Appendix E Description of Range and Systems

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

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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).

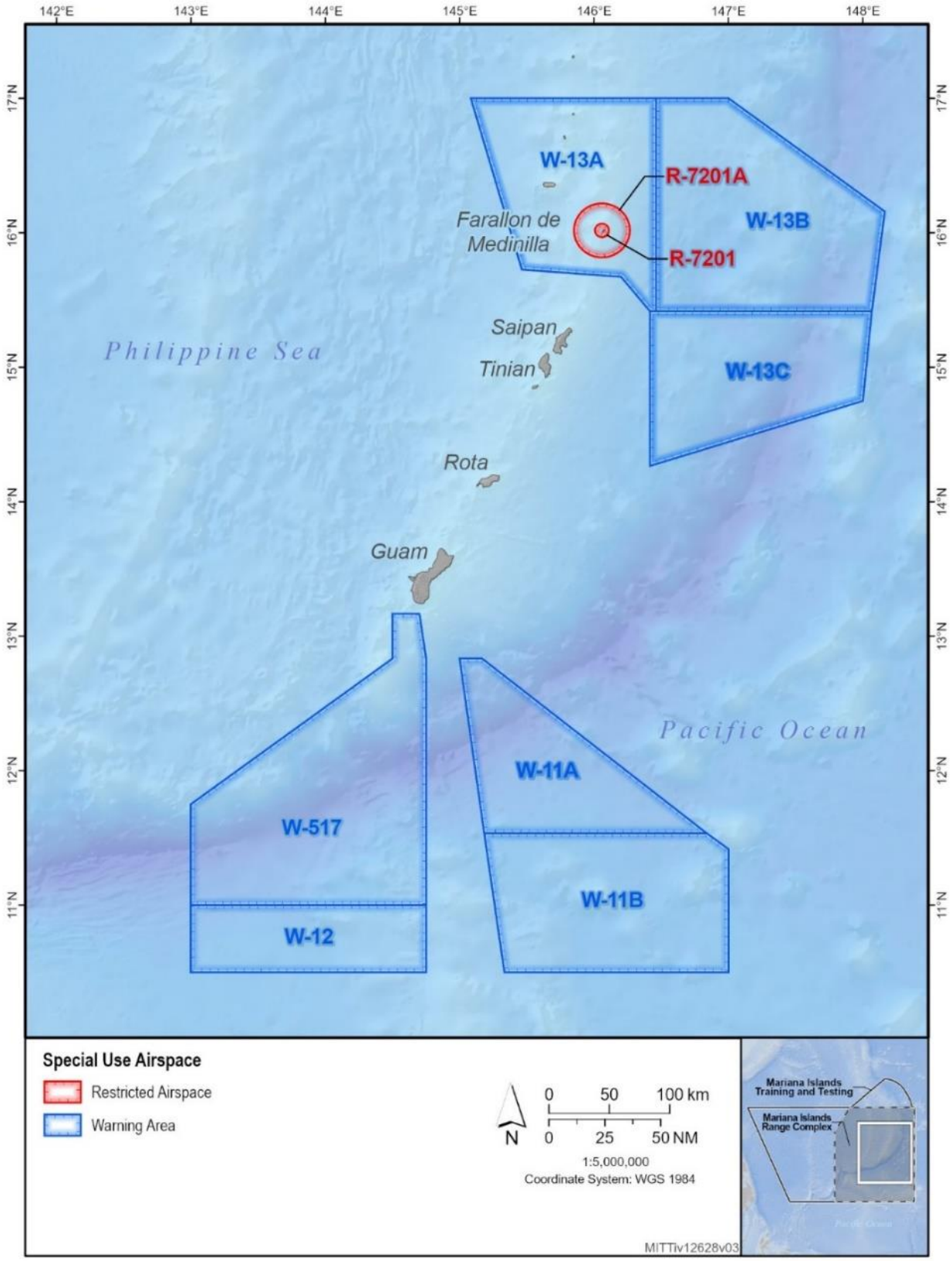

Figure E-1: Mariana Islands Range Complex Airspace

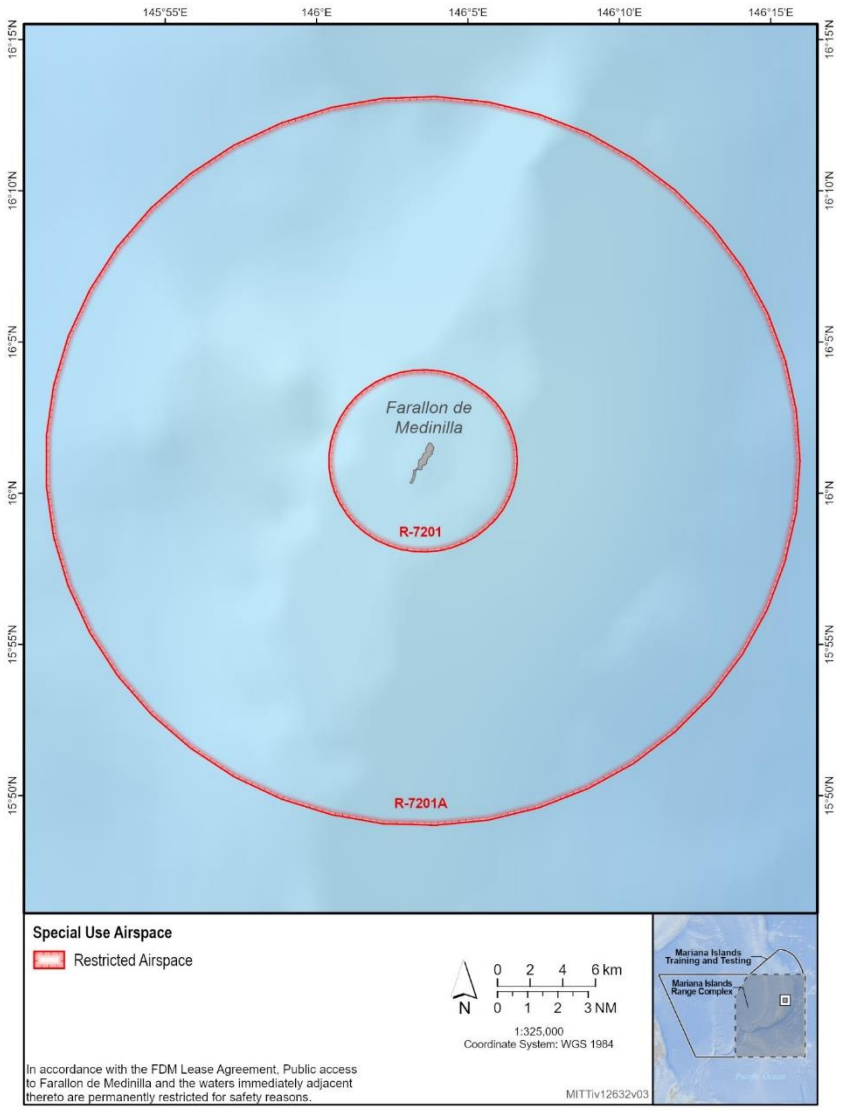

Figure E-2: Farallon de Medinilla Restricted Airspace 7201 and 7201A

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.

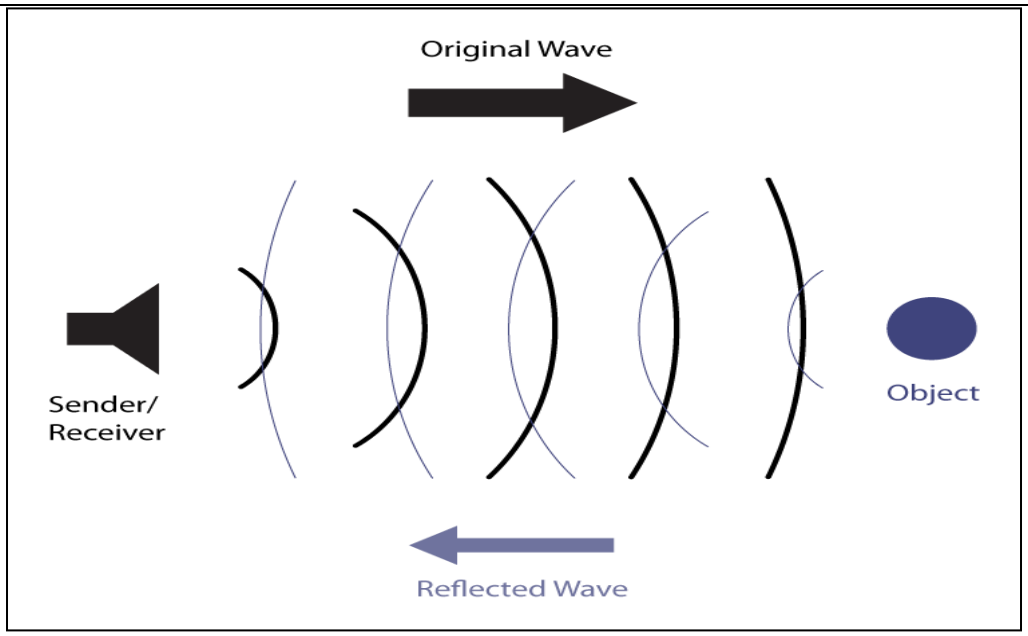

Figure E-3: Principle of an Active Sonar

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.

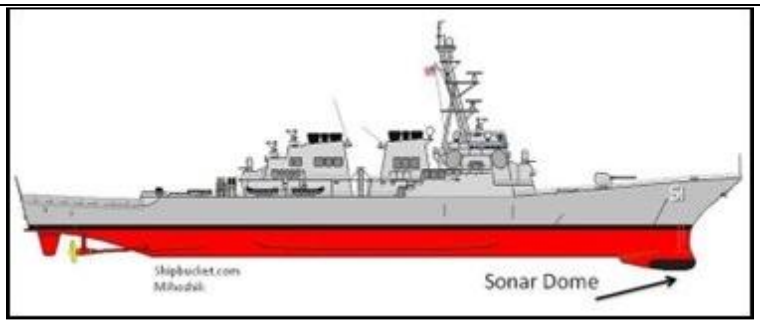

Figure E-4: Guided Missile Destroyer with a Hull-Mounted Sonar

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.

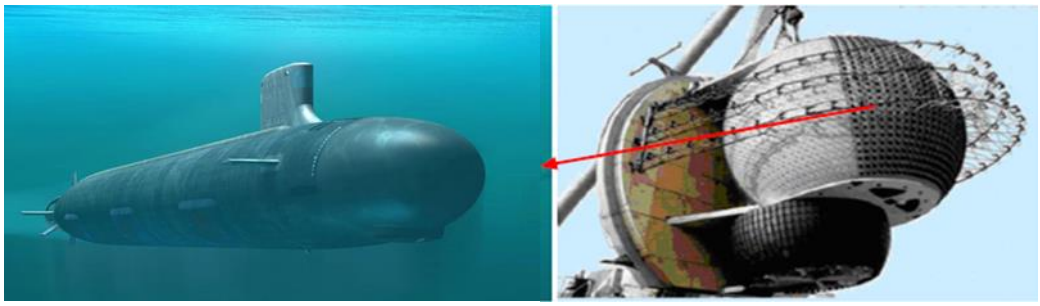

Figure E-5: Submarine Active Sonar Array

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.

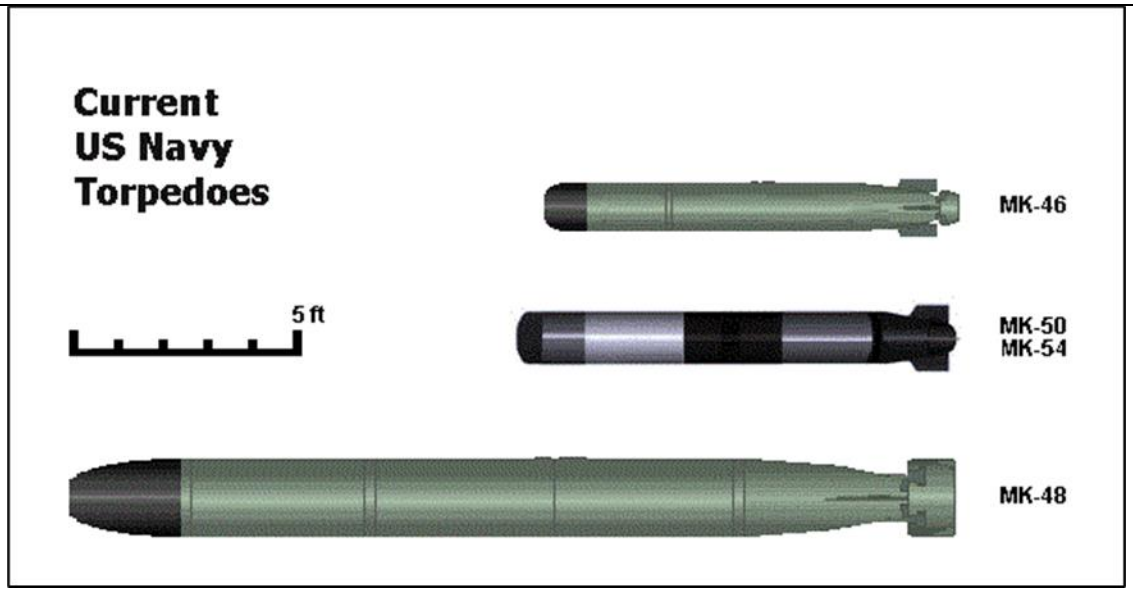

Figure E-8: Current United States Navy Torpedoes

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.

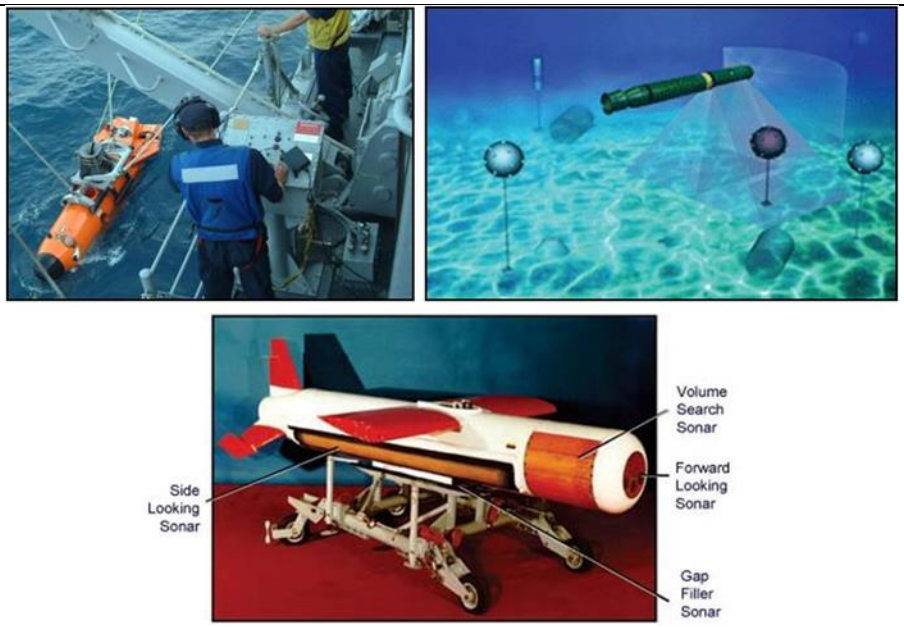

Figure E-10: Mine Warfare Systems
(Source: Graphic on upper right side from Lockheed Martin)

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).

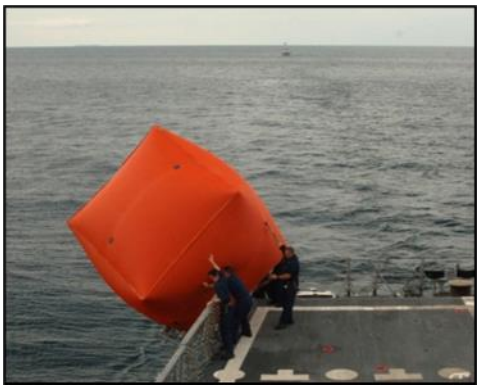

Figure E-21: Deploying a "Killer Tomato™" Floating Target

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.

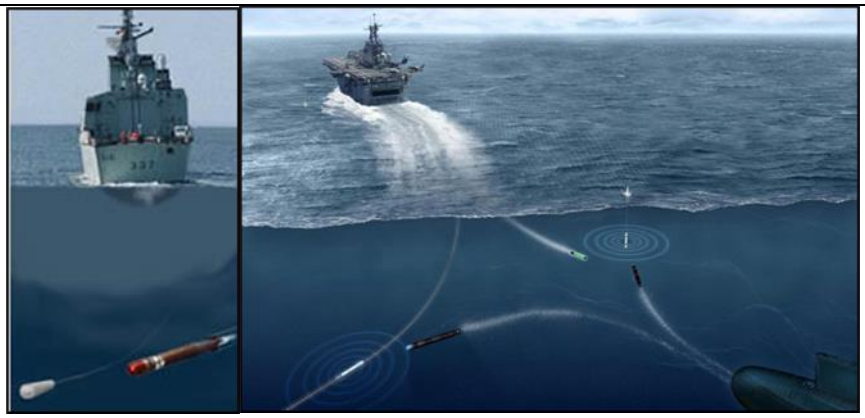

Figure E-23: Acoustic Countermeasures

- **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

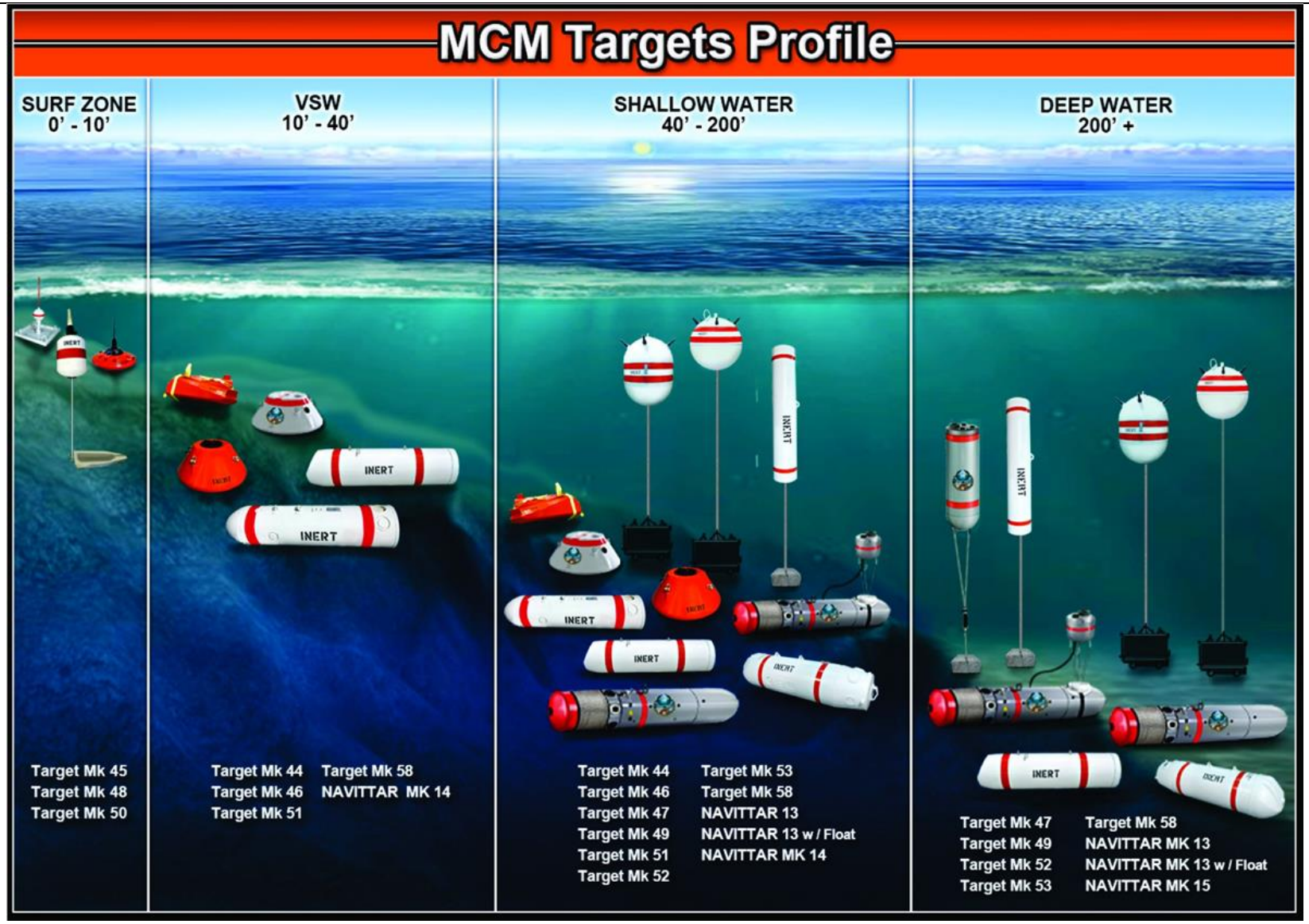

Figure E-25: Application (Location) of Training Mines

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).

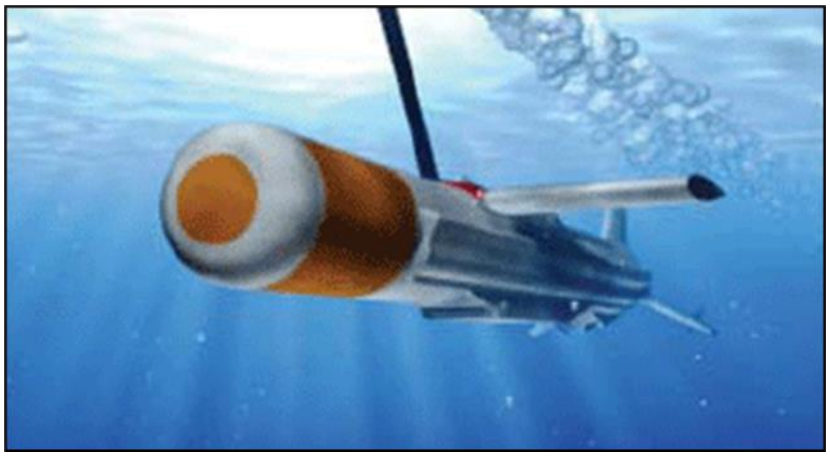

Figure E-26: Towed Mine Detection System

- **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).

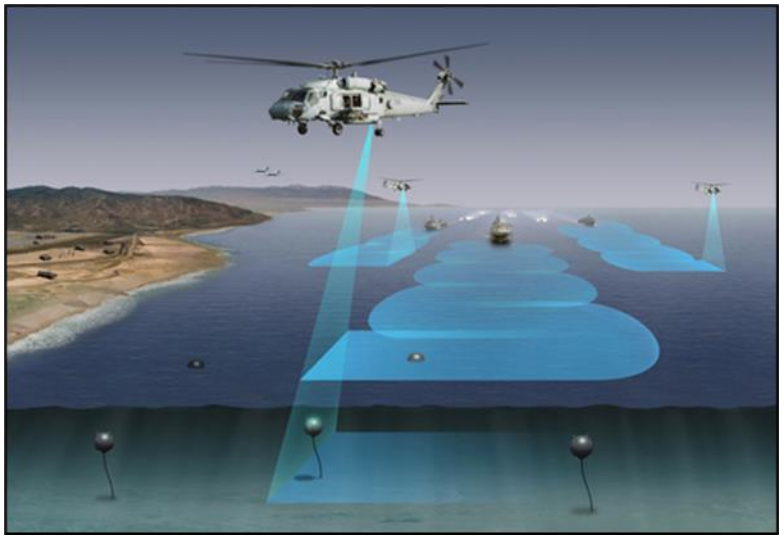

Figure E-27: Airborne Laser Mine Detection System

- **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).

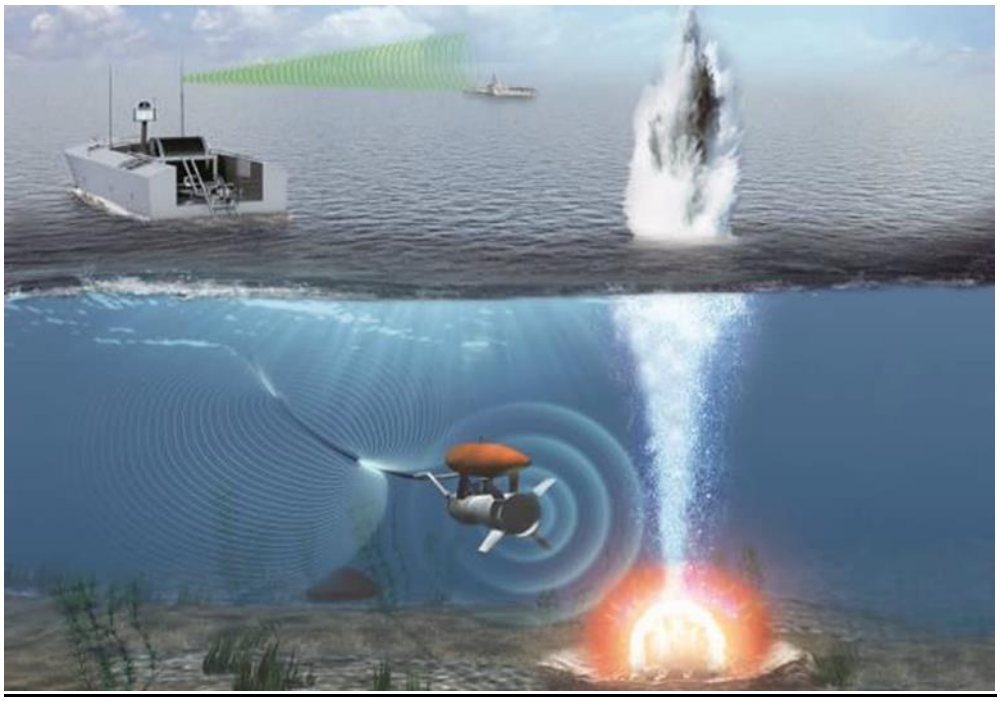

Figure E-28: Unmanned Influence Sweep Mine Hunting System

- **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).

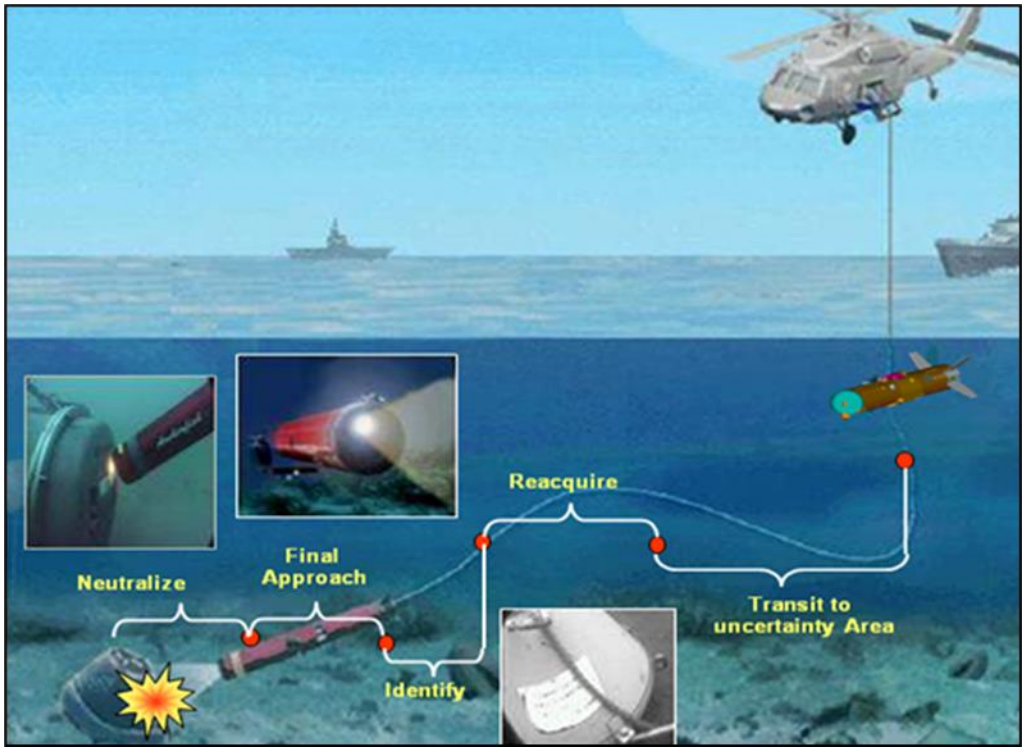

Figure E-29: Airborne Mine Neutralization System

- **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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