft from radar-guided systems. Chaff, which is stored in canisters, is either dispensed from aircraft or fired into the air from the decks of surface ships when an attack is imminent. The glass fibers create a radar cloud that masks the position of the ship or aircraft.
- **Flares:** Flares are pyrotechnic devices used to defend against heat-seeking missiles, where the missile seeks out the heat signature from the flare rather than the aircraft's engines. Similar to chaff, flares are also dispensed from aircraft and fired from ships.
- **Acoustic Countermeasures:** Acoustic countermeasures are used by surface ships and submarines to defend against torpedo attack (Figure E-23). Acoustic countermeasures are either released from ships and submarines or towed at a distance behind the ship.

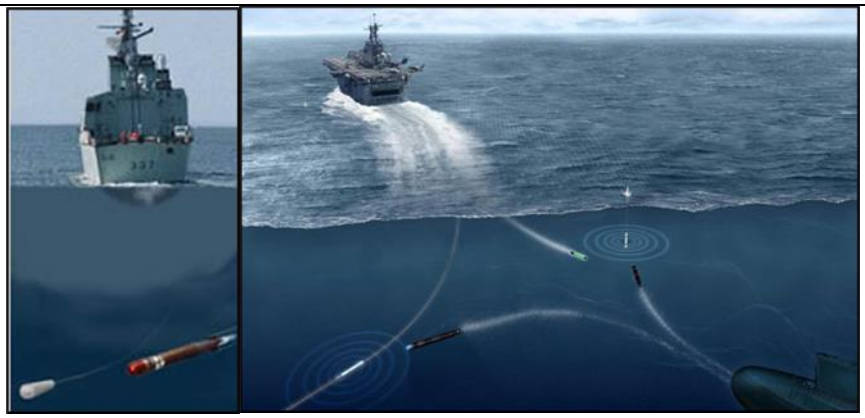

**Figure E-23: Acoustic Countermeasures**

- **Electromagnetic Countermeasures:** Electromagnetic countermeasures are used by surface ships and aircraft to defend against missile attacks. Electromagnetic countermeasures are also used in anti-submarine warfare activities.

### E.2.5 Portable Underwater Tracking Range

This is a portable instrumented range that allows near-real-time tracking and feedback to all participants. The tracking range provides for both a shallow-water and deep-water operating environment. MK-84 range pingers are used in association with the Portable Underwater Tracking Range. Tracking range transponders are anchored to the seafloor with approximately 200- lb. concrete blocks or buckets filled with sandbags. The range can track up to four MK-84 range pingers. A typical tracking range configurations consists of 10 transponders with three held in reserve and is deployable from 400 meters (m) to 3,500 m depth. Signals from the transponders are uplinked to a range control vessel for processing. The transponders can be released from their anchors by acoustic signal to float to the surface for recovery. The anchor blocks are not recovered.

### E.2.6 Mine Warfare

#### E.2.6.1 Training Mines

As addressed in the Range Modernization and Sustainment activity in Appendix A, training mines, also referred to as “mine shapes” or “mine countermeasure (MCM) targets,” are temporarily installed across mine warfare training areas in the Study Area. MCM targets contain no explosives but may contain instrumentation that can provide feedback during or after a training activity. Training mines come in several shapes and sizes, as shown in Figure E-24 and Figure E-25. Depending on the training objectives, specific MCM targets would be selected and placed at depths and locations appropriate to the training and the mine shape.

**Figure E-24: Portfolio of Training Mines**

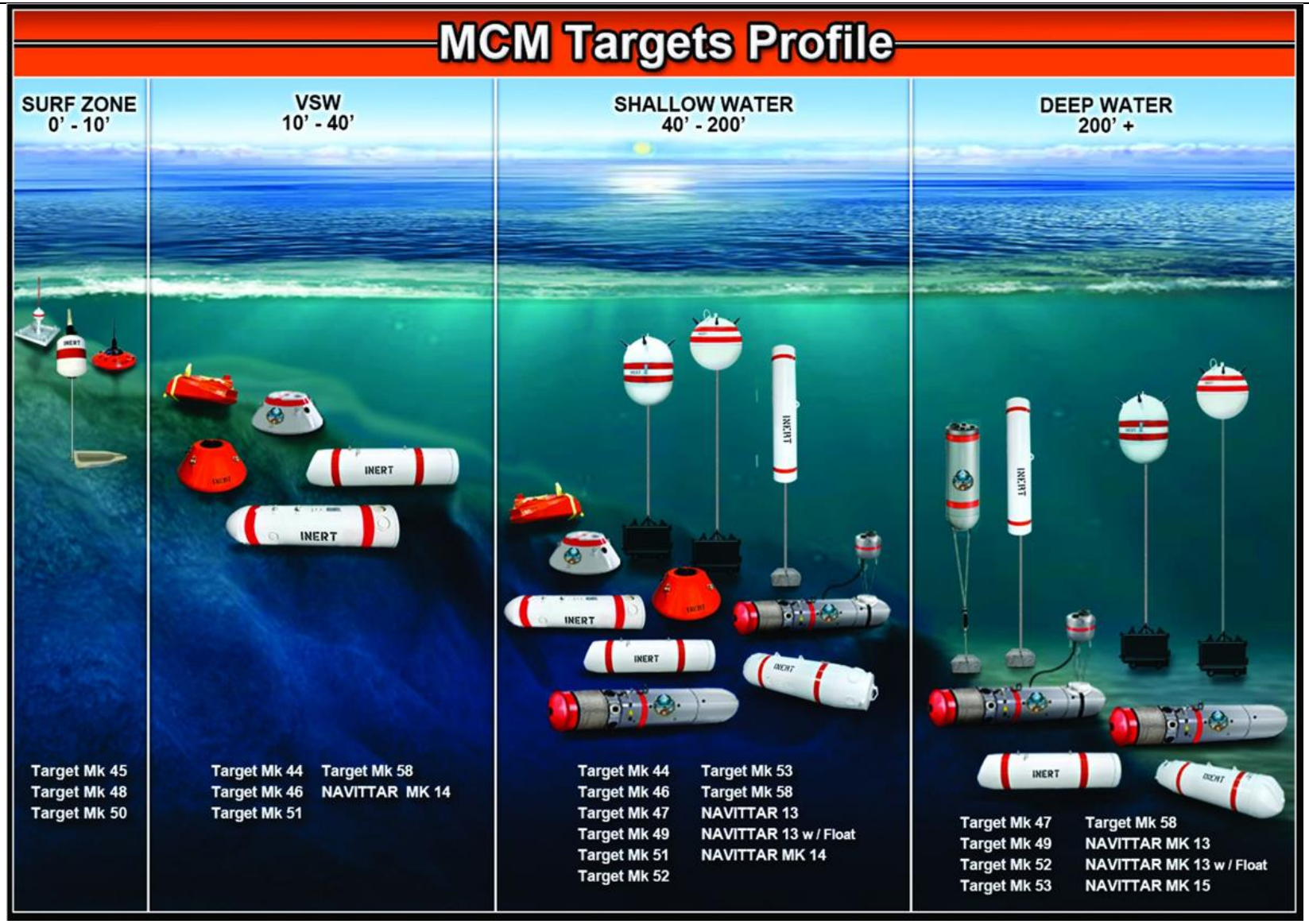


**Figure E-25: Application (Location) of Training Mines**

### E.2.6.2 Mine Warfare Systems

Mine warfare systems fall into two broad categories: mine detection and mine neutralization.

**Mine Detection Systems.** Mine detection systems are used to locate, classify, and map suspected mines. Once located, the mines can either be neutralized or avoided. These systems are specialized to either locate mines on the surface, in the water column, or on the seafloor.

- **Towed or Hull-Mounted Mine Detection Systems:** These detection systems use acoustic and laser or video sensors to locate and classify suspect mines. Ships and unmanned vehicles are used for towed systems, which can rapidly assess large areas (Figure E-26).

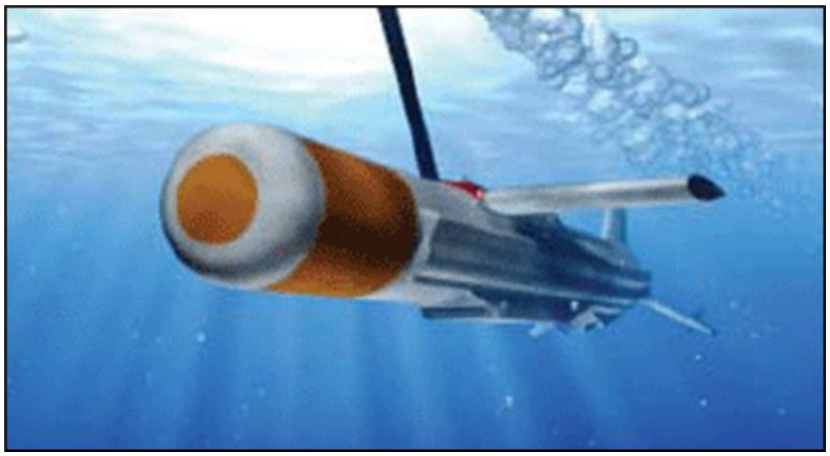

**Figure E-26: Towed Mine Detection System**

- **Airborne Laser Mine Detection Systems:** Airborne laser detection systems work in concert with neutralization systems. The detection system initially locates mines, and a neutralization system is then used to relocate and neutralize the mine (Figure E-27).

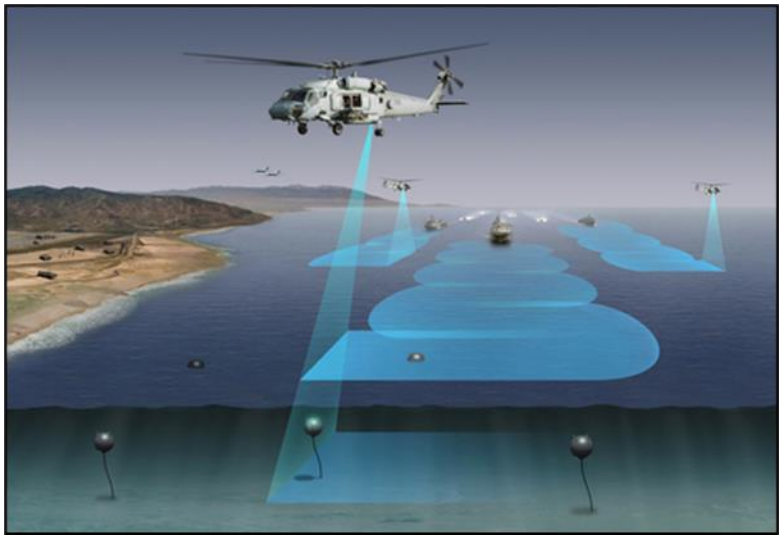

**Figure E-27: Airborne Laser Mine Detection System**

- **Unmanned/Remotely Operated Vehicles:** These vehicles use acoustic and video or lasers to locate and classify mines. Unmanned/remotely operated vehicles provide unique mine warfare capabilities in nearshore littoral areas, surf zones, ports, and channels.
- **Marine Mammal System:** Navy personnel and Navy marine mammals work together to detect specified underwater objects. The Navy deploys trained bottlenose dolphins as part of the marine mammal minehunting and object recovery system.
- **Dipping Mine Detection Systems:** Mine-hunting dipping sonar systems are deployed from helicopters and use high-frequency sonar for the detection and classification of bottom and moored mines.

**Mine Neutralization and Countermining Systems.** These systems disrupt, disable, or detonate mines to clear ports and shipping lanes, as well as littoral, surf, and beach areas in support of naval amphibious operations. Mine neutralization systems can clear individual mines or a large number of mines quickly. High-explosive mines are not proposed for MITT.

- **Towed Influence Mine Sweep Systems:** These systems use towed equipment that mimic a particular ship's magnetic and acoustic signature, triggering the mine and causing it to explode (Figure E-28).

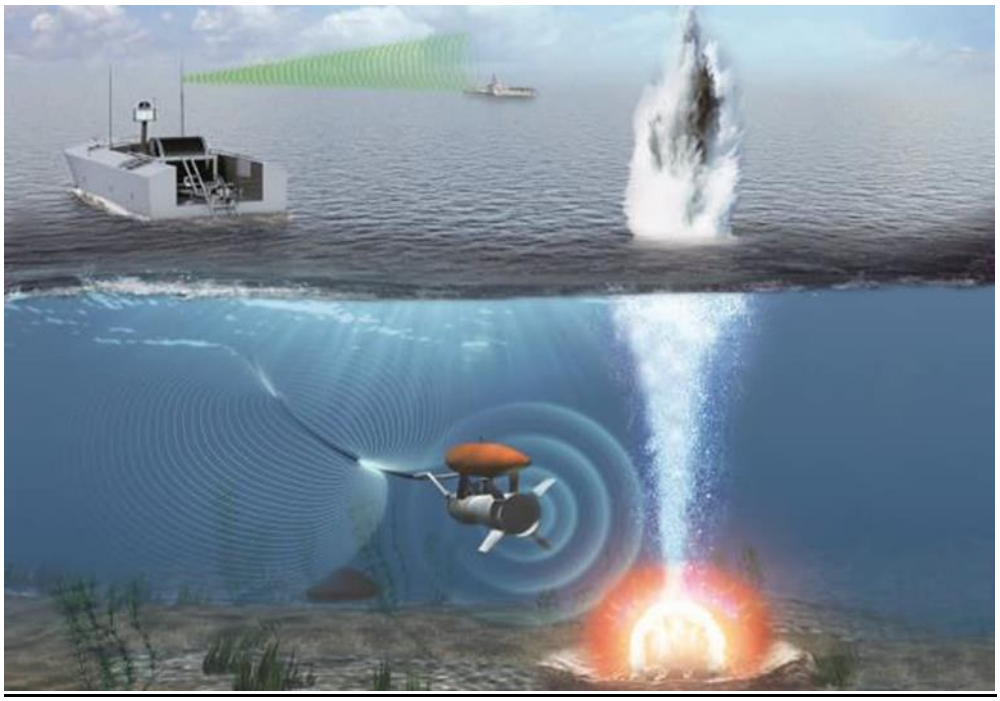

**Figure E-28: Unmanned Influence Sweep Mine Hunting System**

- **Towed Mechanical Mine Sweeping Systems:** These systems tow a sweep wire to snag the line that attaches a moored mine to its anchor, and then use a series of cables and cutters to sever those lines. Once these lines are cut, the mines float to the surface, where explosive ordnance personnel can neutralize the mines.

- **Unmanned/Remotely Operated Mine Neutralization Systems:** Surface ship and aircraft operate these systems, which place explosive charges near or directly against mines to destroy the mine (Figure E-29).

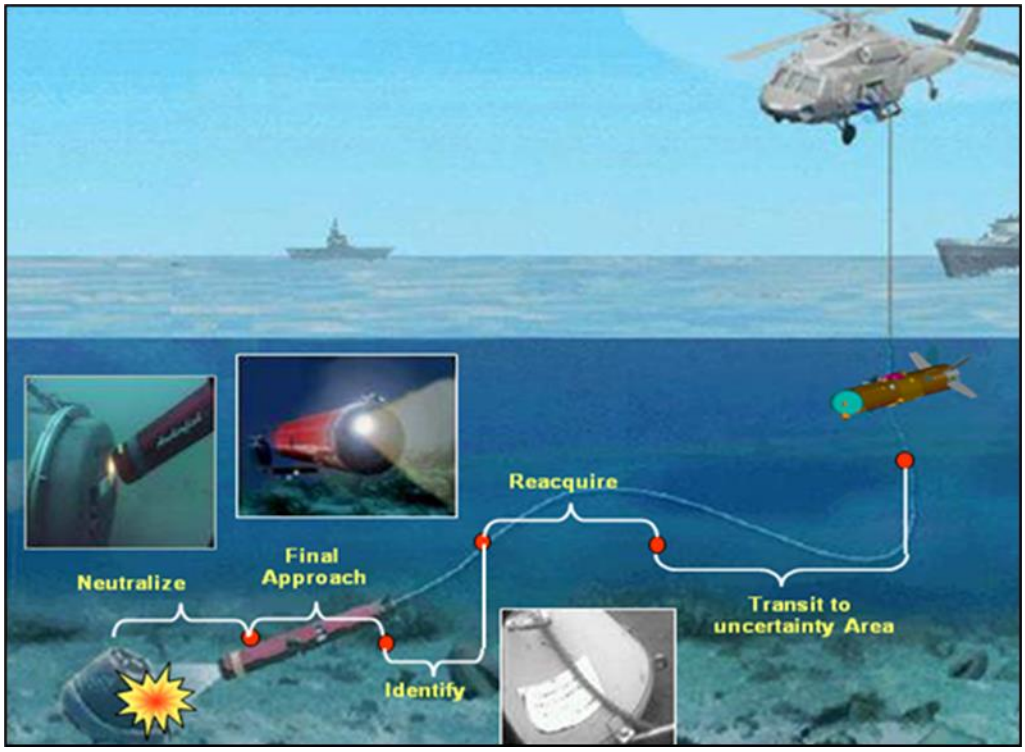


**Figure E-29: Airborne Mine Neutralization System**

- **Projectiles:** Small- and medium-caliber projectiles fired from surface ships or aircraft are used to neutralize floating and near-surface mines.
- **Diver Emplaced Explosive Charges:** Operating from small craft, divers place explosive charges, which may use time-delay fusing, near or on mines to destroy the mine or disrupt its ability to function.
- **Other Systems:** Mat weave (charges laid in a pattern) are placed by Explosive Ordnance Personnel to destroy barriers or obstacles designed to block amphibious vehicle access to beach areas. Time delay fuses may be used on or near the mat weave. The Mine-Clearing Line Charge is a rocket-projected device used to create a breach in minefields. Many charges are connected on a line to be projected onto a minefield and then exploded, detonating buried mines.

### E.2.7 Military Expended Materials

Navy training and testing activities may introduce or expend various items, such as non-explosive munitions and targets, into the marine environment as a direct result of using these items for their intended purpose. In addition to the items described below, some accessory materials—related to the carriage or release of these items—may be released. These materials, referred to as military expended materials, are not recovered, and potentially result in environmental effects. These effects are analyzed in detail in Chapter 3 (Affected Environment

and Environmental Consequences) of this Draft SEIS/OEIS. This section includes descriptions of a representative sample of military expended materials. A more comprehensive discussion can be found in Chapter 3.

Military expended materials analyzed in this document include the following:

- **Sonobuoys:** Sonobuoys consist of decelerators/parachutes, wires, and the sonobuoys themselves.
- **Bathythermographs:** Bathythermographs as used by the Navy are similar to sonobuoys in that they consist of decelerators/parachutes, wires, and the buoy themselves. In the case of bathythermographs, the buoys are used to measure temperature information of the water column and transmit that information to the platform (usually a ship or aircraft) that deployed the bathythermograph.
- **Torpedo Launch Accessories:** Torpedoes are usually recovered; however, materials such as decelerators/parachutes used with air-dropped torpedoes, guidance wire used with submarine-launched torpedoes, and ballast weights are expended. Explosive-filled torpedoes expend torpedo fragments.
- **Projectiles and Bombs:** Non-explosive projectiles, non-explosive bombs, or fragments from explosive projectiles and bombs are expended during training and testing activities. These items are primarily constructed of lead (most small-caliber projectiles) or steel (medium- and large-caliber projectiles and all bombs).
- **Blank Ammunition:** Blank ammunition is used in some training activities when the sound or flash of gunfire adds to the realism of the training activity, but safety of personnel or nearby civilians is critical. Blank ammunition contains gunpowder, but no projectile is sent downrange upon firing the weapon. Casings are expended as a result of firing blank ammunition.
- **Missiles, Rockets, and Loitering Munitions:** Non-explosive missiles and missile fragments from explosive missiles are expended during training and testing activities. Propellant, and any explosive material involved, is consumed during firing/detonation. Some missiles include a wire, which is also expended. Rockets are similar to missiles and both non-explosive and fragments may be expended.
- **Countermeasures:** Countermeasures (acoustic, chaff, flares, biodegradable polymer) are expended as a result of training and testing activities, with the exception of towed acoustic countermeasures. Chaff activities also include an expended canister, end caps, and pistons. Flares expend only end caps and pistons.
- **Targets:** Some targets are designed to be expended; other targets, such as aerial drones and remote-controlled boats, are recovered for re-use. Targets struck with ordnance will result in target fragments.

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# Appendix F Military Expended Materials and Direct Strike Analysis

# Supplemental Environmental Impact Statement/

# Overseas Environmental Impact Statement

# Mariana Islands Training and Testing

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# APPENDIX F MILITARY EXPENDED MATERIALS DIRECT STRIKE ANALYSIS

## F.1 Estimating the Effect of Military Expended Materials and Underwater Explosions on Abiotic Substrates as a Habitat for Biological Resources

This section discusses the methods and results for quantifying two scenarios under Alternative 1 and Alternative 2 of the Proposed Action: (1) the highly improbable worst-case scenario of all military expended materials or underwater explosions occurring on one particular substrate type; and (2) the unlikely, but slightly more realistic, scenario of uniform or proportional effect distribution within a particular area. Training and testing typically occurs in areas that are not called out or linked to specific activities for various reasons (e.g., flexibility and national security). Because military readiness activities would not be conducted under the No Action Alternative, it will not be discussed in this appendix.

This section describes the calculation of the disturbance footprint (i.e., military expended material footprint or explosive crater footprint) or an instantaneous effect of military expended materials or explosions on the substrate. The actual instantaneous effect on the bottom will depend on the number and location of military expended materials expended and not recovered, which is likely much lower and more concentrated than either scenario being analyzed. Longer-term effects on the bottom are far more difficult to quantify—refer to Section 3.1 (Sediments and Water Quality) and Section 3.3 (Marine Habitats), or Chapter 3 (Affected Environment and Environmental Consequences) for qualitative discussion.

The analysis requires two data elements: (1) a tabular summary of the military expended material or crater (underwater explosions) footprints expected in training and testing areas; and (2) a tabular summary of analysis dimensions, which includes abiotic substrate areas.

- The data for (1) comes from the Mariana Islands Training and Testing (MITT) Action Proponents and represents the most locational flexibility with regard to expenditure of military expended materials and underwater explosions. The data for the number of military expended materials and in-water explosions are then multiplied by an estimate of the footprint size. The footprints listed for various expended materials in previous MITT analyses were rough estimates compared to the more accurate estimates used for the current analysis.
    - The footprint sizes for military expended material are estimated to be twice the size of its material footprint, to account for some disturbed sediment around the object. Items with a casing have two separate entries in the data for their impact footprints. One incorporates that size of the unrecovered casing itself, and the other is for the size of the projectile. A percentage of the casings are assumed to be recovered and are not included in the footprints, which is an improvement over the analyses in previous MITT documents.
    - The footprint sizes for in-water explosive effects on the bottom are based on equations and empirical data reported in Gorodilov and Sukhotin (1996) and O'Keeffe and Young (1984). The crater footprint was then doubled to account for an area of ejected substrate.

- The data for analysis dimensions (data element 2) comes from the Benthic Habitat Database Technical Report, in addition to spatial data depicting training and testing areas.

The combined analysis dimensions data was used to create a table of substrate category acreage by training and testing areas, and large marine ecosystems. The percentage of affected substrate was calculated by totaling the effect footprint of individual activities divided by the total area of a given substrate in the training and testing area for which the effects could occur. The results are provided in Table F-2 and Table F-3.

Assumptions used in the Scenario 1 analysis included the following:

- Areas of unknown substrate type were not included in the analysis.
- The analysis focused on substrates that are likely to have habitat for sedentary benthic organisms; therefore, area that are not likely to have substrate inhabited by these organisms were excluded from the analysis.
- Artificial substrate was removed from the analysis because it was inconsistently mapped or mapped with a degree of uncertainty considered too high for quantitative analysis.

## F.2 Effects on Seafloor Habitats – Military Readiness Activities

Table F-1 shows the MITT Study Area bottom types. Using the methodology and assumptions described in Section F.1, Tables F-2 and F-3 show single-year effects on applicable habitat types, from both explosive charges and military expended materials.

**Table F-1: Area and Percent Coverage of Abiotic Substrate Types in the Study Area**

| Study Area | Habitat | | | | | | Total Area ($km^2$) |
|---|---|---|---|---|---|---|---|
| | Hard | | Mixed | | Soft | | |
| | Area ($km^2$) | % | Area ($km^2$) | % | Area ($km^2$) | % | |
| MITT | 215 | 68.05 | 74 | 23.39 | 27 | 8.56 | 316 |

**Table F-2: Effect from MEM on or Near the Bottom for Military Readiness Activities Under Alternative 1 and Alternative 2 in a Single Year**

| Alternative | Impact Footprint (Acres) | | | Effect by Bottom Type (Acres) | | |
|---|---|---|---|---|---|---|
| | Training | Testing | Combined | Hard | Mixed | Soft |
| Alternative 1 | 16.711 | 0.6491 | 17.360 | 11.814 | 4.061 | 1.486 |
| Alternative 2 | 26.847 | 1.7680 | 28.617 | 19.474 | 6.693 | 2.450 |

**Table F-3: Effect from Explosives on or Near the Bottom for Military Readiness Activities under Alternative 1 and Alternative 2 in a Single Year**

| Alternative | Impact Footprint (Acres) | | | Effect by Bottom Type (Acres) | | |
|---|---|---|---|---|---|---|
| | Training | Testing | Combined | Hard | Mixed | Soft |
| Alternative 1 | 0.291 | 0.078 | 0.369 | 0.251 | 0.086 | 0.032 |
| Alternative 2 | 0.291 | 0.078 | 0.369 | 0.251 | 0.086 | 0.032 |

## F.3 Statistical and Probability Analysis for Estimating Direct Strike Effect and Number of Potential Exposures from Military Expended Material

This section discusses the methods and results for calculating the probability of a direct strike of a marine animal from any military items resulting from the proposed training and testing activities falling toward (or directed at) the sea surface. For the purposes of this section, military items include non-explosive practice munitions, sonobuoys, acoustic countermeasures, targets, and high-energy lasers. Only marine mammals and sea turtles will be analyzed using these methods because animal densities are necessary to complete the calculations and density estimates are currently only available for marine mammals and sea turtles within the Study Area. The analysis conducted here does not account for explosive munitions because impacts from explosives are analyzed within the Navy Acoustic Effects Model as described in the report, Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase IV Training and Testing (U.S. Department of the Navy, 2024). Table F-4 provides a list of symbols used in the equations located in the preceding sections.

**Table F-4: A List of Symbols and Their Brief Descriptions as They Are Used in the Analysis**

| Symbol | Explanation |
|---|---|
| $A_S$ | Area of an individual marine animal |
| $L_S$ | Length of an individual marine animal |
| $W_S$ | Width of an individual marine animal |
| $N_S$ | Number of individual animals within a single marine species |
| $D_S$ | Density of animals within a single marine species |
| $A_{TotS}$ | The total footprint area of a single marine species |
| $A_{RC}$ | The area of a single testing/training range |
| $L_{mun}$ | The length of an individual piece of military expended material |
| $W_{mun}$ | The width of an individual piece of military expended material |
| $A_{mun}$ | The area of an individual piece of military expended material |
| $N_{mun}$ | The total number of military expended materials used of a single type (e.g., non-explosive bomb) |
| $A_I$ | The total area of military expended materials used of a single type (e.g., non-explosive bomb) |
| $A_{TotI}$ | The area of impact for all types of military expended materials; the impact footprint |
| $A_{BZ}$ | The area of the buffer zone around the impact footprint |
| $A_{Final}$ | The total area of concern, including the buffer zone ($A_{BZ}$), the impact footprint ($A_{TotI}$), and the total animal footprint of a single marine species ($A_{TotS}$) |
| $R_{TotS}$ | The total footprint radius of a single marine species |
| $R_{TotI}$ | The total footprint radius of the impact footprint for all types of military expended materials |
| $R_{BZ}$ | The buffer zone radius of the impact footprint for all types of military expended materials |
| P | The probability of impacting a marine animal through a military expended material direct exposure impact |
| T | Total number of possible surface animal exposures associated with a direct impact from military expended materials |

### F.3.1 Direct Impact Analysis

A probability was calculated to estimate the impact probability (P) and number of exposures (T) associated with direct impact of military items on marine animals and sea turtles on the sea surface within the specified training or testing area ($A_{RC}$) in which the activities are occurring. The statistical probability analysis is based on probability theory with "footprint" areas for marine animals and total impact inscribed inside the training or testing area. The analysis is over-predictive and conservative, in that it assumes: (1) that all animals would be at or near the surface 100 percent of the time, when in fact, marine mammals spend the majority of their time underwater (e.g., Fonseca et al., 2022; Hochscheid, 2014; Irvine et al., 2017; Lagerquist et al., 2000; Mate et al., 1995), and (2) that the animals are stationary, which does not account for any movement or any potential avoidance of the training or testing activity area. There is some research that suggests marine mammals will avoid areas where there is sonar activity but not areas where there is just vessel traffic noise; so, avoidance behavior in marine mammals is situationally dependent (for review see (Ellison et al., 2012)). For sea turtles, research has demonstrated changes in behavior of sea turtles in response to anthropogenic sounds (O'Hara & Wilcox, 1990; Samuel et al., 2005), but more research is needed to determine if they portray avoidance behavior to any form of anthropogenic activity.

There are three types of areas incorporated into the analyses: species area ($A_S$), total impact footprint area ($A_{TotI}$), and the buffer zone of the impact area ($A_{BZ}$). For each calculation, a basic area is assessed using either the area calculation for a rectangle (A = length * width) or a circle ($A = \pi R^2$, where R is the radius of a circle). These area calculations were used in four different scenarios that make assumptions about the type of interaction between the marine animal and the military expended materials. For the initial three scenarios, all areas are calculated using the rectangular method. For the fourth scenario, all areas are calculated using the circular method.

- Scenario 1: Purely static, rectangular scenario. Impact is assumed to be static (i.e., direct impact effects only; non-dynamic; no explosions or scattering of military items after the initial impact) with a military expended material directly hitting a marine animal. This scenario assumes the marine animal is fully inside the impact area when contact with the military expended material is made.
- Scenario 2: Dynamic scenario with end-on collision. It is assumed that the military expended material is moving through the water, in the same direction as the length of the impact zone, for a distance of six times the initial length of the impact area. The concept here is that the military expended material has forward momentum along the length of the impact area and can make contact with the marine animal at any point inside of this new impact footprint area.
- Scenario 3: Dynamic scenario with broadside collision. It is assumed that the military expended material is moving through the water, in the same direction as the width of the impact zone, for a distance of six times the initial width of the impact area. The concept here is that the military expended material has forward momentum along the width of the impact area and can make contact with the marine animal at any point inside of this new impact footprint area.

- Scenario 4: Purely static, radial scenario, in which the rectangular animal, buffer zone, and impact footprints are replaced with circular footprints. Basically, the assumption is that the animal and the military expended materials are moving in circular patterns, rather than straight paths. This scenario assumes the marine animal is fully inside the impact area when contact with the military expended material is made.

Static impacts (Scenarios 1 and 4) assume no additional aerial coverage effects of scattered military items beyond the initial impact. For dynamic impacts (Scenarios 2 and 3), the distance of any scattered military items must be considered by increasing the length (Scenario 2) or width (Scenario 3), depending on orientation (broadside versus end-on collision), of the impact footprint to account for the forward horizontal momentum of the falling object. Forward momentum typically accounts for six times the impact area's length or width. Significantly different values may result from the static and dynamic orientation scenarios. Both types of collision conditions can be calculated each with 50 percent likelihood (i.e., equal weighting between Scenarios 2 and 3, to average these potentially different values).

The method of area ($A_S$, $A_{TotI}$, and $A_{BZ}$) calculation will vary slightly with each scenario. First, the basic concepts behind the area calculations are addressed below.

- The individual animal area ($A_S$) was calculated by multiplying the length and the width of the animal ($A_S = L_S * W_S$), where width was 20 percent of the length for marine mammals and 84% of the length for sea turtles. Then, the species density and the range complex ($A_{RC}$) size were incorporated to produce the species total area ($A_{TotS}$). $A_S$ was multiplied by the number of animals ($N_S$) in the specified training or testing area, where $N_S$ was the product of the highest average month animal density ($D_S$) and the area of the range complex ($A_{TotS} = A_S * N_S = A_S * D_S * A_{RC}$). As a conservative scenario, the total animal footprint area was calculated for the species with the highest average monthly density in the training or testing area with the highest use of military items within the entire Study Area. For the remainder of the calculations $A_{TotS}$ was used to represent the presence of the species within the area.
- To assess the impact footprint area ($A_I$) for a single type of munition used in the range complex, the area of the munition ($A_{mun}$) was calculated by multiplying the length and width of the munition ($A_{mun} = L_{mun} * W_{mun}$). Then, $A_{mun}$ was multiplied by the total number of that munition type used in a year ($N_{mun}$). Thus, $A_I = N_{mun} * A_{mun}$ is the impact footprint for a single type of munition in a single range complex over a year.
- The $A_I$ for each munition type used in the range complex was then summed across all munition types to get a total impact footprint ($A_{TotI}$) for a year within a single range complex. As a conservative scenario, the total impact footprint area was calculated for the training or testing area with the highest use of military items within the entire Study Area. This total impact footprint area was then converted back into the length-width assessment, with the ratio of the impact area mirroring the animal $\frac{W_S}{L_S} = \frac{W_{TotI}}{L_{TotI}}$.
- In addition to the impact footprint and the species footprint, a buffer zone around the impact area footprint was included in the analysis. The purpose of this buffer zone was to be overly protective of the species to ensure that any species just outside of the impact area were also included in the analysis. The buffer zone was simply calculated by

taking half of the area of the total impact footprint ($A_{BZ} = A_{TotI} * 0.5$) for the rectangular scenarios. For the circular scenarios, an additional buffer zone radius ($R_{BZ}$) was calculated.

These calculations were then fed into the final calculation area ($A_{Final}$) for the three rectangular scenarios (Scenarios 1-3). So, $A_{Final1} = A_{BZ1} + A_{TotI1} + A_{TotS}$, where 1 designates Scenario 1. The same concept was applied for Scenarios 2 and 3, except the $L_{TotI}$ for Scenario 2 was multiplied by 6 and the $W_{TotI}$ for Scenario 3 was multiplied by 6, which influence both $A_{TotI}$ and $A_{BZ}$ for each of the scenarios. In each case, the buffer zone could also be calculated by simple subtraction $A_{BZ} = A_{Final} – A_{TotI} – A_S$, for each respective scenario. For Scenario 4, the radial scenario, the area calculation was based on a circle. $A_{Final4} = \pi * (R_{TotS} + R_{TotI} + R_{BZ})^2$. To calculate the buffer zone from the final area, the following equation could also be used:

$$A_{BZ4} = \sqrt{(\frac{A_{Final4}}{\pi})} - R_{TotI} - R_{TotS}.$$

Impact probability (P) is the probability of impacting one animal at its species peak density, with the given number, type, and dimensions of all military items used in training or testing activities occurring in the area per year. Therefore, P is the ratio of the final area for each scenario, which includes the species area, the impact footprint, and the buffer zone of the impact footprint, and the range complex area ($P = \frac{A_{Final}}{A_{RC}}$, where $A_{Final}$ is based on the value calculated in each scenario). The total number of possible exposures (T) within a given year is a product of the species density, the area of the range complex, and the impact probability ($T = (D_S * A_{RC})*P$). Using this procedure, P and T were calculated for each of the four scenarios, for the Endangered Species Act (ESA)-listed marine mammals and the non-ESA marine mammal and ESA-listed sea turtle species with the highest average month density (used as the annual density value) and for each military item type. The scenario-specific P and T values were averaged over the four scenarios (using equal weighting) to obtain a single scenario, averaged-annual estimate of P and T.

The analysis is expected to provide an overestimation of the probability of a strike for the following reasons: (1) it calculates the probability of a single military item (of all the items expended over the course of the year) hitting a single animal at its species' highest seasonal density; (2) it does not take into account the possibility that an animal may avoid military activities; (3) it does not take into account the possibility that an animal may not be at the water surface; (4) it does not take into account that most projectiles fired during training and testing activities are fired at targets, and so only a very small portion of those projectiles that miss the target would hit the water with their maximum velocity and force; and (5) it does not quantitatively take into account the Navy avoiding animals that are sighted through the implementation of mitigation measures.

### F.3.2 Parameters for Analysis

Impact probabilities (P) and number of exposures (T) were estimated by the analysis for the following parameters:

- Two action alternatives: Alternative 1 and Alternative 2. Animal densities, animal dimensions, and military item dimensions are the same for the two action alternatives.

- One training or testing area: Mariana Islands Training and Testing Study Area. Area is approximately 3,441,423 square kilometers respectively.
- The following types of non-explosive munitions or other items:
    - **Small-caliber projectiles:** up to and including 0.50 caliber rounds
    - **Medium-caliber projectiles:** larger than 0.50 caliber rounds but smaller than 57 millimeters (mm) projectiles
    - **Large-caliber projectiles:** includes projectiles greater than or equal to a 57 mm projectile
    - **Missiles:** includes rockets and jet-propelled munitions
    - **Bombs:** Non-explosive practice bombs and mine shapes, ranging from 10 to 2,000 pounds
    - **Torpedoes:** includes all lightweight torpedoes
    - **Sonobuoys:** includes all sonobuoys
    - **Targets:** includes expended airborne and surface, as well as mine shapes
    - **Lightweight torpedo accessories:** includes all accessories that are dropped along with the torpedo (e.g., nose cap, air stabilizer)
    - **Anchors:** includes blocks used to anchor mine shapes to the seafloor
    - **Acoustic countermeasures:** includes aircraft deployed acoustic countermeasures
    - **High-energy lasers:** includes high-energy laser weapons that are directed at a surface target
    - **Expended bathythermographs:** small sensor deployed from ships
    - **Animal species of interest:** The species of ESA-listed marine mammals expected in the MITT Study Area and the non-ESA listed marine mammal with the highest average month density in the MITT Study Area

### F.3.3 Output Data

Estimates of impact probability (P) and number of exposures (T) for a given species of interest were made for the specified training or testing area with the highest annual number of military items used for each of the two action alternatives. The calculations derived P and T from the highest annual number of military items used in the Study Area for the given alternative. Differences in P and T between the alternatives arise from different numbers of events (and therefore military items) for the two alternatives.

Results for marine mammals and sea turtles are presented in Table F-5 through Table F-8.

**Table F-5: Estimated Representative Marine Mammal Exposures from Direct Strike of a High-Energy Laser by Area and Alternative in a Single Year**

| MITT Study Area | | | | |
|---|---|---|---|---|
| Species | Training | | Testing | |
| | Alternative 1 | Alternative 2 | Alternative 1 | Alternative 2 |
| Blue Whale | 0.0000021 | 0.0000022 | 0.0000021 | 0.0000021 |
| Fin Whale | 0.0000017 | 0.0000017 | 0.0000017 | 0.0000017 |
| Humpback Whale | 0.1290252 | 0.1290840 | 0.1289779 | 0.1289779 |
| Sperm Whale | 0.0454001 | 0.0454291 | 0.0453769 | 0.0453769 |
| Sei Whale | 0.0000109 | 0.0000110 | 0.0000109 | 0.0000109 |
| Pantropical Spotted Dolphin | 0.0000000 | 0.0000000 | 0.0000000 | 0.0000000 |

**Table F-6: Estimated Representative Sea Turtle Exposures from Direct Strike of a High-Energy Laser by Area and Alternative in a Single Year**

| MITT Study Area | | | | |
|---|---|---|---|---|
| Species | Training | | Testing | |
| | Alternative 1 | Alternative 2 | Alternative 1 | Alternative 2 |
| Green Turtle | 0.0321414 | 0.0322051 | 0.0320912 | 0.0320912 |

**Table F-7: Estimated Representative Marine Mammal Exposures from Direct Strike of Military Expended Material by Area and Alternative in a Single Year**

| MITT Study Area | | | | |
|---|---|---|---|---|
| Species | Training | | Testing | |
| | Alternative 1 | Alternative 2 | Alternative 1 | Alternative 2 |
| Blue Whale | 0.0000244 | 0.0000371 | 0.0000034 | 0.0000146 |
| Fin Whale | 0.0000266 | 0.0000410 | 0.0000030 | 0.0000156 |
| Humpback Whale | 0.1502127 | 0.1589340 | 0.1317434 | 0.1428359 |
| Sperm Whale | 0.0575342 | 0.0628676 | 0.0468014 | 0.0531154 |
| Sei Whale | 0.0001041 | 0.0001570 | 0.0000162 | 0.0000633 |
| Pantropical Spotted Dolphin | 0.1672362 | 0.2048580 | 0.0982709 | 0.1371733 |

**Table F-8: Estimated Representative Sea Turtle Exposures from Direct Strike of Military Expended Materials by Area and Alternative in a Single Year**

| MITT Study Area | | | | |
|---|---|---|---|---|
| Species | Training | | Testing | |
| | Alternative 1 | Alternative 2 | Alternative 1 | Alternative 2 |
| Green Turtle | 0.0849260 | 0.1125958 | 0.0361857 | 0.0631411 |

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# Appendix G Public Participation

# Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Mariana Islands Training and Testing

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# APPENDIX G PUBLIC PARTICIPATION

This appendix describes outreach efforts, conducted by the Department of the Navy, including both the U.S. Navy and U.S. Marine Corps; the U.S. Army; the U.S. Air Force; and the U.S. Coast Guard (collectively referred to as "Action Proponents"), to involve the public and stakeholders during the development of the Supplemental Environmental Impact Statement (SEIS)/Overseas Environmental Impact Statement (OEIS) for Mariana Islands Training and Testing (MITT).

## G.1 Project Website

A website was established to provide the public with project information; it includes public notices, project fact sheets, maps, virtual presentations, National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA) Section 106 processes, project video, and public commenting information. Parties with demonstrated interest in the undertaking and its effects on historic properties may request to become a consulting party in the NHPA Section 106 process via the informational request form. The public is able to submit comments via the website comment form during designated comment periods and subscribe to receive future notifications via email. The project website is https://www.nepa.navy.mil/mitteis.

## G.2 Scoping Period

The public scoping period began with publication of the Notice of Intent in the *Federal Register* on June 7, 2025 (90 Federal Register 24109), and ran through July 22, 2025, Chamorro Standard Time (ChST). The *Federal Register* notice is found in Figure G-1. While holding a public scoping period is not required for an SEIS/OEIS, the Action Proponents held this scoping process to ensure understanding of the proposal and receive input from the public and stakeholders to enhance the accuracy and thoroughness of the environmental analysis.

### G.2.1 Public Notifications

The Action Proponents made significant efforts to notify the public of the scoping process and encourage participation. All public notices included information about the intent to prepare an SEIS/OEIS; the Proposed Action and its purpose and need; the virtual scoping presentation; the NEPA and NHPA Section 106 processes, including how to request information on the NHPA Section 106 consultation process and how to participate; public commenting information; and the website address. A summary of these efforts follows.

#### G.2.1.1 Notification Letters

Notification letters with a fact sheet enclosure were mailed June 5, 2025 (ChST), to 251 federal and local elected officials and government agencies and other key stakeholders. Entities that received a notification letter are listed in Table G-1, and an example of the letter can be found in Figure G-2: Scoping Notification LetterFigure G-2.

Federal Register / Vol. 90, No. 108 / Friday, June 6, 2025 / Notices 24109

mail to: CJMT Project Manager, 415 Chalan San Antonio Road, Suite 112, Baltej Pavillion Building, Tamuning, Guam 96913.

**SUPPLEMENTARY INFORMATION:** The purpose of the Proposed Action is to reduce joint training deficiencies for U.S. Armed Forces in the Indo-Pacific area of operations. The development and operation of a realistic and instrumented training environment on Tinian would enable forward-deployed U.S. Armed Forces to meet evolving operational training requirements and support U.S. training with allied nations, changes in U.S. force structure, and geographic repositioning of forces.

The Proposed Action would support land-based expeditionary warfare tactics and training within the Military Lease Area on Tinian and would accommodate land-based training for all service components of the United States Indo-Pacific Command, including the USMC, Navy, Air Force, Army, Special Operations Command, and Space Command, as well as U.S. allies and partners.

New training infrastructure would create a physical and virtual training environment to include two live-fire ranges, improvements to North Field, the development of Landing Zones, an expeditionary Base Camp at the former U.S. Agency for Global Media site, and a communications system using a combination of sensors, emitters, and communication towers. Subject to additional approvals, construction would include a biosecurity area at the Port of Tinian and an aircraft shelter at the Francisco Manglona Borja/Tinian International Airport. To ensure training unit and public safety during training, an on-island Training Area and Range Operations Command (Range Control) would be established. Range Control would schedule training and coordinate with local officials and the public.

Two training Alternatives and a No Action Alternative on Tinian are analyzed in this Revised Draft EIS. Under the No Action Alternative, existing land-based training at levels analyzed in existing NEPA documents for Tinian would continue (see the 2010 Mariana Islands Range Complex Final EIS/Overseas Environmental Impact Statement (OEIS), 2015 Mariana Islands Training and Testing EIS/OEIS, and associated consultations and authorizations). Much of the proposed training is similar to existing training in terms of type that have been conducted on Tinian in recent decades. Alternative 1 and Alternative 2 would represent new training infrastructure with varying increases over existing training tempos.

Potential effects on environmental resources resulting from activities included in the two Action Alternatives and the No Action Alternative were evaluated in accordance with NEPA. Resources analyzed in this Revised Draft EIS include, but are not limited to, public access, land use and recreation, socioeconomics, biological resources, cultural resources, noise, air quality, public health and safety, utilities, and groundwater and hydrology. The Revised Draft EIS also includes an analysis of measures that would avoid, minimize, or mitigate environmental effects potentially resulting from military training and construction of training infrastructure. Direct, indirect, and cumulative effects on these resource areas are analyzed in the Revised Draft EIS.

The USMC is coordinating and consulting with appropriate Federal agencies as required by the NHPA, Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, Clean Water Act, Rivers and Harbors Act, Coastal Zone Management Act, Clean Air Act, and other laws and regulations as determined to be applicable to the project.

The USMC distributed the Revised Draft EIS to the CNMI government agencies, Federal Government agencies they are consulting with, and other interested persons. The Revised Draft EIS is available for public review on the project website at *www.CJMTJointMilitaryTrainingEIS.com* and at these public libraries:

1. Joeten-Kiyu Public Library, Saipan.
2. Tinian Public Library, Tinian.
3. Antonio C. Atalig Memorial Rota Public Library, Rota.

The public involvement process is helpful in identifying public concerns and local issues to be considered during the development of the EIS. The USMC encourages the public to provide substantive comments on the Proposed Action and the environmental analysis, as well as the project's potential to affect historic properties as it relates to section 106 of the NHPA. All comments received prior to the deadline of August 20, 2025 at the in-person public meetings, electronically via the project website, or mailed to the address provided in the **ADDRESSES** section will be considered during the development of the Final EIS.

In-person public meetings on Tinian and Saipan will begin at approximately 5 p.m. local time; the meeting on Rota will begin at 3 p.m. local time. Informational posters will be displayed, and project team members will be available to discuss the Proposed Action and accept comments, written and oral, from the public. A Chamorro and Carolinian interpreter will be available at each of the five in-person public meetings.

Oral comments will be recorded by a stenographer. Equal weight will be given to oral and written statements.

Dated: May 28, 2025.

**A.R. DeMaio,**

*Lieutenant Commander, Judge Advocate General's Corps, U.S. Navy, Federal Register Liaison Officer.*

[FR Doc. 2025–09980 Filed 6–5–25; 8:45 am]

BILLING CODE 3810–FF–P

## DEPARTMENT OF DEFENSE

### Department of the Navy

### Notice of Intent To Prepare a Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement for the Mariana Islands Training and Testing (ID# EISX–007–17–USN–1744382878)

**AGENCY:** Department of the Navy (DoN), Department of Defense (DoD).

**ACTION:** Notice.

**SUMMARY:** Pursuant to the National Environmental Policy Act (NEPA), the National Environmental Policy Act of 1969, DoN regulations, and Presidential Executive Order 12114, the DoN (including both the United States (U.S.) Navy and the U.S. Marine Corps (USMC)) as the lead agency, jointly with the U.S. Air Force, the U.S. Army, and the U.S. Coast Guard (referred to as ''Action Proponents''), announce their intent to prepare a supplement to the 2015 Mariana Islands Training and Testing (MITT) Environmental Impact Statement (EIS)/Overseas EIS (OEIS) and the 2020 MITT Supplemental EIS (SEIS)/OEIS. The MITT SEIS/OEIS will include an analysis of training activities (referred to as ''training''); research, development, testing, and evaluation (referred to as ''testing'') activities; and range modernization and sustainment that will be conducted in the MITT Study Area beginning in July 2027. When discussed together, these activities are referred to as ''military readiness activities.''

**DATES:** The 45-day public scoping period begins on June 7, 2025, and ends on July 22, 2025, Chamorro Standard Time (ChST). The scoping period is extended 15 calendar days (from the usual 30-day period) to allow more time to provide comments. The DoN will host a virtual presentation and have public outreach material on the project website during the scoping period to

**Figure G-1: Federal Register Notice of Intent**

provide information related to the Proposed Action, its purpose and need, alternatives under consideration, environmental resource areas to be analyzed in the SEIS/OEIS, the NEPA process, the consultation under Section 106 of the National Historic Preservation Act (NHPA), and public involvement opportunities.

**ADDRESSES:** Comments on the scope of the SEIS/OEIS or information regarding the project's potential to affect historic properties pursuant to section 106 of the NHPA through the project website at *www.nepa.navy.mil/mitteis* or by mail to: Naval Facilities Engineering Systems Command Pacific, Attention: MITT SEIS/OEIS Project Manager, 258 Makalapa Drive, Suite 100, Pearl Harbor, HI 96860–3134.

**FOR FURTHER INFORMATION CONTACT:** U.S. Pacific Fleet Command, Attention: Ms. Heather Paynter, Environmental Public Affairs Specialist, 808–471–3769, *CPF-Environmental-PA@us.navy.mil,* or visit the project website at *www.nepa.navy.mil/mitteis.*

**SUPPLEMENTARY INFORMATION:** Within the DoN, the lead action proponent is Commander, U.S. Pacific Fleet. Additional DoN action proponents include Naval Sea Systems Command, Naval Air Systems Command, Office of Naval Research, and the U.S. Marine Corps (USMC). In addition to DoN action proponents, this SEIS/OEIS includes certain activities by the U.S. Air Force, U.S. Army, and U.S. Coast Guard when those activities are similar to Navy or USMC activities and are scheduled on DoN controlled at-sea ranges.

Proposed military readiness activities are generally consistent with those analyzed in the 2015 MITT EIS/OEIS and the 2020 MITT SEIS/OEIS and are representative of activities that the services have been conducting off Guam and around Commonwealth of the Northern Mariana Islands for decades.

The MITT Study Area (hereafter referred to as the "Study Area") is the same Study Area used for the 2015 MITT EIS/OEIS and the 2020 MITT SEIS/OEIS analysis, which includes in-water areas within the Mariana Islands Range Complex (MIRC), areas on the high seas to the north and west of the MIRC, a transit corridor between the MIRC and the Hawaii Range Complex, and pier side within Apra Harbor. The Study Area excludes land-based training areas located on Guam, Saipan, Tinian, and Rota that were included in the 2015 MITT EIS/OEIS. Similar to the 2020 MITT SEIS/OEIS, this action does not propose any changes to land-based activities on these islands that were analyzed in the 2015 MITT EIS/OEIS. Thus, activities on these islands are not reanalyzed in this supplement. As in the 2020 SEIS/OEIS, the only land component included in the Study Area is Farallon de Medinilla.

The Proposed Action is to continue to conduct military readiness activities within the Study Area. These activities include the use of active sonar and explosives while employing appropriate marine species protective mitigation measures.

The purpose of the Proposed Action is to ensure the U.S. military services, to include the U.S. Coast Guard, can organize, train, and equip service members and personnel to meet their respective national defense missions in accordance with their Congressionally-mandated requirements [1] and advance joint interoperability in Navy led exercises with other military services including foreign allies. A SEIS/OEIS is considered the appropriate level of analysis as there are updated activities which are similar to those analyzed in the 2015 MITT EIS/OEIS and the MITT 2020 SEIS/OEIS, and scientific information and acoustic effects criteria that are relevant to understanding the environmental effects of the Proposed Action. New information since the 2015 EIS/OEIS and the 2020 SEIS/OEIS will be considered in furtherance of NEPA and will support Marine Mammal Protection Act (MMPA) authorization requests.

The Action Proponents have identified two preliminary action alternatives to carry forward for analysis in the SEIS/OEIS along with the No Action Alternative. Alternative 1 reflects a representative year of training and testing to account for the natural fluctuation of training cycles and deployment schedules that generally limit the maximum level of training and testing occurring every year over any seven-year period. Alternative 2 reflects the maximum number of training and testing activities that could occur within a given year and assumes that the maximum level of activity would occur every year over any seven-year period. As required by NEPA for the purpose of establishing a baseline for analysis, a No Action Alternative will be evaluated which represents a scenario where no military readiness activities are conducted in the Study Area. The tempo and types of military readiness activities have fluctuated because of the introduction of new technologies, the evolving nature of international events, advances in war fighting doctrine and procedures, and changes in force structure (organization and basing of ships, submarines, aircraft, weapons, and Sailors). Such developments influence the frequency, type, duration, intensity, and location of required military readiness activities. The MITT SEIS/OEIS will reflect the current compilation of training and testing activities required to fulfill the military readiness requirements, and therefore both action alternatives include the analysis of newly proposed activities and changes to previously analyzed activities. Additionally, both action alternatives will include range modernization and sustainment necessary to support military readiness activities.

Environmental resources that are determined to be potentially affected are carried forward for full analysis. Resources to be evaluated include, but are not limited to, biological resources (including marine mammals and other protected species), sediments and water quality, air quality, noise, cultural resources, socioeconomics, and public health and safety. The Action Proponents will also analyze measures that would avoid, minimize, or mitigate environmental effects. The Action Proponents will conduct all coordination and consultation activities required by the MMPA, NHPA, ESA, Magnuson-Stevens Fishery Conservation and Management Act, Coastal Zone Management Act, Clean Air Act, and other laws and regulations determined to be applicable to the project. As part of this process, the DoN will seek the reissuance of authorizations under MMPA and ESA to support at-sea military readiness requirements within the Study Area beginning in July 2027.

Pursuant to NEPA, the Action Proponents invited the National Oceanic and Atmospheric Administration's National Marine Fisheries Service to be a cooperating agency in preparation of the SEIS/OEIS.

The scoping process is helpful in identifying public concerns and local issues to be considered during the development of the SEIS/OEIS. Federal agencies, Territorial agencies, the public, and interested persons are invited to comment on the scope of the SEIS/OEIS, including identifying potential alternatives or issues that should be addressed in the NEPA analysis, relaying environmental concerns, and providing information or analysis relevant to the Proposed Action or the project's potential to affect historic properties pursuant to Section 106 of the NHPA.

[1] 10 U.S.C. 8062 (Navy), 8063 (USMC), 9062 (U.S. Air Force), and 7062 (U.S. Army); and 14 U.S.C. 101–102 (U.S. Coast Guard).

**Figure G-1: Federal Register Notice of Intent (continued)**

Scoping comments submitted via the project website or mailed to the address provided in the **ADDRESSES** section will be considered during the development of the Draft SEIS/OEIS. Scoping comments should be postmarked or received online by 11:59 p.m. ChST on July 22, 2025, for consideration in the Draft SEIS/OEIS.

After the scoping period, the Action Proponents will coordinate with participating and cooperating agencies to develop a Draft SEIS/OEIS. The Action Proponents intends to release the Draft SEIS/OEIS in the winter of 2026, release the Final SEIS/OEIS in the winter of 2027, and sign a Record of Decision following the 30-day Final SEIS/OEIS wait period.

Dated: May 21, 2025.

**A.R. DeMaio,**

*Lieutenant Commander, Judge Advocate General's Corps, U.S. Navy, Federal Register Liaison Officer.*

[FR Doc. 2025–09429 Filed 6–5–25; 8:45 am]

BILLING CODE 3810–FF–P

## DEPARTMENT OF ENERGY

**[Docket No. 13–147–LNG]**

### Delfin LNG LLC; Request for Amendment of Long-Term Authorizations To Export Liquefied Natural Gas and for Additional Extension of Time To Commence Exports

**AGENCY:** Office of Fossil Energy and Carbon Management, Department of Energy.

**ACTION:** Notice of request.

**SUMMARY:** The Office of Fossil Energy and Carbon Management (FECM) (formerly the Office of Fossil Energy) of the Department of Energy (DOE), gives notice (Notice) of receipt of a request (Request), filed on May 2, 2025, by Delfin LNG LLC (Delfin). Delfin requests to amend its existing authorization to export domestically produced liquefied natural gas (LNG) to non-free trade agreement countries set forth in DOE/FE Order No. 4028, as amended, by extending the current commencement of export operations deadline from Delfin's proposed floating LNG (FLNG) liquefaction facility (Project) to June 1, 2031. Delfin also asks that its existing authorization be amended to reflect a facility redesign that includes three FLNG vessels instead of the original four. Delfin filed its Request under the Natural Gas Act (NGA) and DOE's regulations.

**DATES:** Protests, motions to intervene, or notices of intervention, as applicable, and written comments are to be filed as detailed in the Public Comment Procedures section no later than 4:30 p.m., eastern time, July 7, 2025.

**ADDRESSES:**

*Electronic Filing by email (Strongly encouraged): fergas@hq.doe.gov.*

*Postal Mail, Hand Delivery, or Private Delivery Services (e.g., FedEx, UPS, etc.):* U.S. Department of Energy (FE–34), Office of Regulation, Analysis, and Engagement, Office of Fossil Energy and Carbon Management, Forrestal Building, Room 3E–056, 1000 Independence Avenue SW, Washington, DC 20585.

Due to potential delays in DOE's receipt and processing of mail sent through the U.S. Postal Service, we encourage respondents to submit filings electronically to ensure timely receipt.

**FOR FURTHER INFORMATION CONTACT:**

Jennifer Wade or Peri Ulrey, U.S. Department of Energy (FE–34), Office of Regulation, Analysis, and Engagement, Office of Resource Sustainability, Office of Fossil Energy and Carbon Management, Forrestal Building, Room 3E–042, 1000 Independence Avenue SW, Washington, DC 20585, (202) 586–4749 or (202) 586–7893, *jennifer.wade@hq.doe.gov* or *peri.ulrey@hq.doe.gov*

Ajoke Agboola, U.S. Department of Energy (GC–76), Office of the Assistant General Counsel for Energy Delivery and Resilience, Forrestal Building, Room 6D–033, 1000 Independence Avenue SW, Washington, DC 20585, (240) 805–2147, *ajoke.agboola@hq.doe.gov*

**SUPPLEMENTARY INFORMATION:** On June 1, 2017, in DOE/FE Order No. 4028 (as amended) [1] and pursuant to NGA section 3(a),[2] DOE authorized Delfin to export domestically produced LNG by vessel from the proposed Project, to be located offshore of Cameron Parish, Louisiana, to any country with which the United States does not have a free trade agreement (FTA) requiring national treatment for trade in natural gas, which currently has or in the future develops the capacity to import LNG, and with which trade is not prohibited by U.S. law or policy (non-FTA countries). Delfin is authorized to export this LNG in a volume equivalent to 657.5 billion cubic feet per year of natural gas through December 31, 2050.[3]

On March 21, 2025, the U.S. Department of Transportation's Maritime Administration (MARAD) issued the license, under the Deepwater Port Act (DWPA), required for Delfin to own, construct, and operate its Project.[4] According to Delfin, the DWPA license requires Delfin to "begin construction of the deepwater port no later than five years after the effective date of the license," but "the deadline may be extended for delays in necessary construction permits, delays due to time-of-year construction limitations beyond Delfin's direct control, or additional periods as MARAD may permit for good cause." [5] Delfin notes that its DWPA license "does not mandate any timing deadline for completion of the Project." [6]

As relevant here, Order No. 4028, as amended, requires Delfin to commence export operations from the Project no later than June 1, 2029.[7] In its Request, Delfin asks DOE to extend the deadline to commence commercial non-FTA LNG export operations from the Project by another two years, from June 1, 2029, to June 1, 2031.[8]

Delfin also asks for an amendment "to reflect the current design of its Project in accordance with the [DWPA] license," stating that the amendment would "reflect the refinements of Delfin's Project over time [and would] not require any change in the authorized volumes nor in any of the other Ordering Paragraphs." [9] Specifically, "[t]o ensure that the export authorizations properly reflect the current Project design (as detailed to

[1] *Delfin LNG LLC,* DOE/FE Order No. 4028, Docket No. 13–147–LNG, Opinion And Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from a Proposed Floating Liquefaction Project and Deepwater Port 30 Miles Offshore of Louisiana to Non-Free Trade Agreement Nations (June 1, 2017), *reh'g denied,* DOE/FE Order No. 4028–A (Apr. 3, 2018), *amended by* DOE/FE Order No. 4028–B (Dec. 10, 2020) (extending term through 2050), *further amended by* DOE/FE Order No. 4028–C (May 18, 2021) (correcting and amending location of FLNG vessels), *further amended by* DOE/FECM Order No. 4028–D (Mar. 10, 2025) (extending export commencement deadline). In addition, Delfin's export authorization was amended by DOE/FE Order No. 4641 (Dec. 18, 2020) to include short-term export authority on a non-additive basis.

[2] 15 U.S.C. 717b(a).

[3] DOE/FE Order No. 4028, as amended in Order No. 4028–B (Ordering Para. E).

[4] MARAD Press Release, "The Maritime Administration Issues the License for the Delfin LNG, LLC Deepwater Port Application" (Mar. 21, 2025), *https://www.maritime.dot.gov/newsroom/maritime-administration-issues-license-delfin-lng-llc-deepwater-port-application.*

[5] Request at 5–6 & n.17 (May 2, 2025) (emphasis in original), *https://www.energy.gov/sites/default/files/2025-05/Delfin%20LNG%20DOE%20Extension%20request%20%28050225%29.pdf* (citing Delfin DWPA License, Article 5).

[6] *Id.* at 6 n.17.

[7] DOE/FECM Order No. 4028–D, at 25 (Ordering Para. B). Delfin has also asked DOE to amend its existing FTA authorization (DOE/FE Order No. 3393, as amended). DOE will address the FTA portion of the Request separately pursuant to NGA section 3(c), 15 U.S.C. 717b(c).

[8] Request at 2.

[9] *Id.*

**Figure G-1: Federal Register Notice of Intent (continued)**

## Table G-1: Entities that Received the Scoping Notification Letter

| ***Guam*** |
|---|
| ***Federal Elected Officials and Federal Agencies*** |
| U.S. Congress |
| Guam Air Traffic Control Center |
| U.S. Army Corps of Engineers |
| U.S. Coast Guard |
| U.S. Department of Agriculture |
| Animal and Plant Health Inspection Service |
| Wildlife Services |
| Natural Resources Conservation Service |
| Guam Service Center |
| U.S. Department of the Interior |
| National Park Service |
| War in the Pacific National Historic Park |
| U.S. Fish & Wildlife Service |
| Guam National Wildlife Refuge |
| Pacific Islands Office, Guam Office |
| Western Pacific Regional Fishery Management Council |
| Guam Education & Outreach |
| ***Local Elected Officials and Local Agencies*** |
| Office of the Governor |
| Community Defense Liaison Office |
| Guam Commission on Decolonization |
| Military and Regional Affairs |
| Office of the Lt. Governor of Guam |
| Office of the Senator |
| 38th Guam Legislature |
| Mayors' Council of Guam |
| Municipality of Agana Heights |
| Municipality of Asan-Ma'ina |
| Municipality of Barrigada |
| Municipality of Chålan Pågu-Otdot |
| Municipality of Dededo |
| Municipality of Hågat |
| Municipality of Hagåtña |
| Municipality of Humåtak |
| Municipality of Inalåhan |
| Municipality of Malesso' |
| Municipality of Mangilao |
| Municipality of Mongmong-To'to-Maite' |
| Municipality of Piti |
| Municipality of Sånta Rita-Sumai |
| Municipality of Sinajana |
| Municipality of Talo'fo'fo' |
| Municipality of Tamuning-Tumon-Harmon |
| Municipality of Yigo |
| Municipality of Yo'ña |
| Antonio B. Won Pat International Airport Authority (Guam International Airport) |
| Guam Ancestral Lands Commission |
| Guam Army National Guard |
| Guam Behavioral Health and Wellness Center |

Guam Bureau of Statistics and Plans
    Coastal Management Program
Guam Chamber of Commerce
Guam Consolidated Commission on Utilities
Guam Customs and Quarantine Agency
Guam Department of Agriculture
    Division of Aquatic and Wildlife Resources
    Forestry and Soil Resources
Guam Department of Education
    CHamoru Studies and Special Projects Division
Guam Department of Integrated Services for Individuals with Disabilities
Guam Department of Labor
Guam Department of Land Management
    Guam Chamorro Land Trust Commission
Guam Department of Public Health and Social Services
Guam Department of Public Works
Guam Department of Youth Affairs
Guam Economic Development and Commerce Authority
Guam Energy Office
Guam Environmental Protection Agency
    Water Pollution Control Program
    Water Resources Management Program
Guam Fire Department
Guam Homeland Security Department
    Office of Civil Defense
Guam Land Use Commission
Guam Memorial Hospital Authority
Guam Military Buildup Office
Guam Power Authority
    Consolidated Utility Services
Guam State Historic Preservation Office
    Department of Community and Cultural Affairs
Guam Veterans Affairs Office
Guam Visitors Bureau
    Cultural Heritage, Community Outreach and Branding
Guam Waterworks Authority
    Compliance & Safety Division
Kumision CHamoru
Northern Guam Soil and Water Conservation Districts
    Pacific Islands Area Soil and Water Conservation District
Port Authority of Guam
University of Guam
    Cooperative Extension Service
    Division of Natural Sciences
    Marine Laboratory
    Water and Environmental Research Institute
U.S. Marshals Service, District of Guam

***Saipan***

***Federal Elected Officials and Federal Agencies***

U.S. Congress
National Oceanic and Atmospheric Administration
    National Marine Fisheries Service

| |
|---|
| Commonwealth of the Northern Mariana Islands (CNMI) Field Office |
| U.S. Department of Agriculture |
| Natural Resources Conservation Service |
| Saipan, Tinian & Aguiguan Service Center |
| U.S. Department of the Interior |
| Office of Insular Affairs, Northern Mariana Islands |
| Western Pacific Regional Fishery Management Council |
| ***Local Elected Officials and Local Agencies*** |
| CNMI Office of the Governor |
| CNMI Public Information and Protocol Office |
| Office of the Mayor, Northern Islands |
| CNMI Senate |
| CNMI House of Representatives |
| CNMI Office of the Mayor |
| Municipality of Saipan |
| Asia Pacific Academy of Science, Education, and Environmental Management |
| CNMI Bureau of Military Affairs |
| CNMI Department of Commerce |
| CNMI Department of Lands and Natural Resources |
| Division of Fish and Wildlife |
| CNMI Department of Public Lands |
| CNMI Department of Public Safety |
| Office of the Commissioner |
| Tinian Fire Division |
| CNMI Division of Coastal Resources Management |
| CNMI Northern Marianas College Cooperative, Research, Extension and Education Service |
| CNMI Office of Military and Veteran Affairs |
| CNMI Zoning Office |
| Marianas Visitors Authority |
| Port of Saipan |
| Commonwealth Ports Authority |
| Saipan Chamber of Commerce |
| Saipan International Airport |
| ***Tinian*** |
| ***Federal Elected Officials*** |
| U.S. Congress |
| ***Local Elected Officials and Local Agencies*** |
| Office of the Mayor |
| Municipality of Tinian & Aguiguan |
| CNMI Department of Public Lands, Tinian Office |
| Tinian Chamber of Commerce |
| ***Rota*** |
| ***Federal Elected Officials*** |
| U.S. Congress |
| ***Local Elected Officials and Local Agencies*** |
| Office of the Mayor |
| Municipality of Rota |
| 19th Rota Municipal Council |
| Department of Public Lands, Rota Office |
| Rota Gaming Commission |
| ***Federal Agencies outside of Guam, Saipan, Tinian, and Rota*** |
| Advisory Council on Historic Preservation |

Federal Maritime Commission
- Bureau of Certification and Licensing
- Office of the Secretary

Marine Mammal Commission

U.S. Army Corps of Engineers
- Honolulu District

U.S. Coast Guard

U.S. Department of Agriculture
- Animal and Plant Health Inspection Service
  - Wildlife Services
- Natural Resources Conservation Service
- U.S. Forest Service
  - Pacific Southwest Region 5
  - Pacific Southwest Research Station
    - Institute of Pacific Islands Forestry

U.S. Department of Commerce
- National Oceanic and Atmospheric Administration
  - National Marine Fisheries Service
    - Headquarters
    - Office for Coastal Management
    - Office of Law Enforcement
    - Office of Protected Resources
    - Pacific Islands Regional Office
    - Protected Resources Division
  - National Ocean Service

U.S. Department of State
- Office of Environmental Quality

U.S. Department of the Interior
- National Park Service (Regions 8, 9, 10, 12)
- Office of Environmental Policy and Compliance
- Office of Insular Affairs
- U.S. Fish and Wildlife Service
  - Pacific Islands Office
  - Pacific Islands Refuges and Monuments Office
    - Marianas Trench Marine National Monument
  - Pacific Region
- U.S. Geological Survey
  - Pacific Coastal and Marine Science Center
  - Pacific Islands Water Science Center

U.S. Department of Transportation
- Federal Aviation Administration
  - Western Pacific Region
- Maritime Administration

U.S. Environmental Protection Agency
- Office of Environmental Justice and External Civil Rights
- Region IX
  - National Environmental Policy Act Office
  - Pacific Islands Office

Western Pacific Regional Fishery Management Council

**DEPARTMENT OF THE NAVY**
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR HI 96860-3131

IN REPLY REFER TO:
5090
Ser N46/0388
May 21, 2025

Salutation First Name Last Name
Title
Organization
Address 1 Address 2
City, State Zip Code

Håfa Adai Salutation2 Last Name:

SUBJECT: NOTICE OF INTENT TO PREPARE A SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT FOR MARIANA ISLANDS TRAINING AND TESTING

The Department of the Navy (lead agency), including both the U.S. Navy and the U.S. Marine Corps; the U.S. Air Force; the U.S. Army; and the U.S. Coast Guard (referred to as "Action Proponents"), are preparing a supplement to the 2015 Mariana Islands Training and Testing (MITT) Environmental Impact Statement (EIS)/Overseas EIS (OEIS) and the 2020 MITT Supplemental EIS (SEIS)/OEIS to assess the potential environmental effects associated with the Proposed Action to continue military readiness activities at sea and on Farallon de Medinilla (FDM) within the MITT Study Area (referred to as "Study Area"). The Navy as the lead agency for the Proposed Action is responsible for the scope and content of the SEIS/OEIS. The purpose of the Proposed Action is to ensure U.S. military services, to include the Coast Guard, can organize, train, and equip service members and personnel to meet their respective national defense missions.

The public is invited to comment on the scope of the SEIS/OEIS, including identifying potential alternatives or issues that should be addressed in the National Environmental Policy Act (NEPA) analysis, relaying environmental concerns, identifying historic properties, and providing information or analysis relevant to the Proposed Action or the project's potential to affect historic properties pursuant to Section 106 of the National Historic Preservation Act (NHPA). Parties with demonstrated interest in the undertaking and its effects on historic properties may request to become a consulting party in the Section 106 process. Please visit the project website at **www.nepa.navy.mil/mitteis** to view a virtual scoping presentation and learn more about the Proposed Action, its purpose and need, NEPA and NHPA Section 106 processes, and public involvement opportunities. Additional project information can also be found in the enclosed fact sheet (Enclosure).

The Action Proponents are accepting scoping comments from **June 7 to July 22, 2025,** Chamorro Standard Time (ChST). The public's input is welcome, valued, and appreciated. Comments will be considered under NEPA and pursuant to Section 106 of the NHPA. Comments may be submitted via the website at **www.nepa.navy.mil/mitteis** or by mail to:

**Figure G-2: Scoping Notification Letter**

5090
Ser N46/0388
May 21, 2025

Naval Facilities Engineering Systems Command Pacific
Attention: MITT SEIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

Scoping comments must be postmarked or received online by **11:59 p.m. ChST on July 22, 2025**, for consideration in the Draft SEIS/OEIS. You may also contact Ms. Heather Paynter, U.S. Pacific Fleet Environmental Public Affairs, 808-471-3769, CPF-Environmental-PA@us.navy.mil, if you have questions or would like to schedule a briefing.

Please help the Action Proponents inform the community about the intent to prepare an SEIS/OEIS for military readiness activities within the MITT Study Area by sharing this information with your staff and interested individuals.

Sincerely,

J. H. BEATTIE
Captain, U.S. Navy
Deputy Fleet Civil Engineer
By direction

Enclosure: Mariana Islands Training and Testing SEIS/OEIS fact sheet

EIS ID# EISX-007-17-USN-1744382878

2

**Figure G-2: Scoping Notification Letter (continued)**

#### G.2.1.2 Postcards

Postcards were mailed first-class to 500 interested individuals, non-governmental organizations, and other groups or organizations June 5, 2025 (ChST). The postcard is shown in Figure G-3.

#### G.2.1.3 Newspaper Advertisements

Display advertisements were published in the Guam Daily Post and Pacific Daily News (Guam), and Marianas Variety (Commonwealth of the Northern Mariana Islands [CNMI]) beginning June 7, 2025 (ChST), for three consecutive publication days. The newspaper advertisement is shown in Figure G-4.

#### G.2.1.1 News Release

A news release was distributed by the Joint Region Marianas (JRM) Public Affairs Office (PAO) to local and regional media outlets June 6, 2025 (ChST). The news release is shown in Figure G-5**.**

#### G.2.1.2 Social Media Post

The JRM PAO posted information on existing social media platforms, such as Facebook, June 5, 2025 (ChST), to notify their followers. The social media post is shown in Figure G-6.

#### G.2.1.3 Email Notifications

An email notification was distributed June 7, 2025 (ChST), to 75 existing website subscribers.

### G.2.2 Public Scoping Information

The Action Proponents developed informational materials for the public to learn more about the Proposed Action, the environmental analysis process, and public involvement opportunities.

#### G.2.2.1 Fact Sheet

A project fact sheet was developed in English and translated into CHamoru (Guam) and Carolinian. Fact sheets were included in the notification letter mailings, at stakeholder briefings, and on the project website.

#### G.2.2.2 Project Video

The Action Proponents utilized a previous project overview video to provide information on the importance of training and testing in the Study Area. The project video was available on the project website.

#### G.2.2.3 Virtual Scoping Presentation

The Action Proponents prepared a virtual scoping presentation and made it available on the project website to provide the public with detailed information about the Proposed Action, its purpose and need, the importance of training and testing in the Study Area, environmental resource areas to be analyzed in the Draft SEIS/OEIS, the Navy's marine species research and monitoring program, NEPA and NHPA Section 106 processes, public involvement opportunities, and commenting information.

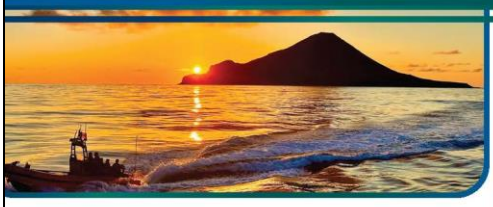
### G.2.2.4 Stakeholder Briefings

The Action Proponents briefed multiple project stakeholders to provide information and to identify and respond to issues early in the process (Table G-2). Briefings were also offered upon request to recipients of the notification letters.

**Table G-2: Stakeholder Briefings**

| Stakeholders | Conducted By | Format of Outreach | Date |
|---|---|---|---|
| CNMI Department of Land and Natural Resources Fish and Wildlife | U.S. Pacific Fleet Environmental Readiness | In Person | June 16, 2025 |
| CNMI Army Coordination Element Guam | U.S. Pacific Fleet Environmental Readiness | In Person | June 16, 2025 |
| CNMI Commonwealth Bureau of Military Affairs | U.S. Pacific Fleet Environmental Readiness | In Person | June 16, 2025 |
| DoD-CNMI Environmental & Land Stewardship Work Group | U.S. Pacific Fleet Environmental Readiness | In Person | June 16, 2025 |
| National Marine Fishery Service Pacific Islands Regional Office, Saipan Office | U.S. Pacific Fleet Environmental Readiness | In Person | June 16, 2025 |
| Mariana Trench Marine National Monument | U.S. Pacific Fleet Environmental Readiness | In Person | June 17, 2025 |
| CNMI Historic Preservation Office | U.S. Pacific Fleet Environmental Readiness | In Person | June 17, 2025 |
| CNMI Department of Community and Cultural Affairs | U.S. Pacific Fleet Environmental Readiness | In Person | June 17, 2025 |
| CNMI Bureau of Environmental and Coastal Quality Divisions of Environmental Quality and Coastal Resource Management | U.S. Pacific Fleet Environmental Readiness | In Person | June 17, 2025 |
| DoD-CNMI Senior Stakeholders Executive Session | U.S. Pacific Fleet Environmental Readiness | In Person | June 17, 2025 |
| DoD-CNMI Agency Session | U.S. Pacific Fleet Environmental Readiness | In Person | June 18, 2025 |
| Western Pacific Fisheries Management Council CNMI Advisory Panel | U.S. Pacific Fleet Environmental Readiness | In Person | June 18, 2025 |
| Tinian Women's Association | U.S. Pacific Fleet Environmental Readiness | In Person | June 19, 2025 |
| Tinian Mayor's Office | U.S. Pacific Fleet Environmental Readiness | In Person | June 20, 2025 |
| Western Pacific Fisheries Management Council Guam Advisory Panel | U.S. Pacific Fleet Environmental Readiness | In Person | June 19, 2025 |
| Guam Department of Agriculture | U.S. Pacific Fleet Environmental Readiness | In Person | June 20, 2025 |
| Guam Department of Agriculture Department of Aquatic & Wildlife Resources | U.S. Pacific Fleet Environmental Readiness | In Person | June 20, 2025 |
| Guam Bureau Statistics and Plans Guam Coastal Management Program | U.S. Pacific Fleet Environmental Readiness | In Person | June 20, 2025 |
| Guam Community Defense Liaison Office | U.S. Pacific Fleet Environmental Readiness | In Person | June 20, 2025 |
| University of Guam -- Sea Grant Program | U.S. Pacific Fleet Environmental Readiness | In Person | June 20, 2025 |

# Mariana Islands Training and Testing
## Supplemental EIS/OEIS



The Department of the Navy (lead agency), including both the U.S. Navy and the U.S. Marine Corps; the U.S. Air Force; the U.S. Army; and the U.S. Coast Guard (referred to as "Action Proponents"), are preparing a supplement to the 2015 Mariana Islands Training and Testing (MITT) Environmental Impact Statement (EIS)/Overseas EIS (OEIS) and the 2020 MITT Supplemental EIS (SEIS)/OEIS to assess the potential environmental effects associated with the Proposed Action to continue military readiness activities at sea and on Farallon de Medinilla (FDM) within the MITT Study Area. The purpose of the Proposed Action is to ensure U.S. military services, to include the U.S. Coast Guard, can organize, train, and equip service members and personnel to meet their respective national defense missions.

The public is invited to comment on the scope of the SEIS/OEIS, including identifying potential alternatives or issues that should be addressed in the National Environmental Policy Act (NEPA) analysis, relaying environmental concerns, identifying historic properties, and providing information or analysis relevant to the Proposed Action or the project's potential to affect historic properties pursuant to Section 106 of the National Historic Preservation Act (NHPA). The Action Proponents are accepting scoping comments from **June 7 to July 22, 2025, Chamorro Standard Time (ChST)**.

For more project information, please view a virtual scoping presentation at **www.nepa.navy.mil/mitteis**. Comments can be submitted online or mailed to:

Naval Facilities Engineering Systems Command Pacific
Attention: MITT SEIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

The public's input is welcomed, valued, and appreciated.

**Please share this information with friends and family to help inform your community.**

**Comments must be postmarked or received online by 11:59 p.m. ChST on July 22, 2025, for consideration in the Draft SEIS/OEIS.**

### Proposed Action

The Proposed Action is to continue military readiness activities within the MITT Study Area. Military readiness activities include training; research, development, testing, and evaluation (referred to as "testing") activities; and range modernization and sustainment. Proposed training and testing activities are similar to those previously analyzed and are representative of activities conducted around the Mariana Islands for decades, with some updates to the type, frequency, duration, intensity, and location.

At-sea military readiness activities may include the use of active sonar, explosives, and other sources of sound. The Action Proponents would continue to employ mitigation measures when conducting at-sea activities to reduce or avoid potential adverse effects on marine species. The Navy will seek the reissuance of an authorization under the Marine Mammal Protection Act and consultations under the Endangered Species Act to support at-sea military readiness requirements within the Study Area beyond July 2027 and will comply with other applicable laws and regulations.

The Navy, as the lead agency, will initiate NHPA Section 106 consultation and comply with existing 2020 Guam and 2022 Commonwealth of the Northern Mariana Islands programmatic agreements in coordination with the historic preservation offices and all signatories to those agreements.

For more information or to submit comments online, visit **www.nepa.navy.mil/mitteis**.

ID#-EISX-007-17-USN-1744382878

Naval Facilities Engineering
Systems Command Pacific
Attention: MITT SEIS/OEIS
Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

**Figure G-3: Scoping Postcard Mailer**

**YOU ARE INVITED TO PARTICIPATE**
**in the Public Scoping Process for**
**Mariana Islands Training and Testing Supplemental EIS/OEIS**

The Department of the Navy (lead agency), including both the U.S. Navy and the U.S. Marine Corps; the U.S. Air Force; the U.S. Army; and the U.S. Coast Guard (referred to as "Action Proponents"), are preparing a supplement to previous environmental analyses to assess the potential environmental effects associated with the Proposed Action to continue military readiness activities at sea and on Farallon de Medinilla (FDM) within the Mariana Islands Training and Testing (MITT) Study Area. The purpose of the Proposed Action is to ensure U.S. military services, to include the U.S. Coast Guard, can organize, train, and equip service members and personnel to meet their respective national defense missions.

**Public Involvement Opportunity**

The public is invited to comment on the scope of the MITT Supplemental Environmental Impact Statement (SEIS)/Overseas EIS (OEIS), including identifying potential alternatives or issues that should be addressed in the National Environmental Policy Act (NEPA) analysis, relaying environmental concerns, identifying historic properties, and providing information or analysis relevant to the Proposed Action or the project's potential to affect historic properties pursuant to Section 106 of the National Historic Preservation Act.
The Action Proponents are accepting scoping comments from **June 7 to July 22, 2025, Chamorro Standard Time (ChST)**.

For more project information, please view a virtual scoping presentation at **www.nepa.navy.mil/mitteis**. Comments can be submitted online or by mail to:

Naval Facilities Engineering Systems Command Pacific
Attention: MITT SEIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

**Scoping comments must be postmarked or received online by 11:59 p.m. ChST on July 22, 2025, for consideration in the Draft SEIS/OEIS.**

ID#EISX-007-17-USN-1744382878

**Figure G-4: Scoping Newspaper Advertisement**

**COMMANDER, JOINT REGION MARIANAS**
**Public Affairs Office**
**Main: (671) 349-2115**
**Fax: (671) 349-1201**
**E-Mail: jrmpublicaffairs@us.navy.mil**

*FOR IMMEDIATE RELEASE*
*Press Release 25-036*

## U.S. Military Services Announce Intent to Prepare a Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement for Mariana Islands Training and Testing

**ASAN, Guam** – The Department of the Navy (lead agency), including both the U.S. Navy and the U.S. Marine Corps; the U.S. Air Force; the U.S. Army; and the U.S. Coast Guard (referred to as "Action Proponents"), are preparing a supplement to the 2015 Mariana Islands Training and Testing (MITT) Environmental Impact Statement (EIS)/Overseas EIS (OEIS) and the 2020 MITT Supplemental EIS (SEIS)/OEIS to assess the potential environmental effects associated with the Proposed Action to continue military readiness activities at sea and on Farallon de Medinilla (FDM) within the MITT Study Area (referred to as "Study Area").

The Navy as the lead agency for the Proposed Action is responsible for the scope and content of the SEIS/OEIS. The purpose of the Proposed Action is to ensure U.S. military services, to include the Coast Guard, can organize, train, and equip service members and personnel to meet their respective national defense missions.

The public is invited to comment on the scope of the SEIS/OEIS, including identifying potential alternatives or issues that should be addressed in the National Environmental Policy Act (NEPA) analysis, relaying environmental concerns, identifying historic properties, and providing information or analysis relevant to the Proposed Action or the project's potential to affect historic properties pursuant to Section 106 of the National Historic Preservation Act (NHPA). The Action Proponents are accepting scoping comments from **June 7 to July 22,** Chamorro Standard Time (ChST).

Military readiness activities include training; research, development, testing, and evaluation (referred to as "testing") activities; and range modernization and sustainment. Proposed training and testing activities are similar to those previously analyzed and are representative of activities conducted around the Mariana Islands for decades, with updates to the type, frequency, duration, intensity, and location.

At-sea military readiness activities may include the use of active sonar, explosives, and other sources of sound. The Action Proponents would continue to employ mitigation measures when conducting at-sea activities to reduce or avoid potential adverse effects on marine species. The Navy will seek the reissuance of an authorization under the Marine Mammal Protection Act and consultations under the Endangered Species Act to support at-sea military readiness

– more –

**Figure G-5: Scoping News Release**

requirements within the Study Area beyond July 2027 and will comply with other applicable laws and regulations.

The DoN will initiate consultation in accordance with Section 106 of the NHPA. The Navy will comply with the existing 2020 *Programmatic Agreement Between the Commander, Joint Region Marianas and the Guam State Historic Preservation Officer, Regarding Military Training and Testing on and within the Surrounding Waters of the Island of Guam* and the 2022 *Programmatic Agreement Between the Commander, Joint Region Marianas and the Commonwealth of the Northern Mariana Islands Historic Preservation Officer, Regarding Military Training and Testing on and within the Surrounding Waters of the Islands of the Commonwealth of the Northern Mariana Islands* in coordination with the historic preservation offices of Guam and the Commonwealth of the Northern Mariana Islands and all signatories to those agreements.

The Study Area has not changed from the 2020 environmental analysis. The Study Area includes the at-sea areas of the Mariana Islands Range Complex (MIRC); additional areas on the high seas north and west of the MIRC; the transit corridor between the MIRC and the Hawaii Range Complex; Navy pierside and harbor locations on Guam; and the land-based training area on FDM. The SEIS/OEIS does not include changes to the land-based activities on Guam, Saipan, Tinian, and Rota previously analyzed in 2015. Therefore, activities on these islands will not be reanalyzed in the upcoming SEIS/OEIS.

Scoping comments must be postmarked or received online by **11:59 p.m. ChST on July 22** for consideration in the Draft SEIS/OEIS. Comments may be submitted via the project website at **www.nepa.navy.mil/mitteis** or by mail to:

Naval Facilities Engineering Systems Command Pacific
Attention: MITT SEIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

The public's input is welcomed, valued, and appreciated.

Comments will be considered under NEPA and pursuant to Section 106 of the NHPA. There will be another public comment opportunity when the Draft SEIS/OEIS is available, which is anticipated to be released in January/February 2026.

Please visit the project website at **www.nepa.navy.mil/mitteis** to view a virtual scoping presentation and learn more about the Proposed Action, its purpose and need, NEPA and NHPA Section 106 processes, and public involvement opportunities.

Media seeking further information should contact Joint Region Marianas Public Affairs at jrmpublicaffairs@us.navy.mil or 671-349-4055.

**Please help inform your community by sharing the information in this news release.**

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ID#-EISX-007-17-USN-1744382878

**Figure G-5: Scoping News Release (continued)**

https://www.facebook.com/jrmguam/

**Joint Region Marianas**
June 5 at 11:28 PM ·

You are invited to participate in the Public Scoping Process for the Mariana Islands Training and Testing (MITT) Supplemental Environmental Impact Statement (SEIS) / Overseas EIS (OEIS).

The U.S. Navy, Marine Corps, Air Force, Army, and Coast Guard are preparing a supplement to previous analyses to assess the potential environmental effects associated with the Proposed Action to continue military readiness activities at sea and on Farallon de Medinilla within the MITT Study Area.

Interested members of the public are invited to learn more and submit comments during a public scoping period from June 7 to July 22, 2025.

Comments will be considered under the National Environmental Policy Act and pursuant to Section 106 of the National Historic Preservation Act.

Comments must be postmarked or received online by 11:59 p.m. ChST on July 22, 2025, for consideration in the Draft SEIS/OEIS. For more information or to submit comments online, visit www.nepa.navy.mil/mitteis.

14 2 shares

Like Comment Share

Write a comment...

**Figure G-6: Social Media Post**

### G.2.3 Public Scoping Comments

Public comments were accepted via the project website and by postal mail. A total of 19 public comments were received. All comments submitted during the public scoping period are part of the public record, and relevant and substantive comments were considered during the development of the Draft SEIS/OEIS. A summary of public comments is found in Table G-3.

**Table G-3: Summary of Scoping Comments**

| Resource Area/Topic | Issue/Concern |
|---|---|
| Proposed Action | • Concerns about continuing military training and testing in the Mariana Islands.<br>• Questions about the scope of the project, including changes in proposed activities from previous analyses and activity baselines.<br>• Concerns about potential impacts on infrastructure by military activities.<br>• Concerns about sinking ships and the effects on fishes and other marine species.<br>• Concerns about long-term effects of military activities on the FDM (No'os) ecosystem and surrounding marine environments.<br>• Concerns that debris or expended materials from military activities would remain in the environment.<br>• Requests for the Action Proponents to evaluate an alternative that includes the demilitarization of the Study Area and Mariana Islands.<br>• Questions about where military readiness activities would be conducted in proximity to Rota.<br>• Questions about equipment or expended materials left on FDM.<br>• Recommendations to shift Warning Area-517 slightly eastward to reduce fisher access limitations to productive fishing grounds.<br>  ○ Concerns about training and testing activities closing access for fishers at various Warning Areas and other ranges off Guam during prime fishing times and in prime fishing areas, such as Ritidian.<br>• Concerns about environmental impacts resulting from temporary minefields and underwater detonations in Agat Bay and other similar areas.<br>• Statements expressing general opposition to the proposal.<br>• Requests to consider alternatives that support geographic exclusion zones to better protect critical ecosystems and Indigenous resources.<br>• Concerns about the impacts on Apra Harbor from proposed activities.<br>  ○ Requests and suggestions for close coordination with local agencies to prevent disruption to time-sensitive cargo deliveries, fuel resupply, and essential civilian maritime activities.<br>• Requests to consider the impacts military activities may have on infrastructure upgrade planning. |
| Sediments and Water Quality | • Concerns about how military readiness activities would affect water quality.<br>• Recommendations for direct water quality and sediment monitoring, including baseline and reference data collection, and comparing values to water quality standards and coral-specific thresholds.<br>• Recommendations to consider the inclusion of the antidegradation policy that is part of CNMI's water quality standards.<br>• Requests to detail active monitoring techniques used to limit suspended solids and control turbidity in the water following training and testing activities.<br>• Concerns about biosecurity risk associated with ballast water and incidental discharges from military vessels. |

| Resource Area/Topic | Issue/Concern |
|---|---|
| | • Concerns about the effects of chemicals, metals, and hazardous discharges from military expended materials and military equipment.<br>• Concerns about groundwater contamination from military activities.<br>• Questions about the general approach to be taken for the water quality analysis in the SEIS/OEIS, and requests for a comprehensive assessment.<br>• Recommendations for toxicology assessments on the potential bioaccumulation of toxins and chemicals in marine organisms found in the MITT Study Area. |
| Air Quality and Greenhouse Gases | • Concerns about how military readiness activities would affect clean air and climate change. |
| Biological Resources<br><br>*(Marine Habitats, Marine Mammals, Sea Turtles, Marine Birds, Marine Vegetation, Marine Invertebrates, Fishes)* | • Concerns about the effects of military readiness activities on coral reefs, especially from debris and expended materials.<br>• Recommendations for updated dive surveys to assess the health and status of coral reefs and undersea flora/fauna.<br>• Concerns about the effects military readiness activities would have on sensitive species, seafood contamination, and invasive species.<br>• Concerns about the impacts of proposed military readiness activities on the Micronesian megapode; migratory birds, such as boobies, terns, and frigates; cetaceans, such as beaked whales, humpback, and false killer whales; and green sea turtles.<br>• Concerns about how noise from military readiness activities could startle marine species and could lead to hearing loss.<br>• Concerns about the effects of sonar and other military activities on marine species and the potential linkage to stranding events.<br>  ○ Requests for equipment or financial assistance to manage strandings and perform necropsy studies.<br>• Concerns about the impacts military readiness activities would have on fisheries and marine biodiversity.<br>• Concerns about how military readiness activities would affect endangered and endemic marine species.<br>• Recommendations to increase the frequency of coral health surveys and monitoring.<br>• Requests to analyze the effects of noise on coral reefs.<br>• Concerns about the potential effects military activities would have on critical habitats of marine and terrestrial species, such as the Mariana crow, green sea turtles, and the Mariana fruit bat.<br>• Recommendations to integrate data from recent scientific cruises in the Mariana Islands (May 2025 Ocean Exploration Trust and July 2025 National Oceanic and Atmospheric Administration expeditions) to support spatial analysis of deep-sea coral, seamounts, hydrothermal vents, and other sensitive habitats.<br>• Requests to minimize disruptions to traditional and commercial fishing activities through early and inclusive coordination.<br>• Questions about how the proposal would impact permitting fees from Distant Waters Fishing Nations for fishing in Exclusive Economic Zones of Palau and Federated States of Micronesia.<br>• Requests to incorporate all previously stipulated conditions from the Guam Bureau of Statistics and Plans Coastal Zone Management Act consistency determination, and to follow the proper channels to satisfy the Federal Consistency requirements of the Coastal Zone Management Act.<br>• Concerns about vessel strikes on marine mammals and sea turtles. |

| Resource Area/Topic | Issue/Concern |
|---|---|
| | • Concerns about contaminants affecting fish populations and the people consuming these fish.<br>  ○ Questions about fish species most impacted by military activities.<br>• Concerns about potential impacts on essential fish habitat. |
| Terrestrial Species and Habitats | • Concerns about the negative effects of military activities on the local fauna and flora of FDM (No'os).<br>• Concerns about impacts on the Mariana fruit bat and tree snails from military activities.<br>• Concerns about terrestrial species ingesting military debris.<br>• Concerns about noise from military readiness activities startling wildlife, including driving out roosting sites for the Mariana fruit bat.<br>• Concerns about how military readiness activities would affect endangered and endemic species, such as the Mariana fruit bat, Mariana crow, and the Rota bridled white-eye.<br>• Concerns about how military readiness activities would affect species habitats, such as forests, limestone cliffs, and coastal ecosystems. |
| Cultural Resources | • Concerns about military activities in the Mariana Islands and effects on Indigenous people of the Pacific, sacred lands, and sacred water.<br>• Concerns about the impacts military readiness activities would have on traditional fishing grounds.<br>• Concerns that military readiness activities would interfere with traditional practices, such as talaya fishing, reef gleaning, and communal gatherings. |
| Socioeconomics | • Concerns about how activities would affect food security.<br>• Recommendations to describe the effects of activities on local infrastructure and utilities, and the storage and disposal of hazardous substances and solid waste, on Guam and CNMI.<br>  ○ Include discussions on the impacts on goods, services, and resources on the islands, and how these impacts would be minimized.<br>• Questions about the effects of military activities on marine tourism, public access, navigation routes, recreation, fishing, and shipping.<br>• Questions about whether access restrictions would disproportionately affect local communities who primarily rely on certain ocean areas contained in the Study Area.<br>• Questions about the general approach to be taken on the socioeconomics analysis; potential for compensation to cover economic hardships; deployment of Fish Aggregating Devices and financial support for saltwater aquaculture programs to minimize fishing impacts; and financial contributions to local infrastructure improvement projects. |
| Public Health and Safety | • Requests to prioritize the long-term health of the local people, waters, and ecosystems.<br>• Concerns about ocean access.<br>• Concerns about how activities would affect public health, especially of children.<br>• Recommendations to conduct a seafood contamination study representative of local seafood consumption patterns to determine any potential connection to testing and training activities.<br>• Concerns about the effects of minefields, underwater explosives, sonar, and other underwater noise on public safety.<br>• Concerns about military activities compromising vessel safety and Apra Harbor port efficiency.<br>• Requests to post signage for Surface Danger Zones in the Study Area. |

| Resource Area/Topic | Issue/Concern |
|---|---|
| Mitigation Measures and Monitoring | • Concerns about the effectiveness of existing mitigation measures, such as observation-based mitigation.<br>• Concerns that adaptive management plans are reactive rather than proactive, and that development of proactive mitigation measures are necessary.<br>• Requests for new mitigation measures to address noise, maritime safety, climate change, and legacy damage.<br>  ○ Recommendations for new measures include temporal separation protocols, predefined safety corridors, hazard simulation modeling with commercial vessel data, and inclusion of third-party observers.<br>  ○ Requests for passive acoustic monitoring to be a mandated mitigation measure.<br>  ○ Questions about whether new mitigation measures would be developed to address the changes in type, location, duration, and frequency of proposed activities.<br>• Recommendations to consider geographic mitigations to avoid coral reef habitats, areas with shipwrecks, and hard substrate areas, including the folllowing:<br>  ○ Measures that minimize military readiness activities during coral reef bleaching events to eliminate additional stressors and foster reef recovery.<br>  ○ Measures that minimize or halt in-water activities during primary coral spawning events each year for both hard and soft corals.<br>• Recommendations to consider mitigation measures to prevent water runoff into the ocean from training and testing activities conducted on FDM.<br>• Requests to detail the biosecurity measures/plan that would be employed to ensure that invasive species, such as the brown tree snake, do not spread from island to island due to training and testing activities.<br>  ○ Requests to collaborate with local agencies focused on marine invasive species.<br>• Requests to post notices to mariners at Agat and Agana marinas detailing schedules and locations to help minimize disruptions to fishing operations and ensure maritime safety.<br>  ○ Requests to consider expanded notices to mariners and use real-time digital alerts.<br>• Requests for Action Proponents to distribute information on area closures and activity schedules to local government agencies, nongovernmental organizations, fishing clubs, air and sea transport companies, and local media. Distribution methods should include email, social media, and podcasts.<br>  ○ Place printed notices at agency bulletin boards, fishing supply stores, local shops and markets, and announcements on AM radio to reach elders and rural communities.<br>• Recommendations to schedule activities to avoid overlapping with local fishing tournaments, cargo transport operations, and traditional inter-island voyages.<br>• Recommendations to conduct or support baseline and post-training environmental monitoring for water quality, fish stock health, catch rates, acoustic impacts, and overall ecosystem conditions; make findings publicly available.<br>• Recommendations to consider funding and supporting fishing ground restoration projects if degradation occurs.<br>• Recommendations to consider other geographic mitigations, such as avoidance of humpback whale breeding sites and seasons. |

| Resource Area/Topic | Issue/Concern |
|---|---|
| | • Recommendations to consider independent, third-party monitoring and enforcement.<br>• Recommendations to communicate and collaborate with the U.S. Bureau of Ocean Energy Management to identify submerged historic properties within the Study Area and to create avoidance measures around those areas.<br>• Concerns about oversight and enforcement of proposed mitigation measures.<br>• Requests for survey methods and reports for marine species avoidance measures, including marine mammals and endangered species, and questions about the effectiveness of those measures. |
| National Environmental Policy Act and Public Involvement | • Questions about how the Action Proponents will be coordinating with Pacific Island agencies, such as the Guam Environmental Protection Agency and CNMI Bureau of Environmental and Coastal Quality.<br>• Concerns about the Action Proponents ability to effectively consult with NMFS, the Environmental Protection Agency, CNMI agencies, and other regulatory agencies because of funding constraints and budget cuts under the current administration.<br>  ○ Concerns that failure to properly consult would compromise data integrity, responsiveness, and oversight over the analysis process.<br>  ○ Concerns that regulatory agencies would not be able to monitor and ensure adherence to environmental regulations.<br>  ○ Requests to postpone the MITT SEIS/OEIS and implementation of activities until proper review, regulatory oversight, and monitoring can be guaranteed.<br>• Concerns that a 45-day comment period was inadequate and requests for a scoping comment period extension.<br>  ○ Requests for the Action Proponents to exceed the standard 45-day comment period when the Draft SEIS/OEIS is available for public review and comment.<br>• Concerns that the project website and virtual scoping presentation were not easy to navigate.<br>• Concerns that many people do not have access to the internet or technological devices, and that a lack of in-person meetings and non-digital resources meant that information was not being adequately disseminated to the local communities.<br>• Concerns that translated materials were not available or were delayed.<br>• Concerns about the content presented in the virtual scoping presentation, such as the following:<br>  ○ The content was vague, especially when it came to the sonar testing and live-bombing exercises.<br>  ○ No technical information on the types of ammunitions and sonar technology that would be used, or the frequency and intensity of these activities.<br>• Requests to use tables to present technical information in a clear and understandable way.<br>• Requests to ensure proper coordination with CNMI Bureau of Environmental and Coastal Quality and Guam Department of Agriculture.<br>• Recommendations to consult with the fishing community during the environmental planning and mitigation processes.<br>• Requests for full transparency and public engagement by taking the following steps:<br>  ○ Holding in-person public meetings on Guam and the CNMI with ample notice and providing direct responses to community concerns. |

| Resource Area/Topic | Issue/Concern |
|---|---|
| | ○ Clarifying whether the rescission of Council on Environmental Quality NEPA regulations would limit future public outreach by the military services and any impacts on the MITT NEPA outreach approach.<br>• Recommendations to improve communication, coordination, and transparency with local stakeholders.<br>• Requests to integrate the best available science and traditional ecological knowledge into planning and impact analyses.<br>• Recommendations to ensure the SEIS/OEIS is comprehensive and thorough; include in-depth descriptions of the Proposed Action, surrounding installations, Action Proponent activities, and cumulative effects; and provide detailed and accurate assessments of the environmental impacts on biological resources using updated data and scientific research, including peer-reviewed publications.<br>• Concerns about assessment inadequacies of the 2020 SEIS/OEIS, specifically of the cultural resource assessment, and carrying those over in the development of the Phase IV SEIS/OEIS.<br>• Recommendations for various independent resources and studies for the Action Proponents to review and consider during the development of the SEIS/OEIS.<br>• Requests for the implementation of targeted community outreach and educational initiatives.<br>• Requests for transparency to show all the agencies consulted with during the development of the SEIS/OEIS.<br>• Concerns that outreach efforts were focused on federal and territorial agencies and not community members.<br>○ Requests to consider more active engagement and consultation, including recurring meetings, with local and federal regulatory agencies and community members. |
| National Historic Preservation Act | • Concerns about the existing Programmatic Agreement, specifically:<br>○ Protecting cultural and historical resources, including those not currently listed, but that are eligible for listing, on the National Register of Historic Places.<br>○ Overcoming the limited scope and depth of consultation with the CHamoru community members during the Programmatic Agreement development.<br>○ Working collaboratively with Guam's State Historic Preservation Office and CHamoru cultural experts to conduct annual reviews and updates to constraint maps and conducting archaeological surveys in high-risk or inaccessible areas, such as FDM.<br>○ Developing mitigation measures and environmental stewardship protocols that exceed technical compliance, including avoidance measures that reflect spatial data and cultural sensitivity.<br>• Concerns about the current Programmatic Agreements and application of the Programmatic Agreements.<br>○ Concerns about the adequacy of the 2020 Programmatic Agreement and its ability to fulfill Section 106 requirements of NHPA.<br>○ Requests that any future Programmatic Agreements are shaped collaboratively, transparently, and with a commitment to Indigenous heritage and land stewardship.<br>• Questions about the Section 106 consultation process and requests for proper community consultation and respect for Indigenous knowledge. |

| Resource Area/Topic | Issue/Concern |
|---|---|
| | • Concerns that the Area of Potential Effects includes Guam's surrounding waters and landscapes that are home to submerged shipwrecks, artifacts, and sacred sites that hold historical and cultural significance.<br>  ○ Requests to limit or restrict conducting military readiness activities in these areas.<br>• Requests that the Section 106 review process continue to have oversight and accountability, that annual reviews be conducted collaboratively with Guam's State Historic Preservation Office and local cultural advisory boards, and that findings be communicated to the community.<br>• Concerns that the 2020 SEIS/OEIS did not accurately identify submerged historic properties or actively engage with Indigenous communities.<br>  ○ Requests to consider Traditional Cultural Places and consult with Indigenous communities.<br>• Questions about the potential development of a Built Environment Treatment Plan or an Archaeological Treatment Plan. |
| Cumulative Effects | • Questions about the interaction of MITT activities with nearby large-scale projects and other military build-up in the area, and potential cumulative effects. Projects include the following:<br>  ○ CNMI Joint Military Training<br>  ○ Tinian Divert Infrastructure Improvements<br>  ○ F-15 Beddown and Infrastructure Upgrades at Andersen Air Force Base<br>  ○ Enhanced Integrated Air and Missile Defense System on Guam<br>  ○ Surveillance Towed Array Sensor System Low Frequency Active Ship Training and Testing<br>  ○ Other applicable projects<br>• Requests to address cumulative environmental, cultural, and health effects of the proposed military readiness activities in the SEIS/OEIS.<br>• Questions about the analysis of cumulative effects.<br>• Concerns about how the reopening of the Marianas Trench Marine National Monument to fishing may affect the MITT analysis.<br>• Concerns about the cumulative effects of military activities and severe weather events, such as typhoons, on marine and terrestrial environments. |
| Other | • Questions about the amount of waste from military activities that would need to be disposed of on Rota.<br>• Concerns about the current administration's adherence to environmental laws and constitutional rights.<br>• Concerns about military activities in other regions and the release of potential pollution and toxic substances.<br>• Statements of opposition to the perceived militarization of the Mariana Islands.<br>• Recommendations to participate in the Guam Civil-Military Coordinating Council meeting to present project information. |

## G.3 Notification of Availability of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement, Public Review and Comment Period, and Public Meetings

The Draft SEIS/OEIS public review and comment period begins with the posting of the joint Notice of Availability (NOA) and Notice of Public Meetings (NOPM) on the project website. The public is invited to review the Draft SEIS/OEIS and provide comments, especially those that are substantive to the accuracy and adequacy of the environmental analysis. Comments will be accepted by mail, through the SEIS/OEIS website at https://www.nepa.navy.mil/mitteis, and at the public meetings.

### G.3.1 Public Meeting Notifications

The Action Proponents will make significant efforts to notify the public of the availability of the Draft SEIS/OEIS and encourage participation during the public review and comment period. All public notices will coincide with posting of the NOA/NOPM on the project website and will include information about the availability of the Draft SEIS/OEIS and where it can be accessed; the Proposed Action and its purpose and need; the NEPA and NHPA processes; public commenting information; the locations, dates, and times of public meetings; and availability of a virtual presentation on the project website. The Action Proponents will also provide the public with project information and invite public review and comment. A summary of these efforts follows.

#### G.3.1.1 Notification Letters

Notification letters will be mailed to federal and local elected officials and government agencies and other key stakeholders. Entities that will receive a notification letter are listed in Table G-4**.**

**Table G-4: Entities that Will Receive the Draft SEIS/OEIS Notification Letter**

| ***Guam*** |
|---|
| ***Federal Elected Officials and Federal Agencies*** |
| U.S. Congress<br>Guam Air Traffic Control Center<br>U.S. Army Corps of Engineers<br>U.S. Coast Guard<br>U.S. Department of Agriculture<br>Animal and Plant Health Inspection Service<br>Wildlife Services<br>Natural Resources Conservation Service<br>Guam Service Center<br>U.S. Department of the Interior<br>National Park Service<br>War in the Pacific National Historic Park<br>U.S. Fish & Wildlife Service<br>Guam National Wildlife Refuge<br>Pacific Islands Office, Guam Office<br>Western Pacific Regional Fishery Management Council<br>Education and Outreach Coordinator |
| ***Local Elected Officials and Local Agencies*** |
| Office of the Governor |

- Community Defense Liaison Office
- Guam Commission on Decolonization
- Guam Committee on Decolonization
- Military and Regional Affairs
- Office of the Lt. Governor of Guam

Office of the Senator
38th Guam Legislature
Mayors' Council of Guam

- Municipality of Agana Heights
- Municipality of Asan-Ma'ina
- Municipality of Barrigada
- Municipality of Chålan Pågu-Otdot
- Municipality of Dededo
- Municipality of Hågat
- Municipality of Hagåtña
- Municipality of Humåtak
- Municipality of Inalåhan
- Municipality of Malesso'
- Municipality of Mangilao
- Municipality of Mongmong-To'to-Maite'
- Municipality of Piti
- Municipality of Sånta Rita-Sumai
- Municipality of Sinajana
- Municipality of Talo'fo'fo'
- Municipality of Tamuning-Tumon-Harmon
- Municipality of Yigo
- Municipality of Yo'ña

Antonio B. Won Pat International Airport Authority (Guam International Airport)
Guam Ancestral Lands Commission
Guam Army National Guard
Guam Behavioral Health and Wellness Center
Guam Bureau of Statistics and Plans

- Coastal Management Program

Guam Chamber of Commerce
Guam Consolidated Commission on Utilities
Guam Customs and Quarantine Agency
Guam Department of Agriculture

- Aquatic and Wildlife Resources
- Fisheries
- Guam Department of Education
- CHamoru Studies and Special Projects Division

Guam Department of Integrated Services for Individuals with Disabilities
Guam Department of Labor
Guam Department of Land Management

- Guam Chamorro Land Trust Commission

Guam Department of Public Health and Social Services
Guam Department of Public Works
Guam Department of Youth Affairs
Guam Economic Development Authority
Guam Energy Office
Guam Environmental Protection Agency

- Water Pollution Control Program

Water Resources Management Program
Guam Fire Department
Guam Homeland Security Department
Office of Civil Defense
Guam Land Use Commission
Guam Memorial Hospital Authority
Guam Military Buildup Office
Guam Power Authority
Consolidated Utility Services
Guam State Historic Preservation Office
Department of Community and Cultural Affairs
Guam Veterans Affairs Office
Guam Visitors Bureau
Cultural Heritage, Community Outreach and Branding
Guam Waterworks Authority
Compliance & Safety Division
Kumision CHamoru
Northern Guam Soil and Water Conservation Districts
Pacific Islands Area Soil and Water Conservation District
Port Authority of Guam
University of Guam
Cooperative Extension Service
Division of Natural Sciences
Marine Laboratory
Water and Environmental Research Institute
U.S. Marshals Service, District of Guam

***Saipan***

***Federal Elected Officials and Federal Agencies***

U.S. Congress
U.S. House of Representatives
U.S. Department of Agriculture
Natural Resources Conservation Service
Saipan, Tinian & Aguiguan Service Center
Western Pacific Regional Fishery Management Council

***Local Elected Officials and Local Agencies***

CNMI Office of the Governor
CNMI Public Information and Protocol Office
Office of the Mayor, Saipan
Northern Islands
CNMI Senate
CNMI House of Representatives
CNMI Office of the Mayor
Municipality of Saipan
Asia Pacific Academy of Science, Education, and Environmental Management
CNMI Bureau of Military Affairs
CNMI Department of Commerce
CNMI Department of Community and Cultural Affairs
CNMI Department of Lands and Natural Resources
Division of Fish and Wildlife
CNMI Department of Public Lands
CNMI Department of Public Safety
Office of the Commissioner

CNMI Division of Coastal Resources Management
CNMI Northern Marianas College Cooperative, Research, Extension and Education Service
CNMI Office of Military and Veteran Affairs
CNMI Zoning Board Office
Division of Parks and Grounds
Marianas Visitors Authority
Commonwealth Ports Authority
Saipan Chamber of Commerce

***Tinian***

***Federal Elected Officials***

U.S. Congress
U.S. House of Representatives

***Local Elected Officials and Local Agencies***

Office of the Mayor
    Municipality of Tinian & Aguiguan
CNMI Department of Public Lands, Tinian Office
CNMI Department of Public Safety
    Tinian Fire Division
Tinian Chamber of Commerce

***Rota***

***Federal Elected Officials***

U.S. Congress

***Local Elected Officials and Local Agencies***

Office of the Mayor
    Municipality of Rota
19th Rota Municipal Council
Department of Public Lands, Rota Office
Rota Gaming Commission

***Federal Agencies outside of Guam, Saipan, Tinian, and Rota***

Advisory Council on Historic Preservation
Federal Maritime Commission
    Bureau of Certification and Licensing
    Office of the Secretary
Marine Mammal Commission
U.S. Army Corps of Engineers
    Honolulu District
U.S. Coast Guard
U.S. Department of Agriculture
    Natural Resources Conservation Service
    U.S. Forest Service
        Pacific Southwest Region 5
        Pacific Southwest Research Station
            Institute of Pacific Islands Forestry
U.S. Department of Commerce
    National Oceanic and Atmospheric Administration
        National Marine Fisheries Service
            Headquarters
            Office for Coastal Management
            Office of Law Enforcement
            Office of Protected Resources
            Pacific Islands Regional Office
            Protected Resources Division

National Ocean Service
U.S. Department of State
Office of Environmental Quality
U.S. Department of the Interior
National Park Service (Regions 8, 9, 10, 12)
Office of Environmental Policy and Compliance
Office of Insular Affairs
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Pacific Islands Refuges and Monuments Office
Marianas Trench Marine National Monument
Pacific Region
U.S. Geological Survey
Pacific Coastal and Marine Science Center
Pacific Islands Water Science Center
U.S. Department of Transportation
Federal Aviation Administration
Western Pacific Region
Maritime Administration
U.S. Environmental Protection Agency
Region IX
National Environmental Policy Act Office
Pacific Islands Office
Western Pacific Regional Fishery Management Council

#### G.3.1.2 Postcards

Postcards will be mailed to interested individuals, nongovernmental organizations, and other groups or organizations.

#### G.3.1.3 Newspaper Advertisements

Display advertisements will be placed in the Guam Daily Post and Pacific Daily News (Guam), and Marianas Variety (CNMI).

#### G.3.1.4 News Releases and Public Service Announcement

Two news releases and a public service announcement will be distributed by the JRM PAO to local and regional media outlets.

#### G.3.1.5 Social Media Post

The JRM PAO will post information on their active social media platforms, such as Facebook.

#### G.3.1.6 Email Notifications

Email notifications will be distributed to existing website subscribers.

### G.3.2 Public Information

#### G.3.2.1 Fact Sheets

The Action Proponents will prepare a project fact sheet with information about the Proposed Action and environmental analysis contained in this Draft SEIS/OEIS. The fact sheet will be

posted on the project website. An abbreviated version of the fact sheet will be translated into CHamoru (Guam), Chamorro (CNMI), and Carolinian.

#### G.3.2.2 Project Video

The Action Proponents are developing a video to provide information on the importance of military readiness activities and the military's successful natural and cultural stewardship programs in the Study Area. The project video will be available on the project website.

#### G.3.2.3 Virtual Presentation

The Action Proponents will prepare a virtual presentation for the Draft SEIS/OEIS public review and comment phase and make it available on the website. The presentation provides more information about the Proposed Action, its purpose and need, and the importance of military readiness activities in the Study Area; potential effects on environmental resource areas from the Proposed Action and measures intended to avoid, minimize, or mitigate these effects; the Navy's marine species research and monitoring program; NEPA and NHPA Section 106 processes; public involvement opportunities; and commenting information.

#### G.3.2.4 Stakeholder Briefings

The Action Proponents will brief multiple project stakeholders in person on Guam, Saipan, and Tinian during the public review and comment period. Briefings will also be offered upon request to recipients of the notification letters.

### G.3.3 Public Meetings

In support of the NEPA process, the Action Proponents will hold one in-person public meeting on Guam and one in-person meeting in the CNMI to inform the public about the Proposed Action and answer questions on the draft environmental analysis and potential effects, and will solicit public comments on the environmental analysis in this Draft SEIS/OEIS. The public meetings will include informational poster stations staffed by project representatives, a presentation, and oral comment session. A certified court reporter will be available during the oral comment session and during the open house for one-on-one oral comments; written comments can be submitted at any time during the meetings. Language interpreter(s) may be available at the public meetings.

## G.4 Distribution of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

Parties to be notified of the availability of this Draft SEIS/OEIS will be directed to access the document electronically on the project website at www.nepa.navy.mil/mitteis or to access hard copies available at established information repositories.

### G.4.1 Federal Agencies

This Draft SEIS/OEIS will be distributed to federal and local agencies upon request.

### G.4.2 Information Repositories

This Draft SEIS/OEIS will be mailed in hard copy form to the information repository locations shown in Table G-5. These copies are to be made available to the public for a minimum of one year.

**Table G-5: Information Repositories**

| | |
|---|---|
| **Guam**<br>Robert F. Kennedy Memorial Library<br>University of Guam<br>UOG Station<br>Mangilao, GU 96923-1871<br><br>Nieves M. Flores Memorial Library<br>254 Martyr St.<br>Hagåtña, GU 96910-5141 | **Tinian**<br>Tinian Public Library<br>San Jose Village<br>Tinian, MP 96952-9997 |
| **Rota**<br>Antonio C. Atalig Memorial Library<br>(Rota Public Library)<br>Rota, MP 96951-9997 | **Saipan**<br>Joeten-Kiyu Public Library<br>Insatto St. and Beach Road<br>Saipan, MP 96950-9996 |

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# Appendix H List of Preparers

# Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Mariana Islands Training and Testing

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# APPENDIX H LIST OF PREPARERS

This Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement was prepared collaboratively between the U.S. Government and contractor preparers.

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Years of experience: 25

# Appendix I Regulatory Considerations

# Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Mariana Islands Training and Testing

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# APPENDIX I REGULATORY CONSIDERATIONS

In accordance with the Department of Defense National Environmental Policy Act (NEPA) Implementing Procedures, environmental documents will be prepared concurrently with and integrated with analyses and related surveys and studies required by other Federal statutes. This appendix summarizes environmental compliance for the Proposed Action; the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity in the affected environment; irreversible and irretrievable commitments of federal resources.

## I.1 Compliance with Regulatory Considerations

Implementation of the Proposed Action in this Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (SEIS/OEIS) would comply with applicable federal, state, and local laws, regulations, and executive orders. The Navy will consult with regulatory agencies, as appropriate, during the NEPA process and before implementing the Proposed Action. Table I-1 summarizes the regulatory consultations associated with the Proposed Action.

**Table I-1: Summary of Regulatory Consultations for the Proposed Action**

| Statutes, Regulations | Status of Compliance |
|---|---|
| **Statutes and Regulations** | |
| *Coastal Zone Management Act* (CZMA) (16 U.S.C. sections 1451-1464) | The Navy will submit a Consistency Determination (CD) to the Guam Bureau of Statistics and Plans to address proposed military training and testing activities that may affect Guam's coastal use or resources. The CD will be prepared in accordance with Guam's Procedures Guide for Achieving Federal Consistency with the Guam Coastal Management Program (Guam Bureau of Statistics and Plans, 2011). Additionally, the Navy will submit a CD to the CNMI Division of Coastal Resources Management to address proposed military training and testing activities that may affect the CNMI's coastal use or resources. |
| *Endangered Species Act* (ESA) (16 U.S.C. sections 1531 et seq.) | In accordance with section 7 of the ESA (50 CFR section 402), during the preparation of the 2015 EIS/OEIS, the Navy prepared a consultation package and submitted it to USFWS. A Biological Opinion (BO) was issued by USFWS and remains valid. As such, the Navy is not reinitiating ESA consultation with USFWS in support of this SEIS/OEIS because no reinitiation triggers for consultation were met, pursuant to 50 CFR section 402.16. The Navy will continue to adhere to any BO terms and conditions listed within the USFWS 2015 BO. Consultation with NMFS pursuant to section 7 of the Act is underway. See the USFWS 2015 BO for the associated effects analyses. |
| *Magnuson-Stevens Fishery Conservation and Management Act* (16 U.S.C. sections 1801–1882) | The Navy completed an Essential Fish Habitat (EFH) consultation with NMFS for the MITT Study Area in 2014. EFH and Habitat Areas of Particular Concern in the Study Area have not changed and the previous 2014 consultation is still valid for the proposed training and testing activities that have not changed. In 2020, the Navy conducted a supplemental EFH consultation with the NMFS Pacific Island Regional Office considering activities that were new or that have changed since the 2014 consultation. For this SEIS/OEIS, the Navy will conduct another supplemental EFH consultation with the NMFS Pacific Island Regional Office to consider activities that are new or that have changed since the 2020 EFH consultation and that have the potential to adversely affect EFH and managed species for this SEIS/OEIS. |
| *Marine Mammal Protection Act* (16 U.S.C. sections 1431 et seq.) | This SEIS/OEIS updates the analysis and is the basis for a request for a new Letter of Authorization (LOA) permit from NMFS for activities occurring from 2027 to 2034. The Action Proponents will apply for a LOA to be submitted to NMFS as part of the ongoing consultation under the Marine Mammal Protection Act. |

| Statutes, Regulations | Status of Compliance |
|---|---|
| *Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712)* | Under the military readiness rule (50 CFR section 21.42, *Authorization of take of migratory birds incidental to military readiness activities*), the DoD may take migratory birds incidental to military readiness activities described in this SEIS/OEIS provided that the DoD's actions do not result in a significant adverse effect on a population of birds protected under the MBTA. The Navy has determined that the Proposed Action would not result in a significant adverse effect on a population of a migratory bird species at sea or on FDM. If, over the course of training and testing activities, the Navy determines that a population of migratory birds would be significantly affected, the Navy would be required to confer and cooperate with the USFWS to implement appropriate conservation measures to minimize significant adverse effects. The best available science presented in Section 3.6 supports the conclusion that birds protected under the MBTA on FDM are not significantly declining. The Navy and USFWS have worked cooperatively to design targeting and munitions restrictions on the island. |
| *National Historic Preservation Act (NHPA)* (54 U.S.C. section 306108) | Following the 2020 SEIS/OEIS, two Programmatic Agreements were negotiated for military training and testing activities within the MITT Study Area; one Programmatic Agreement (PA) for military training and testing on and within the surrounding waters of the island of Guam was established between the Joint Region Marianas (JRM) Commander, and the Guam State Historic Preservation Office in 2020, and another PA for military training and testing on and within the surrounding waters of the islands of the Commonwealth of the Northern Marianas Islands (CNMI) was established between the JRM Commander and the CNMI Historic Preservation Office in 2022. For this Proposed Action, the Navy is meeting the responsibilities pursuant to Section 106 of the NHPA for the subject undertaking in accordance with the 2020 and 2022 PAs.<br>The Proposed Action is consistent with the national policy for the preservation of historic sites, buildings, and objects of national significance. Furthermore, the Navy will comply with the Section 106 consultation requirements as applicable to the Proposed Action, in accordance with the established PAs. |

Notes: DoD = Department of Defense, EIS = Environmental Impact Statement, FDM = Farallon de Medinilla, MITT = Mariana Islands Training and Testing, OEIS = Overseas Environmental Impact Statement, SEIS = Supplemental Environmental Impact Statement

## I.2 Relationship Between Short-Term Use of the Environment and Maintenance and Enhancement of Long-Term Productivity

NEPA requires the analysis of the relationship between the short-term effects on the environment and the impacts those effects may have on the maintenance and enhancement of the long-term productivity of the affected environment (42 United States Code [U.S.C.] section 4332). This analysis has not changed since it was conducted in the previous Mariana Islands Training and Testing (MITT) analyses. See Section 6.2 (Relationship Between Short-Term Use of The Environment and Maintenance and Enhancement of Long-Term Productivity) of the 2015 EIS/OEIS for more information (U.S. Department of the Navy, 2015b).

## I.3 Irreversible or Irretrievable Commitment of Resources

NEPA requires that environmental analysis include identification of “any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented” (42 U.S.C. section 4332). This analysis has not changed since it was conducted in the 2015 EIS/OEIS and 2020 SEIS/OEIS. See Section 6.3 (Irreversible or Irretrievable Commitment of Resources) of the 2015 EIS/OEIS for more information (U.S. Department of the Navy, 2015b).