Final Comprehensive Report for the Operation of the Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar Onboard the R/V *Cory Chouest*, USNS ABLE (T-AGOS 20), USNS EFFECTIVE (T-AGOS 21), and USNS IMPECCABLE (T-AGOS 23) Under the National Marine Fisheries Service Regulations 50 CFR 216 Subpart Q

Department of the Navy
Chief of Naval Operations
December 2011

Final Comprehensive Report

for the

Operation of the Surveillance Towed Array Sensor System

Low Frequency Active (SURTASS LFA) Sonar

Onboard the R/V *Cory Chouest,*

USNS ABLE (T-AGOS 20),

USNS EFFECTIVE (T-AGOS 21)

and USNS IMPECCABLE (T-AGOS 23)

Under the National Marine Fisheries Service

Regulations 50 CFR 216 Subpart Q

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ACRONYMS AND ABBREVIATIONS

ABR	Auditory Brainstem Response
AIP	Air Independent Propulsion
APAASW	Administrative Procedures Act
	Antisubmarine Warfare
BiOp	Biological Opinion
BRS	Behavioral Response Study
CEE	Controlled Exposure Experiment
CFR	Code of Federal Regulations
CLFA	Compact Low Frequency Active
CNO	Chief of Naval Operations
CW	Continuous Wave
DASN(E)	Deputy Assistant Secretary of the Navy for Environment
dB	Decibel(s)
DoD	Department of Defense
DoN	Department of the Navy
DSEIS	Draft Supplemental Environmental Impact Statement
E	East
EIS	Environmental Impact Statement
EO	(Presidential) Executive Order
ESA	Endangered Species Act
FOEIS/EIS	Final Overseas Environmental Impact Statement/Environmental Impact Statement
FM	Frequency Modulated
FR	Federal Register
FSEIS	Final Supplemental Environmental Impact Statement
ft	Feet
FY	Fiscal Year
HF	High Frequency
HI-LFS	High Intensity Low Frequency (Underwater) Sound
HF/M3	High Frequency Marine Mammal Monitoring
HLA	Horizontal Line Array
Hz	Hertz
ICES	International Council for the Exploration of the Sea
ICP	Integrated Common Processor
IUCN	International Union for Conservation of Nature and Natural Resources
kg	Kilogram
kHz	Kilohertz
km	Kilometer(s)
kph	Kilometer(s) per hour
kt	Knot(s)
lb	Pound
LF	Low Frequency
LFA	Low Frequency Active
LFAS	Low Frequency Active Sonar
LFS SRP	Low Frequency Sound Scientific Research Program
LOA	Letter of Authorization
LTM	Long Term Monitoring
LTS	LFA Transmit System
m	Meter(s)
m/s	Meters per second (sound speed)
MF	Mid-Frequency

MFA MILDET min MMC MMPA MoD	Mid-Frequency Active Military Detachment Minute(s) Marine Mammal Commission Marine Mammal Protection Act Ministry of Defence
N NATO NDAA NE NEPA NGO nmi NMFS NMS NOAA NOI NORLANT NRC NW	North North Atlantic Treaty Organization National Defense Authorization Act Northeast National Environmental Policy Act of 1969 Non-Governmental Organization Nautical mile(s) National Marine Fisheries Service National Marine Sanctuary National Oceanic and Atmospheric Administration Notice of Intent North Atlantic National Research Council Northwest
OBIA OEIS OIC ONR	Offshore Biologically Important Area(s) Overseas Environmental Impact Statement Officer in Charge Office of Naval Research
Pa PTAS	Pascal Passive Towed Array Sonar
RL rms ROD R/V	Received Level Root Mean Squared Record of Decision Research Vessel
S SEIS SEL SERDP SL SMRU SOC SOEIS SONAR SPL SRP SURTASS	South Supplemental Environmental Impact Statement Sound Exposure Level Strategic Environmental Research and Development Program Source Level Sea Mammal Research Unit SURTASS Operations Center Supplemental Overseas Environmental Impact Statement SOund Navigation And Ranging Sound Pressure Level Scientific Research Program Surveillance Towed Array Sensor System
T-AGOS TL TTS	Ocean Surveillance Ship Transmission Loss Temporary Threshold Shift
UK U.S. U.S.C. USNS	United Kingdom United States United States Code United States Naval Ship
W	West
VLA	Vertical Line Array
Symbols	
=	Equal to
/	Divided by
+	Plus

≥	Greater than or equal to
>	Greater than
<	Less than
~	Approximately
±	Plus or minus
μ	Micro (10^{-6})
Log	Logarithm

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1.0 INTRODUCTION

Under the National Marine Fisheries Service (NMFS) Regulations for the Taking of Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar, 50 CFR 216 Subpart Q (72 *Federal Register* [FR] 46890-93) (NOAA, 2007a), the Navy is required to provide NMFS and the public with a final comprehensive report analyzing the impacts of SURTASS LFA sonar on marine mammal stocks. This document provides an unclassified summary of the classified quarterly reports and unclassified annual reports of SURTASS LFA operations during the four LOAs for the period 16 August 2007 through 15 August 2011[1].

1.1 Purpose of this Report

The primary purpose of this final report is to provide NMFS with unclassified SURTASS LFA sonar operations information to assist them in their evaluation of future Navy LOA applications. This unclassified report includes an analysis of monitoring and research conducted during the period of these regulations, an estimate of cumulative impacts on marine mammal stocks based on best scientific judgment, and an analysis of the advancement of alternative (passive) technologies as a replacement for LFA sonar.

This final report summarizes the annual reports from August 2007 through August 2011, which were generated as a requirement of the Regulations for the Taking of Marine Mammals Incidental to Navy Operations of SURTASS LFA Sonar, 50 CFR § 216 Subpart Q (72 *Federal Register* [FR] 46890-93). These annual reports for operations of SURTASS LFA sonar systems onboard the R/V *Cory Chouest*, USNS ABLE (T-AGOS 20), USNS EFFECTIVE (T-AGOS 21), and USNS IMPECCABLE (T-AGOS 23) were prepared in accordance with the requirements of the above regulations and LOAs, as issued. The primary purpose of these annual reports was to provide NMFS with an unclassified summary of each year's quarterly reports and an analysis of any Level A and/or Level B harassment takings by SURTASS LFA sonar operations. These annual reports also provided NMFS with information necessary to demonstrate conformance to the Terms and Conditions of the Biological Opinions under the Endangered Species Act (ESA) and incidental take statements (ITS), as issued, on the issuance of the LOAs.

1.2 SURTASS LFA Sonar Description

SURTASS LFA sonar is a long-range sonar system that operates in the low frequency (LF) band (100-500 Hertz [Hz]). During the period of this report, there were four SURTASS LFA sonar systems, one each onboard the R/V *Cory Chouest*, USNS ABLE (T-AGOS 20), USNS EFFECTIVE (T-AGOS 21), and USNS IMPECCABLE (T-AGOS 23), operating in the northwestern Pacific Ocean, Philippine Sea, South China Sea, and central Pacific Ocean south of Hawaii. With the R/V *Cory Chouest's* retirement in 2008, two systems are currently operational. At present, there is one SURTASS LFA sonar system onboard USNS IMPECCABLE (T-AGOS 23) and one SURTASS Compact LFA (CLFA) sonar system onboard the USNS ABLE (T-

[1] Fifth year LOAs for the period 16 August 2011 through 15 August 2012 were issued to USNS VICTORIOUS (T-AGOS 19), USNS ABLE (T-AGOS 20), USNS EFFECTIVE (T-AGOS 21), and USNS IMPECCABLE (T-AGOS 23). These four vessels are currently, or will be, performing routine testing and training, as well as military operations under the conditions of the LOAs. These 5th year LOAs are not included in this report.

AGOS 20). Two additional CLFA systems are planned for the T-AGOS 19 Class (Figure 1). Late in 2011, the CLFA system onboard the USNS EFFECTIVE (T-AGOS 21) commenced at sea testing and training. The CLFA system being installed onboard the USNS VICTORIOUS (T-AGOS 19) is scheduled for at sea testing and training in 2012. These systems have both passive and active components.

Figure 1. USNS ABLE (T-AGOS 20) Ocean Surveillance Ship

1.2.1 Active System Component—LFA

The active system component, LFA, is an adjunct to the passive detection system, SURTASS, and is planned for use when passive system performance proves inadequate. LFA complements SURTASS passive operations by actively acquiring and tracking submarines when they are in quiet operating modes, measuring accurate target range, and re-acquiring lost contacts.

LFA is a set of acoustic transmitting source elements suspended by cable from under an ocean surveillance vessel. These elements, called projectors, are devices that produce the active sound pulse, or ping. The projectors transform electrical energy to mechanical energy that set up vibrations, or pressure disturbances, within the water to produce a ping.

The characteristics and operating features of LFA are:

- The source is a vertical line array (VLA) of up to 18 source projectors suspended below the vessel. LFA's transmitted sonar beam is omnidirectional (i.e., a full 360 degrees) in the horizontal (nominal depth of the LFA array center is 122 m [400 ft]), with a narrow vertical beamwidth that can be steered above or below the horizontal.
- The source frequency is between 100 and 500 Hz (the LFA system's physical design does not allow for transmissions below 100 Hz). A variety of signal types can be used, including continuous wave (CW) and frequency-modulated (FM) signals. Signal bandwidth is approximately 30 Hz.
- The source level (SL) of an individual source projector is approximately 215 decibels (dB) re 1 µ Pascal (Pa) at 1 m (rms) as measured by sound pressure level (SPL). The sound field of the LFA array can never be higher than the SL of an individual projector.
- The typical LFA transmitted sonar signal is not a constant tone, but a transmission of various waveforms that vary in frequency and duration. A complete sequence of transmissions is referred to as a wavetrain (also known as a ping) and lasts from 6 to 100 seconds with an average length of 60 sec. Within the wavetrain the duration of each continuous frequency transmission is never longer than 10 seconds.
- Average duty cycles (ratio of sound "on" time to total time) are less than 20 percent. The typical duty cycles are approximately 7.5 to 10 percent based on historical LFA operational parameters (2003 to 2010).
- The time between wavetrain transmissions is typically from 6 to 15 minutes.

References to Underwater Sound Levels

- References to underwater sound pressure level (SPL) in this SEIS/SOEIS are values given in decibels (dBs), and are assumed to be standardized at 1 microPascal at 1 m (dB re 1 µPa at 1 m [rms]) for source level (SL) and dB re 1 µPa (rms) for received level (RL), unless otherwise stated (Urick, 1983; ANSI, 2006).
- In this SEIS/SOEIS, underwater sound exposure level (SEL) is a measure of energy, specifically the squared instantaneous pressure integrated over time and expressed as an equivalent one-second in duration signal, unless otherwise stated; the appropriate units for SEL are dB re 1 μPa^2-sec (Urick, 1983; ANSI, 2006; Southall et al., 2007).
- The term "Single Ping Equivalent" (SPE) (as defined in Chapter 4 and Appendix C of this SEIS/SOEIS) is an intermediate calculation for input to the risk continuum used in this document. SPE accounts for the energy of all of the LFA acoustic transmissions that a modeled animal receives during an entire LFA mission (modeled for operations from 7 to 20 days). Calculating the potential risk from SURTASS LFA is a complex process and the reader is referred to Appendix C for details. As discussed in Appendix C, SPE is a function of SPL, not SEL. SPE levels will be expressed as "dB SPE" in this document, as they have been in the SURTASS LFA sonar FOEIS/FEIS and FSEIS documents (DoN, 2001 and 2007a).

As future undersea warfare requirements continue to transition to littoral[2] ocean regions, the introduction of a compact active system deployable on SURTASS ships was developed. This system upgrade is known as Compact LFA, or CLFA. CLFA consists of smaller, lighter-weight source elements than the current LFA system, and is compact enough to be installed on the VICTORIOUS Class platforms (T-AGOS 19). The initial CLFA installation was completed on the USNS ABLE (T-AGOS 20) (Figure 1) in 2008 and is currently operational. CLFA has also been installed onboard the USNS EFFECTIVE (T-AGOS 21), which is currently undergoing evaluation and testing. The CLFA system to be installed onboard the USNS VICTORIOUS (T-AGOS 19) is scheduled for at sea testing and training in 2012.

CLFA improvements include:

- Operational frequency within the 100 to 500 Hz range, matched to shallow water environments with little loss of detection performance in deep water environments;
- Improved reliability and ease of deployment; and
- Lighter-weight design (mission weight of 64,410 kg [142,000 lb] vice 155,129 kg [324,000 lb] mission weight of LFA).

The operational characteristics of the compact system are comparable to the existing LFA systems as presented above. Therefore, the potential environmental effects from CLFA are expected to be similar to, and not greater than, the environmental effects from the existing SURTASS LFA systems. Hence, for this report, the term low frequency active, or LFA, will be used to refer to both the existing LFA system and/or the compact (CLFA) system, unless otherwise specified.

1.2.2 Passive System Component—SURTASS

The passive, or listening, part of the system is SURTASS. SURTASS detects returning echoes from submerged objects, such as threat submarines, through the use of hydrophones. These devices transform mechanical energy (received acoustic sound wave) to an electrical signal that can be analyzed by the processing system of the sonar. Advances in passive acoustic technology have led to the development of SURTASS Twin-Line (TL-29A) horizontal line array (HLA), a shallow water variant of the single line SURTASS system. TL-29A consists of a “Y” shaped array with two apertures. The array is approximately 1/5th the length of a standard SURTASS array, or approximately 305 m (1,000 ft) long. The TL-29A delivers enhanced capabilities, such as its ability to be towed in shallow water environments in the littoral zones, to provide significant directional noise rejection, and to resolve bearing ambiguities without having to change vessel course. The SURTASS TL-29A HLA provides improved littoral capability.

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[2] The term “littoral” is one of the most misunderstood terms used in naval warfare. Based on a dictionary definition, the adjective “littoral” indicates that something pertains to or exists on the shore. In noun form, the word means a shore or coastal region.

The Navy’s meaning differs because it is based on tactical, not geographic, perspective relating to the overall coastal operations including all assets supporting a particular operation regardless of how close, or far, from the shore they may be operating. The Navy defines littoral as the region that horizontally encompasses the land/water mass interface from fifty (50) statute miles (80 kilometers [km]) ashore to two hundred (200) nautical miles (nmi) (370 km) at sea; extends vertically from the bottom of the ocean to the top of the atmosphere and from the land surface to the top of the atmosphere (Naval Oceanographic Office, 1999).

The passive capability of the USNS IMPECCABLE (T-AGOS 23) was recently upgraded with the installation of the TL-29A array. The three VICTORIOUS Class vessels, equipped with CLFA, are outfitted with the newer SURTASS TL-29A passive arrays.

The SURTASS LFA sonar vessel typically maintains a speed of at least 5.6 kilometers per hour (kph) (3 knots [kt]) through the water in order to tow the HLA. The return signals, which are usually below background or ambient noise level, are then processed and evaluated to identify and classify potential underwater threats.

1.2.3 Integrated Common Processor

SURTASS is also being upgraded with the Integrated Common Processor (ICP) that will result in increased operator proficiency, increased functionality and savings in logistics support and software maintenance. The ICP has been, or is scheduled to be, installed on the SURTASS LFA/CLFA sonar vessels. The ICP uses enhanced signal processing and automation to get accurate, actionable information on undersea threats to operational decision makers. The capability of passive acoustic sensors is also benefiting from increased processing power in computers and by networking, which is incorporating data from a variety of acoustic and non-acoustic sensors, and sources to construct a more complete battlefield picture (Friedman, 2007).

1.3 The Critical Need for SURTASS LFA

The Navy's primary mission is to maintain, train, equip, and operate combat-ready naval forces capable of accomplishing American strategic objectives, deterring maritime aggression, and assuring freedom of navigation in ocean areas. The Secretary of the Navy and Chief of Naval Operations (CNO) have continually validated that Anti-Submarine Warfare (ASW) is a critical part of that mission – a mission that requires unfettered access to both the high seas and littorals. In order to be prepared for all potential threats, the Navy must maintain ASW core competency through continual training and operations in open-ocean and littoral environments.

Excerpts from Declaration of Rear Admiral John M. Bird, U.S. Navy To the United States District Court Northern District of California **15 November 2007**
SURTASS LFA (sonar) has enabled the Navy to meet the clearly defined, real-world national security need for improved ASW capability by allowing Navy Fleet units to reliably detect quieter and harder-to-find submarines at long range, before they get within their effective weapons range and can launch missiles or torpedoes against our ships or missiles against land targets, foreign or domestic. The operative word here is has. SURTASS LFA is a combat-ready system. But in order to protect U.S. and allied fleet assets, and merchant shipping, the operation of SURTASS LFA sonar and the training of our personnel must continue uninterrupted.

The challenges faced by the U.S. Navy today are very different from those faced at the end of the Cold War two decades ago. Since the early 1990s, U.S. Navy ASW strategy has had to shift from a known Soviet adversary to "uncertain potential adversaries with area-denial strategies designed to inflict unacceptable losses" (Benedict, 2005). The wide proliferation of diesel-electric submarines, a Chinese undersea force that is growing in size and tactical capability, and a resurgent Russian submarine service mean that U.S. ASW capability must meet more technologically-capable threats in a wider range of ocean environments (Benedict, 2005; U.S. Office of Naval Intelligence [ONI], 2009a and 2009b). Due to the advancement and use of quieting technologies in diesel-electric and nuclear submarines, undersea threats are becoming increasingly difficult to locate using the passive acoustic technologies that were effective during the Cold War. The range at which U.S. ASW assets are able to identify submarine threats is decreasing and at the same time improvements in torpedo design are extending the effective weapons range of those same threats (Benedict, 2005).

To meet this long range submarine detection need, the U.S. Navy has investigated the use of a broad spectrum of acoustic and non-acoustic technologies. Of the technologies evaluated, low frequency active sonar is the only system capable of meeting the U.S. Navy's long-range ASW detection needs in a variety of weather conditions during the day and night (U.S. Department of the Navy [DoN], 2001; 2011a). SURTASS LFA sonar is providing a quantifiable improvement in the Navy's undersea detection capabilities and therefore markedly improving the survivability of U.S. Naval forces in hostile ASW scenarios.

SURTASS LFA sonar meets the need of the Navy for improved long-range submarine detection capability, which is essential to providing U.S. forces the time necessary to react to and defend against potential undersea threats. It is critical that U.S. forces be able to identify threats while remaining at a safe distance beyond a submarine's effective weapon's range (Davies, 2007).

1.4 Initial Regulatory Compliance and Litigation History

Prior to NMFS promulgating the current (2007) Final Rule (72 FR 46846-93) (NOAA, 2007a) and LOAs, there were a number of key regulatory and litigation events that influenced these regulations.

1.4.1 National Environmental Policy Act (NEPA)

The NEPA process for SURTASS LFA sonar began on 18 July 1996, when the Navy published its Notice of Intent (NOI) in the *Federal Register* (67 FR 37452) (DoN, 1996) to prepare an overseas environmental impact statement/environmental impact statement (OEIS/EIS) for SURTASS LFA sonar under Presidential Executive Order (EO) 12114 Environmental Effects Abroad of Major Federal Actions and the National Environmental Policy Act (NEPA). With NMFS as a cooperating agency, the SURTASS LFA sonar Final Overseas Environmental Impact Statement/Environmental Impact Statement (FOEIS/EIS) was completed in January 2001 (DoN, 2001). The Record of Decision (ROD) was signed by the Deputy Assistant Secretary of the Navy for Environment (DASN(E)) on 16 July 2002 (67 FR 48145) (DoN, 2002). During the NEPA analysis the Navy recognized there were scientific data gaps concerning the potential for moderate-to-low exposure levels to affect cetacean hearing ability or modify biologically important behavior. As a result of this limitation, the Navy sponsored independent, scientific field research referred to as the Low Frequency Sound Scientific Research Program (LFS SRP).

This ground-breaking research program found that the potential for SURTASS LFA sonar to cause these effects was minimal (DoN, 2001).

1.4.2 Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA)

Based on the scientific analyses detailed in the Navy LOA application and further supported by information and data contained in the Navy's FOEIS/EIS (DoN, 2001), NMFS determined that the operations of SURTASS LFA sonar would employ means of effecting the least practicable adverse impact on the species or stock, that would result in the incidental harassment of only small numbers of marine mammals, have no more than a negligible impact on the affected marine mammal stocks or habitats, and would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence uses. Consequently, NMFS issued the initial LOA (NOAA, 2002a) under the MMPA Final Rule (50 CFR Part 216 Subpart Q) (NOAA, 2002b) for the operation of SURTASS LFA sonar on research vessel (R/V) *Cory Chouest*. The ESA section 7 consultation on the issuance of the above MMPA Final Rule and the associated LOAs found that NMFS's action was not likely to jeopardize the continued existence of threatened or endangered species under NMFS's jurisdiction or destroy or adversely modify critical habitat that has been designated for those species. The first biological opinion (BiOp) issued by NMFS was a 5-year programmatic document on the MMPA rule making (NMFS, 2002a). It was followed by the annual BiOp for the LOAs (NMFS, 2002b). After the initial LOA was issued in 2002, the Navy requested annual renewals in accordance with 50 CFR §216.189 for the remaining four years of the 2002 Final Rule for the R/V *Cory Chouest* and USNS IMPECCABLE. NMFS subsequently issued the LOAs (NOAA, 2003, 2004, 2005, and 2006a).

1.4.3 National Defense Authorization Act (NDAA)

On November 24, 2003 the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2004 (NDAA FY04) (Public Law 108-136) was passed by Congress. Included in this law were amendments to the MMPA (16 U.S.C. 1361 *et seq.*) that apply where a "military readiness activity" is concerned. Of special importance for SURTASS LFA sonar take authorization, the NDAA amended Section 101(a)(5) of the MMPA, which governs the taking of marine mammals incidental to otherwise lawful activities. The term "military readiness activity" is defined in Public Law 107-314 (16 U.S.C. § 703 note) to include all training and operations of the Armed Forces that relate to combat; and the adequate and realistic testing of military equipment, vehicles, weapons and sensors for proper operation and suitability for combat use. NMFS and the Navy determined that the Navy' SURTASS LFA sonar testing, training, and operations that are the subject of NMFS's Final Rule constituted military readiness activities because those activities constitute "training and operations of the Armed Forces that relate to combat" and constitute "adequate and realistic testing of military equipment, vehicles, weapons and sensors for proper operation and suitability for combat use."

Changes to the MMPA set forth in the NDAA FY04 amended the act in three ways. First, it focused the definition of harassment on biologically significant effects. Second, it removed references to small numbers and specific geographic regions as applied to incidental take authorizations. Third, it provided for a national defense exemption. SURTASS LFA sonar has never been deployed under this national defense exemption.

1.4.4 Initial Litigation

On 7 August 2002, several non-governmental organizations (NGO) filed suit against the Navy and NMFS over SURTASS LFA sonar use and permitting. The Court recognized the Navy's National Security requirements for operations to continue as the case proceeded. On 15 November 2002, the Court issued a tailored Preliminary Injunction for operations of SURTASS LFA sonar in a stipulated area in the northwest Pacific Ocean/Philippine Sea, and south and east of Japan. On 25 January 2003, the R/V *Cory Chouest*, having met all environmental compliance requirements, commenced testing and training in the northwest Pacific Ocean under this tailored Preliminary Injunction.

The Court issued a ruling on the parties' motions for summary judgment in the SURTASS LFA sonar litigation on 26 August 2003. The Court found deficiencies in the Navy's and NMFS's compliance under NEPA, ESA, and MMPA. The Court, however, indicated that a total ban of employment of SURTASS LFA sonar would pose a hardship on the Navy's ability to protect national security by ensuring military preparedness and the safety of those serving in the military from hostile submarines. Based on Court-directed mediation between the parties, the Court issued a tailored Permanent Injunction on 14 October 2003, allowing SURTASS LFA sonar operations from both R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23) in stipulated areas in the northwest Pacific Ocean/Philippine Sea, Sea of Japan, East China Sea, and South China Sea with certain year-round and seasonal restrictions. On 7 July 2005, the Court amended the injunction to expand the potential areas of operation based on real-world contingencies, as shown in Figure 2.

1.5 Current Regulatory Compliance and Litigation

In response to U.S. District Court ruling on the motion for preliminary injunction, the Deputy Assistant Secretary of the Navy for Environment (DASN(E)) decided that the purposes of NEPA would be served by supplemental analysis of employing SURTASS LFA sonar systems. On 11 April 2003, DASN(E) directed the Navy to prepare a supplemental EIS (SEIS) to address concerns identified by the Court to provide additional information regarding the environment that could potentially be affected by SURTASS LFA sonar systems and additional information related to mitigation. On 26 September 2003, NMFS agreed to be a cooperating agency in the preparation and review of the SEIS. The information developed from this analysis was used to support the Navy's application for the second five-year rule under MMPA (DoN, 2006a) and the biological assessment for Section 7 consultation under the ESA (DoN, 2006b).

Under the Court's opinion, NMFS was found to have improperly conflated its negligible impact determinations with small numbers requirements. As a result of the NDAA FY04 amendments to the MMPA eliminating this issue, the Court vacated and dismissed the MMPA small numbers and specific geographic regions claims on 2 December 2004.

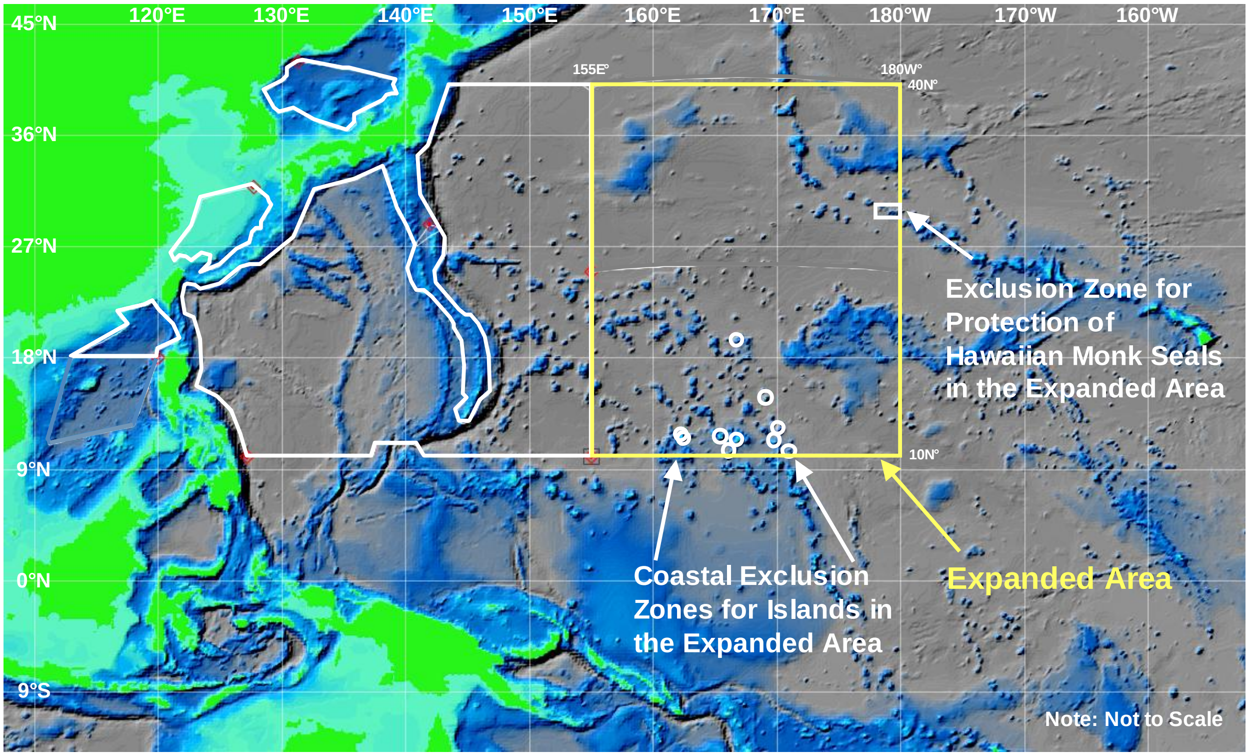

Figure 2. SURTASS LFA Sonar Operations Areas Permitted under Stipulation Regarding Permanent Injunction as Amended on 7 July 2005

1.5.1 Supplemental Environmental Impact Statement

The Final Supplemental Environmental Impact Statement (FSEIS), which included detailed responses to all comments received, was completed in May 2007 (DoN, 2007a). The purpose of the first SURTASS LFA Sonar SEIS was to:

- Address concerns of the U.S. District Court for the Northern District of California in its 26 August 2003 Opinion and Order in relation to compliance with NEPA, ESA, and MMPA[3];
- Provide information necessary to apply for a new five-year Rule that would allow incidental takes under the MMPA when the current Rule expired in 2007, taking into account legislative changes to the MMPA and the need to employ up to four SURTASS LFA sonar systems;
- Analyze potential impacts for LFA system upgrades; and
- Provide additional information and analyses pertinent to the proposed action.

The FSEIS evaluated the potential environmental effects of employment of up to four SURTASS LFA sonar systems in the oceanic areas of the world less Arctic and Antarctic regions. Based on current operational requirements, exercises using these sonar systems would occur in the Pacific,

[3] On 2 December 2004, the Court vacated and dismissed the MMPA claims based on the National Defense Authorization Act Fiscal Year 2004 (NDAA FY04) amendments to the MMPA.

Atlantic, and Indian Oceans, and the Mediterranean Sea. To reduce adverse effects on the marine environment, areas would be excluded as necessary to prevent 180-dB sound pressure level (SPL) or greater within specific geographic range of land, in offshore biologically important areas during biologically important seasons, and in areas necessary to prevent greater than 145-dB SPL at known recreational and commercial dive sites.

1.5.2 Current MMPA and ESA Authorizations

On 12 May 2006, the Navy submitted an application to NMFS requesting an authorization under Section 101 (a)(5)(A) of the MMPA for the taking of marine mammals by Level A and Level B harassment incidental to the deployment of SURTASS LFA sonar systems for military readiness activities, to include routine training, testing, and military operations (DoN, 2006a). The activities were associated with the employment of up to four SURTASS LFA sonar systems for a period of five years (16 August 2007 to 15 August 2012).

The Navy submitted a biological assessment for the employment of SURTASS LFA sonar on 9 June 2006, requesting that NMFS review the document (DoN, 2006b). The Navy further requested a BiOp/incidental take statement (ITS) under Section 7 of the ESA for a period of five years (16 August 2007 to 15 August 2012).

On 28 September 2006, NMFS published a Notice of Receipt of Application and a request for public comments on the Navy's application for authorization to take marine mammals incidental to the operation of SURTASS LFA sonar systems (NOAA, 2006b). The public comment period closed on 30 October 2006. These comments were considered in the development of the Proposed and Final Rules. A Proposed Rule for the renewal of the regulations governing SURTASS LFA sonar MMPA authorization was published on 9 July 2007 (NOAA, 2007b) with a 15-day public comment period. NMFS filed the Final Rule on 15 August 2007 and published on 21 August 2007 (NOAA, 2007a). The initial LOAs under the 2007 Rule were issued by NMFS to the Chief of Naval Operations (N872A) for the R/V *Cory Chouest* and the USNS IMPECCABLE for the period 16 August 2007 to 15 August 2008 (NOAA, 2007c).

NMFS issued, on 14 August 2007, its BiOp on the effects of NMFS's Permits, Conservation and Education Division's proposal to promulgate regulations allowing NMFS to authorize the taking of marine mammals incidental to the Navy's employment of SURTASS LFA sonar in accordance with Section 7 of the ESA, as amended (16 U.S.C. 1531 et seq.) (NMFS, 2007a). On 15 August 2007 (as amended on 17 August 2007), NMFS issued its BiOp/ITS on the effects of the proposed LOAs (effective 16 August 2007 to 15 August 2008) to take marine mammals incidental to the Navy's employment of SURTASS LFA sonar in accordance with Section 7 of the ESA, as amended (16 U.S.C. 1531 et seq.) (NMFS, 2007b; 2007c). The opinions concluded that the proposed LOAs and any takes associated with activities authorized under those regulations were not likely to jeopardize threatened or endangered species in the action area, and that the proposed action was not likely to destroy or adversely modify designated critical habitats.

1.5.3 Second Litigation

On 17 September 2007, a number of plaintiffs filed a lawsuit challenging actions by the Navy and NMFS regarding compliance with NEPA, MMPA, ESA, and the Administrative Procedure Act (APA) for the operation of SURTASS LFA sonar.

On 6 February 2008, the Court issued its Opinion and Order granting in part Plaintiffs' motion for a Preliminary Injunction and required the parties to meet and confer on the precise terms of the Preliminary Injunction. Mediation sessions were held on 26 March 2008 and 27 May 2008 at the U.S. District Court, Northern District of California, in San Francisco, CA.

During the mediation on 26 March 2008, agreement was reached that SURTASS LFA sonar would operate in the northwestern Pacific areas stipulated in the 2003 permanent injunction, as amended in 2005, with the following modifications (Figure 3):

- Stipulated LFA Operational Agreement permitting SURTASS LFA sonar operations up to, but not within, 22 km (12 nmi) from the coast when necessary to continue tracking an existing underwater contact, or when operationally necessary to detect a new underwater contact to maximize opportunities for detection.
- Additional terms include assuring the LFA sound field does not exceed received levels of 180 dB re 1 µPa (rms) at a distance of less than 33 km (18 nmi) from:
    - Islands of the Luzon Strait, including the Bashi Channel; and
    - Eastern coastlines of the islands of the Ryukyu Island Chain.

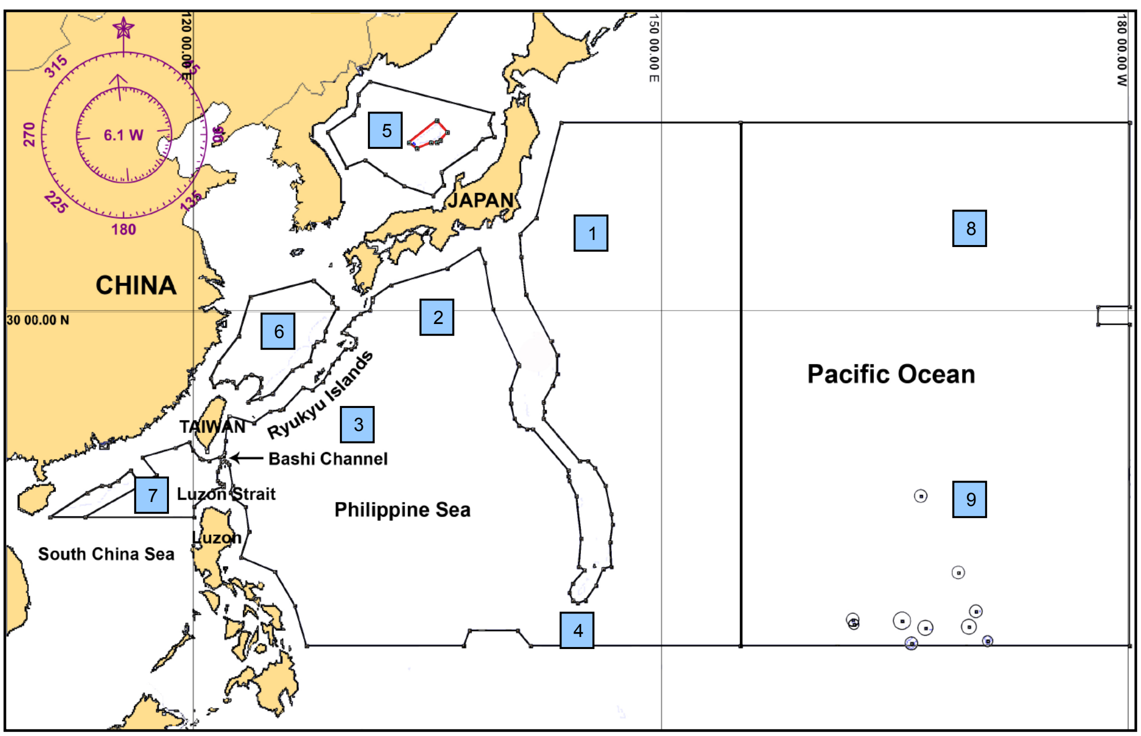

Figure 3. SURTASS LFA Sonar Western Pacific Operations Areas

During the mediation on 27 May 2008, agreement was reached on overall settlement of the litigation, which included the agreement that SURTASS LFA sonar could operate in the Hawaii operating areas (Figure 4). The settlement also permitted SURTASS LFA sonar operations up to 22 km (12 nmi) from the coast when necessary to continue tracking an existing underwater contact, or when operationally necessary to detect a new underwater contact to maximize opportunities for detection within the Hawaii operating areas.

On 12 August 2008, the Court approved the settlement and, on 29 August 2008, the Court signed the Stipulated Voluntary Dismissal with Prejudice, which effectively ended the litigation (APPENDIX A). The LOAs issued by NMFS to the USNS ABLE, USNS IMPECCABLE, USS EFFECTIVE, and USNS VICTORIOUS for the remainder of the current Rule are based on the expanded operating areas described above.

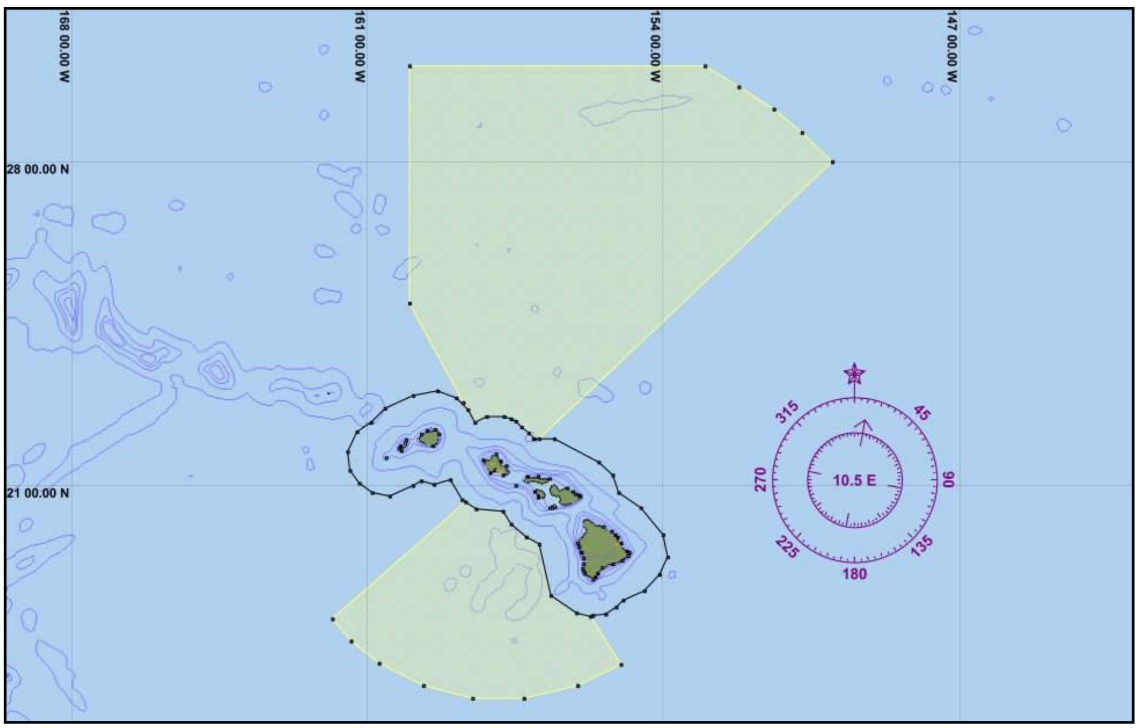

Figure 4. SURTASS LFA Sonar Hawaii Operating Areas

1.6 Second Supplemental Environmental Impact Statement

Due to concerns raised recently during litigation over employment of the SURTASS LFA sonar system and to support issuance of a follow-on five-year Rule under the MMPA for employment of SURTASS LFA sonar systems, DASN(E) determined on 14 November 2008 that the purposes of NEPA and EO 12114 would be furthered by the preparation of an additional supplemental analysis related to the employment of the system. This analysis takes the form of this new (second) SEIS/SOEIS. On 21 January 2009, the Navy published a Notice of Intent (NOI) to prepare a SEIS/SOEIS for the employment of SURTASS LFA sonar, with NMFS as a cooperating agency (DoN, 2009a).

The Draft Supplemental Environmental Impact Statement/Supplemental Overseas Environmental Impact Statement (DSEIS/SOEIS) for Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) sonar systems[4] (DoN, 2011a), which was filed with the United States (U.S.) Environmental Protection Agency (EPA), provides supplemental analyses to the Final Overseas Environmental Impact Statement/Environmental Impact Statement (FOEIS/EIS) for SURTASS LFA Sonar (DoN, 2001) and the Final Supplemental Environmental Impact Statement (FSEIS) for SURTASS LFA Sonar (DoN, 2007a). This second supplemental analysis has been prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [USC] §4321 et seq.)[5]; the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations [CFR] §§1500-1508); Navy Procedures for Implementing NEPA (32 CFR §775); and Executive Order (EO) 12114, Environmental Effects Abroad of Major Federal Actions[6].

The purpose of the August 2011 Draft SEIS/SOEIS (DoN, 2011a) was to:

- Address concerns of the U.S. District Court for the Northern District of California (herein referred to as the Court) in its 6 February 2008 Opinion and Order in relation to compliance with NEPA, Endangered Species Act (ESA), and Marine Mammal Protection Act (MMPA);
- Provide information to support the proposed issuance of MMPA incidental take regulations, the 2012 LOAs, and future LOAs as appropriate; and
- Provide additional information and analyses pertinent to the proposed action.

1.7 Application for Follow-on Incidental Take Authorizations

On 17 August 2011, the Navy submitted an Application to the NMFS for Letters of Authorization (LOAs) under Section 101 (a)(5)(A) of the MMPA for the activities associated with the employment of Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) sonar for a period of five years (August 2012 to 15 August 2017) (DoN, 2011b).

On 9 November 2011, the Navy submitted a Biological Assessment for the Employment of SURTASS LFA Sonar requesting that NMFS review the document. The Navy further requested Biological Opinion/Incidental Take Statements under Section 7 on the ESA for a period of five years (August 2012 to August 2017) (DoN, 2011c).

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4 In this DSEIS/SOEIS, “SURTASS LFA sonar systems” refers to both the LFA and compact LFA (CLFA) systems, each having similar acoustic operating characteristics.

5 The provisions of NEPA apply to major federal actions that occur or have effects in the U.S., its territories, or possessions.

6 The provisions of EO 12114 apply to major federal actions that occur or have effects outside of U.S. territories (the U.S., its territories, and possessions).

2.0 MITIGATION MEASURES

Under the current rule (NOAA, 2007a), NMFS has issued multiple, annual LOAs to the Navy for routine testing, training as well as use of the system during military operations of SURTASS LFA sonar systems onboard the USNS ABLE, USNS EFFECTIVE, USNS IMPECCABLE, and R/V *Cory Chouest*[7](NOAA, 2007c; 2008; 2009a; 2010; 2011). Under these LOAs NMFS has required the Navy to minimize to the greatest extent practicable any adverse impacts on marine mammals, their habitats, and the availability of marine mammals for subsistence uses. Therefore, NMFS has required that the following mitigation measures be implemented during all active sonar missions.

Mitigation protocols and operational restrictions for the LOAs were set forth in the SURTASS LFA Sonar FSEIS (DoN, 2007a), Record of Decision (DoN, 2007b), NOAA/NMFS Final Rule (NOAA, 2007a), annual LOAs, and Court orders (APPENDIX A). These have been promulgated to the Fleet commands by the CNO (N2/N6F24, formerly N872A) via annual executive direction messages.

2.1 Mitigation and Monitoring Requirements

The objective of these mitigation measures is to effect the least practicable adverse impact on marine mammal species or stocks and to avoid risk of injury to marine mammals, sea turtles, and human divers. These objectives are met by:

- Ensuring that coastal waters within 22 km (12 nmi) of shore are not exposed to SURTASS LFA sonar signal received levels (RL) ≥180 dB re 1 µPa (rms) (sound pressure level [SPL])[8];
- Ensuring that no offshore biologically important areas (OBIA) are exposed to SURTASS LFA sonar signal RLs ≥180 dB re 1 µPa (rms) (SPL) during biologically important seasons;
- Minimizing exposure of marine mammals and sea turtles to SURTASS LFA sonar signal RLs below 180 dB re 1 µPa (rms) (SPL) by monitoring for their presence and suspending transmissions when one of these animals enters the LFA mitigation (safety) zone or buffer zone as shown in Figure 5; and
- Ensuring that no known recreational or commercial dive sites are subjected to SURTASS LFA sonar signal RLs >145 dB re 1 µPa (rms) (SPL).

Strict adherence to these measures has minimized impacts on marine mammal stocks and species, as well as sea turtle stocks, and recreational and commercial divers.

In the SURTASS LFA sonar 2007 Final Rule under the MMPA (NOAA, 2007a), NMFS added interim operational restrictions by the establishment of a 1-km (0.54-nmi) buffer shutdown zone:

- Outside of the 180-dB LFA mitigation zone, which may extend up to 2 km (1.1 nmi) from the vessel, depending on oceanographic conditions (50 CFR § 216.184(b)); and

[7] R/V *Cory Chouest* was retired in FY 2008.
[8] This was further restricted by the Court as described in Chapter 3.0 and shown in Figure 3 and 4. See APPENDIX A.

- Seaward of the outer perimeter of any offshore biologically important area designated in 50 CFR § 216.184(f) (50 CFR § 216.184(e)(2)).

At this distance, SPLs will be significantly lower than 180 dB.

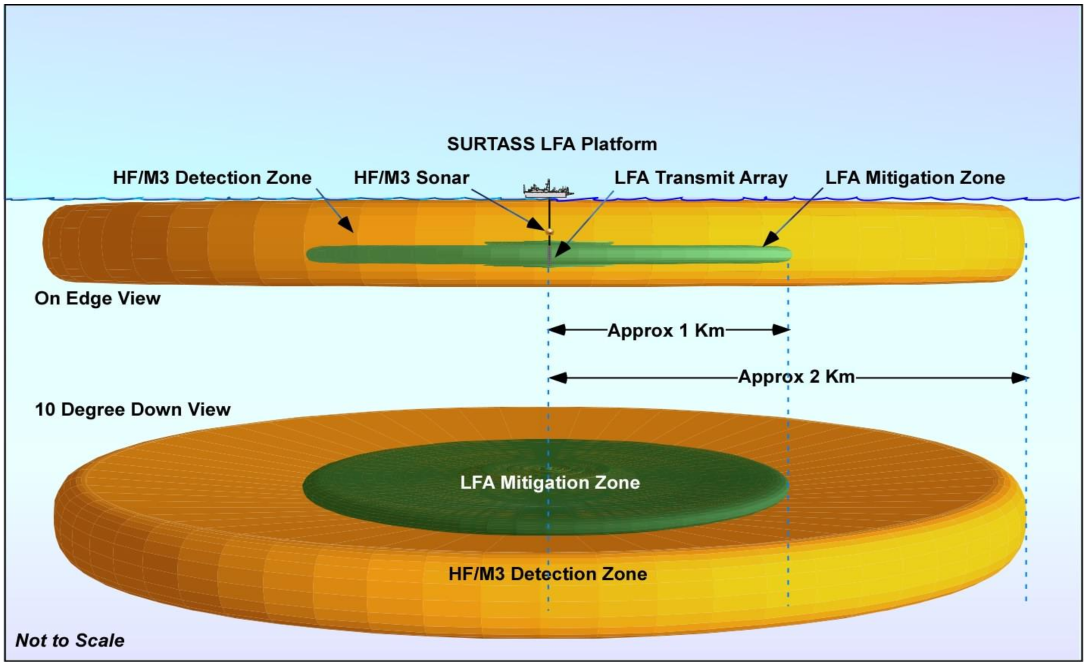

Figure 5. HF/M3 Sonar Detection and LFA Mitigation Zones

2.1.1 Geographic Restrictions

The following geographic restrictions apply to the employment of SURTASS LFA sonar:

- SURTASS LFA sonar-generated sound field will be below RLs of 180 dB re 1 µPa (rms) (SPL) within 22 km (12 nmi) of any coastlines;[9]
- SURTASS LFA sonar-generated sound field will be below RLs of 180 dB re 1 µPa (rms) (SPL) 1 km (0.54 nmi) seaward of the outer perimeter of any offshore biologically important area designated in 50 CFR § 216.184(f);
- When in the vicinity of known recreational or commercial dive sites, SURTASS LFA sonar will be operated such that the sound fields at those sites will not exceed RLs of 145 dB re 1 µPa (rms) (SPL); and
- SURTASS LFA sonar operators will estimate LFA sound field RLs (SPL) prior to and during operations to provide the information necessary to modify operations, including the delay or suspension of transmissions, in order not to exceed RLs of 180 dB re 1 µPa (rms) and 145 dB re 1 µPa (rms) sound field criteria cited above.

[9] Ibid

2.1.1.1 Offshore Biologically Important Areas

Offshore Biologically Important Areas (OBIAs) are areas of the world's oceans outside of 22 km (12 nmi) of a coastline where marine animals of concern (those animals listed under the ESA and/or marine mammals) congregate in high densities to carry out biologically important activities. These areas include migration corridors, breeding and calving grounds, and feeding grounds. There are ten areas designated by NMFS as offshore areas of critical biological importance for marine mammals in the 2007 Final Rule (NOAA, 2007a). These are:

- Shoreward of the 200-m (656-ft) isobath off the North American East Coast, from 28 to 50 degrees North latitude, west of 40 degrees West longitude—year-round.
- Antarctic Convergence Zone, delimited by the following: 1) 30 to 80 degrees East longitude along the 45-degree South latitude; 2) 80 to 150 degrees East longitude along the 55-degree South latitude; 3) 150 degrees East to 50 degrees West longitude along the 60-degree South latitude; and 4) 50 degrees West to 30 degrees East longitude along the 50-deg South latitude—October through March (IUCN, 1995).
- Costa Rica Dome, centered at 9 degrees N latitude and 88 degrees W longitude—year round (Longhurst, 1998; Chandler et al., 1999).
- Hawaiian Islands Humpback Whale National Marine Sanctuary (NMS) - Penguin Bank, Hawaiian Archipelago, centered at 21 degrees North latitude and 157 degrees 30 minutes West longitude—November 1 through May 1. Penguin Bank boundaries extend to the 100-fathom (183 m) isobaths (15 CFR § 922.181).
- Cordell Bank National Marine Sanctuary, boundaries in accordance with 15 CFR § 922.110—year-round.
- Gulf of the Farallones NMS, boundaries in accordance with 15 CFR § 922.80—year-round.
- Monterey Bay NMS, boundaries in accordance with 15 CFR § 922.130—year-round.
- Olympic Coast NMS, boundaries within 42.6 km (23.0 nmi) of the coast from 47 degrees 07 minutes North latitude to 48 degrees 30 minutes North latitude—December, January, March and May.
- Flower Garden Banks NMS, boundaries in accordance with 15 CFR § 922.120—year-round.
- The Gully, 44 degrees 13 minutes North latitude; 59 degrees 06 minutes West longitude to 43 degrees 47 minutes N latitude; 58 degrees 35 minutes West longitude to 43 degrees 35 minutes North latitude; 58 degrees 35 minutes West longitude to 43 degrees 35 minutes North latitude; 59 degrees 08 minutes West longitude to 44 degrees 06 minutes North latitude; 59 degrees 20 minutes West longitude—year round.

None of these areas were within the authorized operational areas for SURTASS LFA sonar during the period of this report.

2.1.1.2 Recreational and Commercial Dive Sites

SURTASS LFA sonar operations are constrained in the vicinity of known recreational and commercial dive sites to ensure that the sound field at such sites does not exceed RLs of 145 dB re 1 µPa (rms) (SPL). Recreational dive sites are generally defined as coastal areas from the shoreline out to the 40-m (130-ft) depth contour, which are frequented by recreational divers; but it is recognized that there are other sites that may be outside this boundary.

2.1.1.3 Sound Field Modeling

SURTASS LFA sonar operators estimate the LFA sound field RLs (SPL) prior to and during operations to provide the information necessary to modify operations, including the delay or suspension of transmissions, in order not to exceed the 180-dB re 1 µPa (rms) and 145-dB re 1 µPa (rms) RL sound field criteria cited above. Sound field limits are estimated using near-real-time environmental data and underwater acoustic performance prediction models. These models are an integral part of the SURTASS LFA sonar processing system. The acoustic models help determine the sound field by predicting the SPLs, or RLs, at various distances from the SURTASS LFA sonar source location. Acoustic model updates are nominally made every 12 hours or more frequently when meteorological or oceanographic conditions change.

If the sound field criteria listed above were exceeded, the sonar operator would notify the Officer in Charge (OIC) of the Military Detachment (MILDET), who would order the delay or suspension of transmissions. If it were predicted that the SPLs would exceed the criteria within the next 12 hours, the OIC would also be notified in order to take the necessary action to ensure that the sound field criteria would not be exceeded.

2.1.2 Monitoring to Prevent Injury to Marine Animals

The following monitoring to prevent injury to marine animals is required by the ROD (DoN, 2007b), the 2007 Rule (50 CFR § 216.185) (NOAA, 2007a), LOAs (NOAA, 2007c; 2008; 2009a; 2010; 2011), when employing SURTASS LFA sonar:

- **Visual monitoring** for marine mammals and sea turtles from the vessel during daylight hours by personnel trained to detect and identify marine mammals and sea turtles;
- **Passive acoustic monitoring** using the passive (low frequency) SURTASS array to listen for sounds generated by marine mammals as an indicator of their presence; and
- **Active acoustic monitoring** using the High Frequency Marine Mammal Monitoring (HF/M3) sonar, which is a Navy-developed, enhanced high frequency (HF) commercial sonar, to detect, locate, and track marine mammals and, to some extent, sea turtles, that may pass close enough to the SURTASS LFA sonar’s transmit array to enter the LFA mitigation and buffer zones.

2.1.2.1 Visual Monitoring

Visual monitoring includes daytime observations for marine mammals and sea turtles from the vessel. Daytime is defined as 30 minutes (min) before sunrise until 30 min after sunset. Visual monitoring begins 30 min before sunrise or 30 min before the SURTASS LFA sonar is deployed. Monitoring continues until 30 min after sunset or until the SURTASS LFA sonar is recovered. Observations are made by personnel trained in detecting and identifying marine mammals and sea turtles. The objective of these observations is to maintain a track of marine mammals and/or sea turtles observed and to ensure that none approach the source close enough to enter the LFA mitigation zone.

These personnel maintain a topside watch and marine mammal/sea turtle observation log during operations that employ SURTASS LFA sonar in the active mode. The numbers and identification of marine mammals/sea turtles sighted, as well as any unusual behavior, is entered into the log. A designated ship's officer monitors the conduct of the visual watches and periodically reviews the log entries. There are two potential visual monitoring scenarios.

First, if a potentially affected marine mammal or sea turtle is sighted outside of the LFA mitigation zone, the observer notifies the OIC. The OIC then notifies the HF/M3 sonar operator to determine the range and projected track of the animal. If it is determined that the animal will pass within the LFA mitigation zone, the OIC orders the delay or suspension of SURTASS LFA sonar transmissions when the animal enters the LFA mitigation zone. If the animal is visually observed within 1-km (0.54 nmi) buffer zone[10] outside of the LFA mitigation zone, the OIC orders the immediate delay or suspension of SURTASS LFA sonar transmissions. The observer continues visual monitoring/recording until the animal is no longer seen.

Second, if the potentially affected animal is sighted anywhere within the LFA mitigation or buffer zones, the observer notifies the OIC who orders the immediate delay or suspension of SURTASS LFA sonar transmissions.

All sightings are recorded in the log and provided as part of the Long Term Monitoring (LTM) Program as discussed in FOEIS/EIS Subchapter 2.4.2 (DoN, 2001) for the monitoring of potential long-term environmental effects.

2.1.2.2 Passive Acoustic Monitoring

Passive acoustic monitoring is conducted when SURTASS is deployed, using the LF SURTASS towed horizontal line array (HLA) to listen for vocalizing marine mammals as an indicator of their presence. If the sound is estimated to be from a marine mammal that may be potentially affected by SURTASS LFA sonar, the technician notifies the OIC who alerts the HF/M3 sonar operator and visual observers. If prior to or during transmissions, the OIC then orders the delay or suspension of SURTASS LFA sonar transmissions when the animal enters the LFA mitigation and buffer zones.

All contacts are recorded in the log and provided as part of the LTM Program, to monitor for potential long-term environmental effects.

2.1.2.3 Active Acoustic Monitoring

HF active acoustic monitoring uses the HF/M3 sonar to detect, locate, and track marine mammals (and possibly sea turtles) that could pass close enough to the SURTASS LFA sonar array to enter the LFA mitigation zone. HF acoustic monitoring begins 30 min before the first

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[10] The 1-km (0.54 nm) buffer zone was added by NMFS as an additional operational restriction in the Rule and LOAs, as issued, and is discussed in more detail in Section 2.1.3

SURTASS LFA sonar transmission of a given mission is scheduled to commence and continues until transmissions are terminated. Prior to full-power operations, the HF/M3 sonar power level is ramped up over a period of 5 min from a source level (SL) of 180 dB re 1 µPa @ 1 meter (rms) in 10-dB increments until full power (if required) is attained to ensure that there are no inadvertent exposures of local animals to RLs ≥ 180 dB from the HF/M3 sonar. There are two potential scenarios for mitigation via active acoustic monitoring.

First, if a contact is detected outside the LFA mitigation and buffer zones, the HF/M3 sonar operator determines the range and projected track of the animal. If it is determined that the animal will pass within the LFA mitigation and buffer zones, the sonar operator notifies the OIC. The OIC then orders the delay or suspension of transmissions when the animal is predicted to enter the LFA mitigation and buffer zones.

Second, if a contact is detected by the HF/M3 sonar within the LFA mitigation or buffer zones, the observer notifies the OIC who orders the immediate delay or suspension of transmissions.

All contacts are recorded in the log and provided as part of the LTM Program.

2.1.2.4 Resumption of SURTASS LFA Transmissions

SURTASS LFA sonar transmissions can commence/resume 15 minutes after there is no further detection by the HF/M3 sonar and there is no further visual observation of the animal within the LFA mitigation and buffer zones.

2.1.3 Final Rule and LOA Conditions

In the SURTASS LFA sonar 2002 to 2007 Final Rule under the MMPA (NOAA, 2002b), NMFS added interim operational restrictions to preclude the potential for injury to marine mammals from resonance effects by establishing 1-km (0.54-nmi) buffer shutdown zones. In the current Final Rule, NMFS once more required that the 1-km (0.54 nmi) buffer zone operational restriction (NOAA, 2007a). Specifically, if the sound field exceeds 180-dB re: 1 µPa (rms) outside of the LFA mitigation zone plus the 1-km (0.54-nmi) buffer zone, SURTASS LFA sonar transmissions will be delayed or suspended until resumption protocols are satisfied. These regulations also required that SURTASS LFA sonar sound fields do not exceed 180 dB re 1 µPa (rms) at a distance of 1 km (0.54 nmi) seaward of the outer perimeter of any designated offshore biologically important area during the biologically important period specified in the regulations.

2.1.4 Summary of Mitigation and Monitoring

There are geographic restrictions that apply to the operation of SURTASS LFA sonar as well as three types of mitigation measures that will be applied during the operation of the sonar (Table 1).

Table 1. Summary of mitigation measures for operation of SURTASS LFA sonar.

MITIGATION MEASURE	CRITERIA	ACTIONS
Geographic Restrictions		
22 km (12 nmi) from coastline	Sound field below 180 dB re 1 µPa (rms) RL, based on SPL modeling	Delay/suspend SURTASS LFA sonar operations if sound field criterion is exceeded
Offshore biologically important areas (OBIA) during biologically important seasons	Sound field below 180 dB re 1 µPa (rms) RL, based on SPL modeling	Delay/suspend SURTASS LFA sonar operations if sound field criterion is exceeded
Recreational and commercial dive sites[11]	Sound field not to exceed 145 dB re 1 µPa (rms) RL, based on SPL modeling	Delay/suspend SURTASS LFA sonar operations if sound field criterion is exceeded
Monitoring to Prevent Injury to Marine Mammals and Sea Turtles		
Visual Monitoring	Potentially affected species near the vessel but outside of the LFA mitigation and buffer zones	Notify OIC
	Potentially affected species sighted near the vessel but outside of the LFA mitigation and buffer zones	Delay/suspend SURTASS LFA sonar operations
Passive Acoustic Monitoring	Potentially affected species detected	Notify OIC
Active Acoustic Monitoring	Contact detected and determined to have a track that would pass within the LFA mitigation and buffer zones	Notify OIC
	Potentially affected species detected inside of the LFA mitigation and/or buffer zones	Delay/suspend SURTASS LFA sonar operations

[11] Recreational dive sites generally are located in coastal areas ranging from the shoreline out to the 40-m (130-ft) depth contour.

2.1.5 National Marine Sanctuaries Restrictions

The NMFS Final Rule (50 CFR § 216.184(e)(3)) requires that SURTASS LFA sonar will not be operated such that the sound field exceeds 180 dB (RL) within the offshore boundaries that extend beyond 12 nmi (22 km) of the following National Marine Sanctuaries: 1) Monterey Bay NMS, 2) Gulf of the Farallones NMS, 3) Cordell Bank NMS, 4) Flower Garden Banks NMS, and 5) Hawaiian Islands Humpback Whale NMS - Penguin Bank. Additionally, SURTASS LFA sonar will not be operated such that the sound field exceeds 180 dB (RL) within 23 nmi (37.4 km) of the coast during the months of December, January, March, and May of each year in the Olympic Coast NMS.

None of these areas were within the authorized operational areas for LFA during the period of this report.

3.0 COURT CONSTRAINTS FOR SURTASS LFA SONAR OPERATIONS

During the period of this report, the SURTASS LFA sonar systems onboard the R/V *Cory Chouest*, USNS ABLE, USNS EFFECTIVE, and USNS IMPECCABLE were operated under the conditions of the LOAs, as issued, and the Stipulated Settlement Agreement Order (APPENDIX A) described in Subchapter 1.5.3. The exception was that the Navy could operate the LFA sonar system within the coastal exclusion zones set forth in APPENDIX A only when necessary to continue tracking an existing underwater contact detected outside of the exclusion zone, or when necessary to detect a new underwater contact that would place the LFA sonar system within the coastal exclusion zone to maximize opportunities for detection. This exception was not exercised during the period of this report.

Details of the authorized areas of operation are shown in Figures 3 and 4.

4.0 ANALYSES OF SURTASS LFA OPERATIONS

Under 50 CFR 216 Subpart Q, this section includes an analysis of monitoring and research conducted during the 5-year period of these regulations, an estimate of cumulative impacts on marine mammal stocks based on best scientific judgment, and an analysis of the advancement of alternative (passive) technologies as a replacement for LFA sonar.

As part of its continuing commitment to protect the environment, the Navy continues to carry out a LTM Program to assess and analyze the potential for effects of the employment of SURTASS LFA on the marine environment as discussed in FOEIS/EIS Subchapter 2.4 (DoN, 2001).

The principal objectives of the LTM Program are to:

- Analyze and assess the effectiveness of proposed mitigation measures, and make recommendations for improvements where applicable, to incorporate them as early as possible, with NMFS concurrence;
- Provide the necessary input data for reports on estimates of percentages of marine mammal populations affected by SURTASS LFA sonar operations, using predictive modeling based on operating location, system characteristics, and animal demographics;
- Study the potential effects of Navy SURTASS LFA sonar-generated underwater sound on long-term ecological processes relative to LF sound-sensitive marine animals, focusing on the application of Navy technology for the detection, classification, localization, and tracking of these animals; and
- Collaborate, as feasible, with pertinent Navy, academic, and industry laboratories and research organizations, and where applicable, with Allied navy and academic laboratories.

The program is designed to:

- Provide a summary of the unclassified SURTASS LFA sonar operations each year;
- Provide a summary of unclassified plans for the following year;
- Assess the efficacy of mitigation measures used during the past year, as well as the value-added from the various LTM elements with recommendations for improvements;
- Provide a synopsis of LOA reports to NMFS on estimates of percentages of marine mammal stocks affected by SURTASS LFA sonar operations to help confirm the validity of the impact analyses, particularly pertaining to the adequacy of scientific information; and
- Assess any long-term ecological processes that may be exhibiting effects from SURTASS LFA sonar operations, and reports or scientific papers on discernible or estimated cumulative impacts from such operations.

4.1 Reporting

The first part of the LTM Program consists of NMFS-directed reports under the MMPA Final Rule and LOAs. These reports provide information for assessments of whether incidental harassment of marine mammals occurred within the SURTASS LFA mitigation zone during operations, based upon data from the monitoring mitigation (visual, passive acoustic, active acoustic). Data analysis from the LTM Program and post-operation acoustic information are utilized to estimate the percent of marine mammal stocks potentially exposed to SURTASS LFA signals at ≥180 dB (RL) and <180 dB (RL).

During routine operations of SURTASS LFA, technical and environmental data are collected and recorded. These include data from visual and acoustic monitoring, ocean environmental measurements, and technical operational inputs. As part of the LTM Program and as stipulated in the MMPA Final Rule and LOAs, the following reports are required.

4.1.1 Quarterly Reports

On a quarterly basis, the Navy has provided NMFS with classified reports for each vessel that includes all active-mode missions completed 30 days or more prior to the date of the deadline for the report. The Navy must submit its quarterly mission reports to NMFS, no later than 30 days after the end of each quarter beginning on the date of effectiveness of an LOA or as specified in the appropriate LOA. Specifically, these reports will include dates/times of exercises, location of vessel, LOA province (as set forth in Longhurst (1998)), location of the mitigation zone in relation to the LFA sonar array, marine mammal observations, and records of any delays or suspensions of operations. Marine mammal observations would include animal type and/or species, number of animals sighted by species, date and time of observations, type of detection (visual, passive acoustic, HF/M3 sonar), the animal’s bearing and range from vessel, behavior, and remarks/narrative (as necessary). The report will include the Navy's assessment of whether any taking occurred within and outside of the SURTASS LFA sonar mitigation zone and, if so, estimates of the percentage of marine mammal stocks affected both for the quarter and cumulatively (to date) for the annual period covered by the LOA by SURTASS LFA sonar operations. This assessment will include estimates of Level A and Level B harassment takes of marine mammals for within and outside of the mitigation zone, using predictive modeling based on operating locations, dates/times of operations, system characteristics, oceanographic environmental conditions, and animal demographics. In the event that no SURTASS LFA sonar missions are completed during a quarter, a report of negative activity would be provided.

4.1.2 Annual Report

The annual report would provide NMFS with an unclassified summary of the year's quarterly reports and will include the Navy's assessment of whether any Level A and/or Level B harassment takings of marine mammals occurred within and outside of the SURTASS LFA sonar’s 180-dB mitigation zone and, if so, estimates of the percentage of marine mammal stocks affected by SURTASS LFA sonar operations. This analysis would include estimates for both within and outside the 180-dB mitigation zone, using predictive modeling based on operating locations, dates/times of operations, system characteristics, oceanographic environmental conditions, and animal demographics. The annual report would also include: (1) analysis of the effectiveness of the mitigation measures with recommendations for improvements where applicable; (2) assessment of any long-term effects from SURTASS LFA sonar operations; and (3) any discernible or estimated cumulative impacts from SURTASS LFA sonar operations.

4.1.3 Comprehensive Report

The Navy is required to provide NMFS and the public with a final comprehensive report analyzing the impacts of SURTASS LFA sonar on marine mammal species and stocks. This report, which is due at least 240 days prior to expiration of these regulations, would include an in-depth analysis of all monitoring and Navy-supported research pertinent to SURTASS LFA sonar conducted during the first 4 years of these regulations, a scientific assessment of cumulative impacts on marine mammal stocks, and an analysis on the advancement of alternative (passive) technologies as a replacement for LFA sonar. This report is an important document for NMFS' review and assessment of impacts for any future rulemaking.

4.2 Mitigation Effectiveness

The following assessment of the effectiveness of the mitigation measures is provided. Table 2 provides a summary of mitigation monitoring and protocols for suspension/delays of LFA transmissions for the LOA periods covered by this report. This includes 70 missions collectively for the R/V *Cory Chouest*, USNS IMPECCABLE, USNS ABLE, and USNS EFFECTIVE.

4.2.1 LFA Mitigation and Buffer Zones

During the missions, the minimum radial distance to the outer edge of the mitigation zone from the LFA array was no greater than 1 km (0.54 nmi). Therefore, the mitigation and buffer zones comprised a 2-km (1.08-nmi) radius.

The 1-km (0.54 nmi) buffer zone interim restriction has proven to be practical under the current operations, but analysis has shown that it would not appreciably minimize adverse impacts below 180 dB re 1 µPa (rms) RL. See Subsection 4.2.5 below for details on the analysis. The monitoring of the 180-dB LFA mitigation zone is to prevent potential injury to marine animals.

4.2.2 Visual Monitoring

Visual observers, trained in marine mammal identification, are posted as specified in the regulations (50 CFR §216.185) and CNO executive directives (see Section 2.0). The personnel responsible for marine animal visual monitoring were trained in the proper methods, procedures, and protocols required to detect and to identify marine animals in accordance with the regulations (50 CFR §216.185(d)). During the 70 missions, eight sightings of marine mammals were noted.

Table 2. Summary of SURTASS LFA Mitigation Monitoring

	Number of Missions	Visual Detections	Passive Acoustic	Active Acoustic HF/M3	HF/M3 Unavail-able[12]	Mitigation Protocol Suspensions/ delays
LOA 1						
R/V *Cory Chouest*	6	0	0	0	16	16
USNS IMPECCABLE	8	1	0	19	7	27
LOA 2						
USNS ABLE	3	1	0	1	3	5
USNS IMPECCABLE	6	2	0	1	0	3
LOA 3						
USNS ABLE	10	0	0	0	0	0
USNS IMPECCABLE	21	1 (non-op)	3	3	4	7
LOA 4						
USNS ABLE	8	1 (non-op)	1	1 (non-op)	0	1
USNS IMPECCABLE	7	0	0	2	0	2
USNS EFFECTIVE	1	2	0	2	1	4
Totals	**70**	**8**	**4**	**29**	**31**	**65**

4.2.2.1 Visual Sightings of Marine Mammals

LOA 1: During an operation on the USNS IMPECCABLE in the second quarter of the LOA period (16 November 2007 to 15 February 2008), there was one visual sighting of 1-3 pilot/pygmy sperm whales. The initial sighting was at 340 degrees relative (R) at 2.6 km (1.4 nmi), and LFA transmissions were suspended.

There were no visual sightings during operations on the R/V *Cory Chouest.*

LOA 2: During operations on the USNS ABLE in the second quarter of the LOA period (16 November 2008 to 15 February 2009), there was one visual sighting of marine mammals. The initial sighting was at 170 degrees R at 1.0 km (~0.5 nmi); the closest point of approach was at 090 degrees R at 100 m (~1.0 nmi); and the final sighting was at 340 degrees R at 1.5 km (~0.8 nmi), and LFA transmissions were suspended. They were identified as most likely to be minke whales (1 adult with 1 or 2 juveniles).

[12] LFA transmissions suspended during HF/M3 non-availability.

During operations on the USNS IMPECCABLE in the fourth quarter of the LOA period (16 May to 15 August 2009), there were two visual sightings. The first sighting was at 135 degrees R at 1.0 km (~0.5 nmi), and LFA transmissions were suspended. The second was at 145 degrees R at 1.9 km (~1.0 nmi), and LFA transmissions were suspended. Both sightings were identified as dolphins, but specific species were unknown.

LOA 3: During a non-operational period (no LFA transmissions) on the USNS IMPECCABLE in the fourth quarter of the LOA period (16 May to 15 August 2010), there was one visual sighting of marine mammals. The sighting was at 185 degrees true (T) at 1.8 km (1.12 nmi). They were identified as most likely to be gray whales (8 – 10).

LOA 4: During a non-operational period (no LFA transmissions) on the USNS ABLE in the third quarter of the LOA period (16 February to 15 May 2011), there was one visual sighting of marine mammals. Species was not identified.

In the fourth quarter of the LOA period (16 May to 15 August 2011) on the USNS EFFECTIVE, there was a visual sighting of a marine mammal at 060 degrees R at 1100 m (1200 yds) after an alert by the HF/M3 sonar operator. Species was not identified. There was no passive confirmation. LFA transmissions were suspended in accordance with protocols.

Also in the fourth quarter of the LOA period (16 May to 15 August 2011) on the USNS EFFECTIVE, there was a visual sighting of a sea turtle at 090 degrees R, 15 m (50 ft). LFA transmissions were suspended in accordance with protocols. Because of the contact's proximity to the SURTASS LFA sonar vessel, an assessment was made to determine the potential for the sea turtle to be within the LFA mitigation zone (180 dB sound field). The closest LFA transmission in time to the sea turtle ended 8 minutes and 20 seconds prior to the sighting and subsequent suspension. This equated to an estimated horizontal range of 700 m (0.4 nmi) from the LFA array. Assuming that at this range the sea turtle would be in the far field (that is the LFA array would appear to be a point source), the RL would be approximately 170 dB re 1 µPa (rms) (SPL) based on spherical spreading. Additionally, the center of the array is approximately 100 m (328 ft) below the surface with the HF/M3 sonar located at the top of the array. Because of the depth of LFA array, the HF/M3 sonar was not designed to detect marine mammals or sea turtles at or near the surface in proximity to the vessel. In order for the sea turtle to enter the 180-dB mitigation zone, it would have to swim through the HF/M3 detection zone, which at this range would have a high probability of detection. The lack of detection by the HF/M3 sonar would indicate that the sea turtle remained at or near the surface and did not dive into the 180 dB LFA mitigation zone during transmissions. Thus, it is improbable that the sea turtle received SPL from SURTASS LFA sonar at or above 180 dB re 1 µPa (rms).

4.2.2.2 Passive Acoustic Monitoring

The embarked military detachment (MILDET) and system support engineers monitored the SURTASS passive displays during all operations for marine mammal vocalizations as specified in the regulations (50 CFR § 216.185) and the conditions of the LOAs, as issued.

LOA 1: There were no passive acoustic detections.

LOA 2: There were no passive acoustic detections.

LOA 3: There were three passive acoustic detections.

During operations on the USNS IMPECCABLE in the first quarter of the LOA period (16 August to 15 November 2009), there were three periods of marine mammal vocalizations. These passive acoustic contacts coincided with three HF/M3 sonar alerts identified as possible marine mammals. There was no visual confirmation because of low visibility at night.

LOA 4: There was one passive acoustic detection.

During operations on the USNS ABLE in the first quarter of the LOA period (16 August to 15 November 2010), there was one period of marine mammal vocalizations. There was no visual or active acoustic (HF/M3) confirmation. LFA transmissions were suspended. After the contact was assessed to be outside of the LFA mitigation and buffers zones, transmissions were resumed.

4.2.2.3 Active Acoustic Monitoring

The HF/M3 sonar systems were operated continuously during the course of the missions as specified in the regulations (50 CFR § 216.185) and the conditions of the LOAs, as issued.

LOA 1: During operations on the USNS IMPECCABLE in the first quarter of the LOA period (16 August to 15 November 2007), there were 19 HF/M3 alerts that were identified as possible marine mammal or sea turtle detections. No additional correlating data were available to further verify, identify, or clarify these detections.

LOA 2: During operations on the USNS ABLE in the second quarter of the LOA period (16 November 2008 to 15 February 2009), there was one HF/M3 alert that was identified as possible marine mammal or sea turtle detection. No additional correlating data were available to further verify, identify, or clarify this detection.

During operations on the USNS IMPECCABLE in the third quarter of the LOA period (16 February to 15 May 2009), there was one HF/M3 alert that was identified as possible marine mammal or sea turtle detection. No additional correlating data were available to further verify, identify, or clarify this detection.

LOA 3: During operations on the USNS IMPECCABLE in the first quarter of the LOA period (16 August to 15 November 2009), there were three HF/M3 sonar alerts identified as possible marine mammals. There was no visual confirmation because of low visibility at night.

LOA 4: There were five HF/M3 sonar alerts.

During operations on the USNS ABLE in the third quarter of the LOA period (16 February to 15 May 2011), there was one HF/M3 alert with no visual or passive confirmation. This occurred just after LFA transmissions ended.

During operations on the USNS EFFECTIVE in the fourth quarter of the LOA period (16 May to 15 August 2011), there were two HF/M3 alerts. The first contact was confirmed by visual monitoring at 060 degrees R, 1100 m (1200 yds). The species was not identified. There was no visual or passive confirmation of the second alert.

During operations on the USNS IMPECCABLE in the first quarter of the LOA period (16 August to 15 November 2010), there were two HF/M3 alerts that were identified as possible marine mammal contacts. The first was at 115 degree T at 1.0 km (0.54 nmi). The second was at 230 degrees T at 1.0 km (0.54 nmi). There were no visual or passive confirmations.

4.2.2.4 Delay/Suspension of Operations

SURTASS LFA transmissions were suspended or delayed on 65 separate occasions during the period of the four LOAs in accordance with the requisite protocols as specified in the regulations (50 CFR § 216.185) and the conditions of the LOAs, as issued. Eight were due to visual contacts, four were due to passive acoustic detections, and HF/M3 sonar contacts accounted for 29. The remaining 31 suspensions/delays were due to the unavailability of the HF/M3 sonar due to mechanical or software problems.

LOA 1: Transmissions were delayed or suspended on 43 occasions.

On the USNS IMPECCABLE, operations were delayed or suspended one time due to visual detection of marine mammals, 19 times due to HF/M3 contacts, and 7 times due to the failure of the HF/M3 sonar or the passive array.

On the R/V *Cory Chouest*, there were 16 delays or suspensions due to HF/M3 sonar failure.

LOA 2: Transmissions were delayed or suspended on eight occasions.

On the USNS ABLE, operations were delayed or suspended one time due to visual detection of marine mammals, one time due to HF/M3 contact, and three times due to the failure of the HF/M3 sonar.

On the USNS IMPECCABLE, operations were delayed or suspended two times due to visual detections of marine mammals and one time due to HF/M3 contact.

LOA 3: Transmissions were delayed or suspended on seven occasions.

There were no operational suspensions or delays aboard the USNS ABLE.

On the USNS IMPECCABLE, operations were delayed or suspended three times for HF/M3 alerts and four times due to HF/M3 malfunctions. Three of these alerts coincided with passive contacts.

LOA 4: Transmissions were delayed or suspended on seven occasions.

There was one operational suspension aboard the USNS ABLE due to a passive acoustic contact.

On the USNS EFFECTIVE, there four suspensions/delays due to two HF/M3 sonar alerts with one visual confirmation, one visual contact of a sea turtle, and one while resolving a tuning issue with the HF/M3 sonar.

On the USNS IMPECCABLE, operations were delayed or suspended two times for HF/M3 alerts.

4.2.3 Marine Mammal Observer Training

In accordance with the regulations (50 CFR § 216-185(d) on-site individuals will be qualified to conduct the mitigation, monitoring, and reporting activities. Specifically, one or more marine mammal biologists, highly experienced in marine mammal observations techniques, will be hired to train observers to conduct visual monitoring during active sonar operations. To meet this requirement, marine mammal observers (watchstanders) were trained by qualified Marine Acoustics, Incorporated (MAI) marine biologists onboard:

- USNS ABLE on 30 July 2008 in Pearl City, Hawaii;
- USNS IMPECCABLE on 13 December 2008 in Yokohama; Japan
- USNS ABLE on 16 March 2009 in Yokohama; Japan.
- USNS IMPECCABLE on 16 October 2009 in Okinawa, Japan;
- USNS ABLE on 13 July 2010 in Sasebo, Japan
- USNS ABLE on 14 August 2011 in Sasebo, Japan; and
- USNS EFFECTIVE on 21 October 2011 in Sasebo, Japan.

The watchstander training consisted of the following training modules. The first module covered the fundamentals of visual observing for marine mammals and sea turtles, while the second module described basic information about marine mammals and sea turtles and tips on their identification at sea. The observation training-module included a description of the reasons why visual observations are required, the observation rules and conditions specified in the LOA when LFA sonar is actively transmitting, cues for marine mammal presence, factors that may adversely or positively affect sightability of marine mammals, and types of behavior to note. Emphasis was placed on the importance of vigilantly monitoring for marine mammals and consistently completing data forms to document watchstander efforts. The species identification training-module included basic information about the types of marine mammals; species of both marine mammals and sea turtles that may be encountered in the western North Pacific (WestPAC) SURTASS LFA operating areas; photographs as well as video and sound clips, and surface profiles. The trainees included the vessel masters, deck officers (mates), and seamen.

4.2.4 Summary of Monitoring Mitigation Effectiveness

The following is a summary of the monitoring mitigation for SURTASS LFA sonar transmissions during the period of this report. As previously discussed in Subsection 2.1.2, the following monitoring to prevent injury to marine animals, as required by the ROD (DoN, 2007b), the 2007 Rule (50 CFR § 216.185) (NOAA, 2007a), and the LOAs (NOAA, 2007c; 2008; 2009a; 2010; 2011), was employed during SURTASS LFA sonar active transmission periods:

- **Visual monitoring** for marine mammals and sea turtles from the vessel during daylight hours by personnel trained to detect and identify marine mammals and sea turtles;
- **Passive acoustic monitoring** using the passive (low frequency) SURTASS array to listen for sounds generated by marine mammals as an indicator of their presence; and
- **Active acoustic monitoring** using the High Frequency Marine Mammal Monitoring (HF/M3) sonar, which is a Navy-developed, enhanced high frequency (HF) commercial sonar, to detect, locate, and track marine mammals and, to some extent, sea turtles, that may pass close enough to the SURTASS LFA sonar's transmit array to enter the LFA mitigation and buffer zones.

During all missions, the minimum radial distance to the mitigation (safety) zone from the LFA array was 1 km (0.54 nmi). Therefore, the mitigation and buffer zones comprised a 2-km (1.08-nmi) radius. There were no marine mammals reported within the mitigation zone during the period of this report.

During the period of this report there were 70 missions collectively for the R/V *Cory Chouest*, USNS IMPECCABLE, USNS ABLE, and USNS EFFECTIVE. During that period there were eight visual sightings with one HF/M3 confirmation, 4 passive acoustics contacts with three HF/M3 confirmations, and 29 HF/M3 contacts with one visual and three passive confirmations. During the period, there were 65 delays or suspensions of transmissions based on mitigation protocols.

Detailed analyses of the effectiveness of these monitoring protocols were provided in the SURTASS LFA sonar FOEIS/EIS (DoN, 2001) and the Final Comprehensive Report for the 2002-2007 Rule (DoN, 2007c). These analyses demonstrated that the overall effectiveness exceeded the original estimates. Visual and LF passive acoustic monitoring showed low probability of detection as predicted in the FOEIS/EIS (DoN, 2001) at 9 percent and 25 percent respectively; but the effectiveness of active acoustic monitoring (HF/M3 sonar) proved to exceed the predicted values (DoN, 2007c). The results presented in this report support the previous findings that the overall monitoring mitigation effectiveness approached 100 percent within the 180-dB mitigation zone.

Therefore, there are no recommendations for mitigation improvements at this time.

4.2.5 Assessment of the Interim Operational Restrictions

In the SURTASS LFA 2002 to 2007 Final Rule under the MMPA (NOAA, 2002b), NMFS added an interim operational restriction to preclude the potential for injury to marine mammals from resonance effects by establishing a 1-km (0.54-nmi) buffer shutdown zone outside of the LFA mitigation zone. In the current five-year Rule (2007 to 2012) (NOAA, 2007a), NMFS once more required that the 1-km (0.54 nmi) buffer zone operational restriction be adhered to. This restriction has proven to be practical under current operations; but the below analysis demonstrates that it did not appreciably minimize adverse impacts below 180-dB re 1 μPa (rms) RL.

The monitoring of the 180-dB mitigation zone is to prevent injury to marine animals. The area between the 180-dB radius and the 1-km (0.54 nmi) buffer zone (estimated to extend to about the 174 dB isopleth) is an area where marine mammals will experience Level B incidental takes in accordance with the risk continuum (FOEIS/EIS Subchapter 4.2.3 [DoN, 2001]). The determination of the percentage of marine mammal stocks potentially affected by LFA operations in the risk assessment case studies are determined based on monitoring mitigation in 180-dB injury zone, without accounting for the 1-km (0.54 nmi) buffer zone. The area without the buffer zone is 3.14 km^2 (1.70 nmi^2) and the area with the buffer zone is 12.6 km^2 (6.80 nmi^2), a difference of 9.5 km^2 (5.1 nmi^2). The model analysis was rerun using the total 2-km (1.08 nmi) mitigation+buffer zone (see Subchapter 2.5.1 of the SURTASS LFA Sonar FSEIS [DoN, 2007a]). The differences in the number of animals affected were insignificant. Thus, the removal of this interim operational restriction would not generate a change of any significance in the percentage of animals potentially affected. However, the Navy continued to adhere to the 1-km buffer zone as implemented by NMFS in the current five-year Rule (2007 to 2012) (NOAA, 2007a).

4.3 Estimates of Potential Effects to Marine Mammal Stocks

SURTASS LFA sonar systems have been and are currently operating under NMFS regulation (50 CFR §216 Subpart Q) (NOAA, 2007a) and annual LOAs as issued. These actions include routine training and testing, as well as the use of the systems during military operations. These actions are classified as military readiness activities under provisions of the NDAA. The purposes of these military readiness activities are to provide fully functional hardware and software, extensive training, job experience, and operational/system monitoring in a variety of LFA mission scenarios and acoustic environments.

The LFA system onboard R/V *Cory Chouest* was retired in 2008 and the CLFA system installed onboard USNS ABLE (T-AGOS 20) became operational in 2008. The second CLFA system onboard USNS EFFECTIVE (T-AGOS 21) commenced sea trials in mid 2011. Summaries of these operations for the period of the four LOAs (16 August 2007 to 15 August 2011) are provided in Table 4.

There were 6 missions from the R/V *Cory Chouest*, 42 missions for the USNS IMPECCABLE, 21 missions for USNS ABLE, and 1 at-sea test mission for USNS EFFECTIVE. These missions occurred in the Pacific Ocean (east of Japan), west and north Philippine Sea, the South China Sea, south of Hawaii, and near Guam.

Under the conditions of the LOAs, LFA transmissions were not to exceed a total of 432 hours of transmission time between the ships for the one year period of each LOA. As demonstrated in Table 3, the Navy met these conditions.

Table 3. Summary of SURTASS LFA Sonar Operations

	Number of Mission	Sites[1]	Length of Mission (days)	Active Transmission Time (hours)	Mitigation Protocol Suspensions/ delays
LOA 1					
R/V *Cory Chouest*	6	2,3	25.5	70.6	16
USNS IMPECCABLE	8	2,3,7	24.3	65.2	27
LOA 1 Total			**49.8**	**135.8**	**43**
LOA 2					
USNS ABLE	3	2,10	14.1	22.9	5
USNS IMPECCABLE	6	1,2,7	9.6	9.6	3
LOA 2 Total			**23.7**	**32.5**	**8**
LOA 3					
USNS ABLE	10	2,3	7.8	20.25	0
USNS IMPECCABLE	21	1,2,3	9.3	23.26	7
LOA 3 Total			**17.1**	**43.51**	**7**
LOA 4					
USNS ABLE	8	2,3,4,7	35.75	31.96	1
USNS IMPECCABLE	7	3,7	21.61	21.74	2
USNS EFFECTIVE	1	2	4.98	10.29	4
LOA 4 Total	**70**		**62.34**	**63.99**	**7**

[1]See Figures 3 and 4

4.3.1 Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected

In its annual LOA applications, the Navy provided estimates of the percentage of marine mammal stocks that could potentially be affected in the bio-geographic regions of proposed LFA operations for the 12-month period of the LOA(s). Overall planning for operations during the LOA periods was based first on the identification of the general ocean areas where routine testing and training, as well as military operations were desired, development of criteria for these mission areas, and then the determination of the best operational sites and seasons within these mission areas that would have the least potential for impacts on marine mammals while meeting the Navy's operational requirements. Potential mission sites within each mission area were then analyzed with regard to spatial and temporal factors. Based on operational requirements for LFA, the general ocean areas were within the Philippine Sea, northwest Pacific Ocean, Sea of Japan, East China Sea, South China Sea, and Hawaii Operating Areas. Marine mammal density and stock/abundance estimates were then assembled.

Species-specific information on the animals that could potentially occur in those above areas was derived from best available published source documentation including estimates for their stock/abundance and density. Animal demographics (stocks and densities) are based on the current literature reviews of the western North Pacific Ocean as provided in the fifth year LOA application (DoN, 2011d).

Analyses for pre-operational estimates were performed at 10 nominal potential operational sites, encompassing all four seasons, which provide a very conservative estimate of the potential for impacts to marine mammal stocks in those provinces where operations were proposed. These sites included:

- Site 1—East of Japan
- Site 2—North Philippine Sea
- Site 3—West Philippine Sea
- Site 4—Guam
- Site 5—Sea of Japan
- Site 6—East China Sea
- Site 7—South China Sea
- Site 8—Offshore Expansion North
- Site 9—Offshore Expansion South
- Site 10—Hawaii Operating Areas

Locations are shown in Figures 3 and 4.

4.3.2 Post-Operational Estimates of Marine Mammal Stocks Potentially Affected

In the quarterly and annual reports, the Navy provided post-operational assessments of whether incidental harassment occurred within the LFA mitigation and buffer zones and estimates of the percentages of marine mammal stocks possibly harassed incidentally using predictive modeling based on dates/times/location of operations, system characteristics, oceanographic/environmental conditions, and animal demographics. The basis for the methodology used for the acoustic modeling to analyze risk and produce the incidental harassment estimates was essentially the scientific analysis process used in the SURTASS LFA Final EIS (DoN, 2001) and detailed in the Navy's FSEIS (DoN, 2007a).

Operations occurred in the vicinity of sites 1, 2, 3, 4, 7, and 10 (as shown in Figures 3 and 4). Tables 4 through 16 provide post-operational risk estimates for marine mammal stocks in these operating areas for the four LOAs (16 August 2007 through 15 August 2011) as documented in the Navy's Annual Reports (DoN, 2008; 2009b; 2010; 2011e). These values support the conclusion that all risk estimates for marine mammal stocks were below—for most cases, well below—the criteria delineated by NMFS in the Final Rule (NOAA, 2007a). Upon completion of the missions under the requested authorization, these estimates were refined and submitted to NMFS under the reporting requirements of the Final Rule and the conditions of the LOAs, as issued. They are summarized below.

Table 4. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected—Totals for the R/V *Cory Chouest* 1st Year LOA

LOA 1—R/V *CORY CHOUEST*								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Fin Whale	***N. Pacific***	***9250***	***0.30***	***0.15***	***0.02***	***--***	***0.47***	***0.00***
Bryde's Whale	Western N. Pacific	22000	0.39	0.20	0.02	--	0.61	0.00
Minke Whale	Western N. Pacific	25049	1.86	0.93	0.10	--	2.89	0.00
N. Pacific Right Whale (spr/fall/win)	***Western N. Pacific***	***922***	***--***	***0.00***	***--***	***--***	***0.00***	***0.00***
Humpback Whale (winter only)	***Western N. Pacific***	***394***	***0.00***	***0.00***	***1.48***	***--***	***1.48***	***0.00***
Gray Whale (winter only)	***Western N. Pacific***	***100***	***--***	***--***	***--***	***--***	***--***	***--***
Sperm Whale	***N. Pacific***	***102112***	***0.05***	***0.04***	***0.00***	***--***	***0.09***	***0.00***
Kogia	N. Pacific	350553	0.03	0.01	0.00	--	0.04	0.00
Cuvier's Beaked Whale	N. Pacific	90725	0.02	0.02	0.00	--	0.04	0.00
Blainville's Beaked Whale	N. Pacific	8032	0.36	0.19	0.02	--	0.57	0.00
Ginkgo-Toothed Beaked Whale	N. Pacific	22799	0.13	0.06	0.01	--	0.20	0.00
Killer Whale	Western N. Pacific	12256	--	0.00	--	--	0.00	0.00
False Killer Whale	Western N. Pacific	16668	1.18	0.59	0.06	--	1.83	0.00
Pygmy Killer Whale	Western N. Pacific	30214	0.47	0.24	0.02	--	0.73	0.00
Melon-Headed Whale	Western N. Pacific	36770	0.22	0.11	0.01	--	0.34	0.00
Short-Finned Pilot Whale	Western N. Pacific	53608	0.96	0.52	0.05	--	1.53	0.00
Risso's Dolphin	Western N. Pacific	83289	1.05	0.53	0.05	--	1.63	0.00
Common Dolphin	Western N. Pacific	3286163	0.13	0.06	0.01	--	0.20	0.00
Bottlenose Dolphin	Western N. Pacific	168791	0.71	0.36	0.04	--	1.11	0.00
Spinner Dolphin	Western N. Pacific	1015059	0.00	0.00	0.00	--	0.00	0.00
Pantropical Spotted Dolphin	Western N. Pacific	438064	0.24	0.12	0.01	--	0.37	0.00
Striped Dolphin	Western N. Pacific	570038	0.22	0.12	0.01	--	0.35	0.00
Rough-Toothed Dolphin	Western N. Pacific	145729	0.31	0.15	0.02	--	0.48	0.00
Fraser's Dolphin	Western N. Pacific	220789	0.14	0.07	0.01	--	0.22	0.00
Pacific White-Sided Dolphin	Western N. Pacific	931000	0.20	0.10	0.01	--	0.31	0.00

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA)

Table 5. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected—Totals for USNS IMPECCABLE 1st Year LOA

LOA 1—USNS IMPECCABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Fin Whale	***N. Pacific***	***9250***	***0.16***	***0.21***	***--***	***--***	***0.37***	***0.00***
Bryde's Whale	Western N. Pacific	22000	0.20	0.26	--	0.03	0.49	0.00
Minke Whale	Western N. Pacific	25049	0.95	1.30	--	0.17	2.42	0.00
N. Pacific Right Whale (spr/fall/win)	***Western N. Pacific***	***922***	***0.00***	***--***	***--***	***0.00***	***0.00***	***0.00***
Humpback Whale (winter only)	***Western N. Pacific***	***394***	***--***	***0.00***	***--***	***--***	***0.00***	***0.00***
Gray Whale (winter only)	***Western N. Pacific***	***100***	***0.00***	***--***	***--***	***--***	***0.00***	***0.00***
Sperm Whale	***N. Pacific***	***102112***	***0.02***	***0.04***	***--***	***0.02***	***0.08***	***0.00***
Kogia	N. Pacific	350553	0.01	0.02	--	0.00	0.03	0.00
Cuvier's Beaked Whale	N. Pacific	90725	0.01	0.01	--	0.03	0.05	0.00
Blainville's Beaked Whale	N. Pacific	8032	0.15	0.25	--	0.03	0.43	0.00
Ginkgo-Toothed Beaked Whale	N. Pacific	22799	0.05	0.09	--	0.01	0.15	0.00
Killer Whale	Western N. Pacific	12256	--	--	--	0.02	0.02	0.00
False Killer Whale	Western N. Pacific	16668	--	0.82	--	0.08	0.90	0.00
False Killer Whale	Inshore Archipelago	9777	0.61	--	--	--	0.61	0.00
Pygmy Killer Whale	Western N. Pacific	30214	0.22	0.33	--	0.03	0.58	0.00
Melon-Headed Whale	Western N. Pacific	36770	0.78	0.15	--	0.02	0.95	0.00
Short-Finned Pilot Whale	Western N. Pacific	53608	0.47	0.67	--	0.13	1.27	0.00
Risso's Dolphin	Western N. Pacific	83289	0.56	0.73	--	0.08	1.37	0.00
Common Dolphin	Western N. Pacific	3286163	0.05	0.09	--	0.01	0.15	0.00
Bottlenose Dolphin	Western N. Pacific	168791	--	0.50	--	0.05	0.55	0.00
Bottlenose Dolphin	Inshore Archipelago	105138	0.65	--	--	--	0.65	0.00
Spinner Dolphin	Western N. Pacific	1015059	0.01	0.00	--	0.00	0.01	0.00
Pantropical Spotted Dolphin	Western N. Pacific	438064	0.24	0.17	--	0.02	0.43	0.00
Striped Dolphin	Western N. Pacific	570038	0.11	0.16	--	0.03	0.30	0.00
Rough-Toothed Dolphin	Western N. Pacific	145729	0.11	0.22	--	0.02	0.35	0.00
Fraser's Dolphin	Western N. Pacific	220789	0.07	0.10	--	0.01	0.18	0.00
Pacific White-Sided Dolphin	Western N. Pacific	931000	--	0.14	--	0.01	0.15	0.00

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA).

Table 6. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected—Totals for 1st Year LOA

LOA 1—R/V CORY CHOUEST & USNS IMPECCABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Fin Whale	***N. Pacific***	***9250***	***0.19***	***0.36***	***0.02***	***--***	***0.57***	***0.00***
Bryde's Whale	Western N. Pacific	22000	0.41	0.28	0.02	--	0.71	0.00
Minke Whale	Western N. Pacific	25049	2.81	2.23	0.10	0.03	5.17	0.00
N. Pacific Right Whale (spr/fall/win)	***Western N. Pacific***	***922***	***0.00***	***0.00***	***--***	***0.17***	***0.17***	***0.00***
Humpback Whale (winter only)	***Western N. Pacific***	***394***	***0.00***	***0.00***	***1.48***	***0.00***	***1.48***	***0.00***
Gray Whale (winter only)	***Western N. Pacific***	***100***	***0.00***	***--***	***--***	***--***	***0.00***	***0.00***
Sperm Whale	***N. Pacific***	***102112***	***0.07***	***0.08***	***0.00***	***--***	***0.15***	***0.00***
Kogia	N. Pacific	350553	0.04	0.03	0.00	0.02	0.09	0.00
Cuvier's Beaked Whale	N. Pacific	90725	0.03	0.03	0.00	0.00	0.06	0.00
Blainville's Beaked Whale	N. Pacific	8032	0.51	0.44	0.02	0.03	1.00	0.00
Ginkgo-Toothed Beaked Whale	N. Pacific	22799	0.18	0.15	0.01	0.03	0.37	0.00
Killer Whale	Western N. Pacific	12256	--	0.00	--	0.01	0.01	0.00
False Killer Whale	Western N. Pacific	16668	1.18	1.41	0.06	0.02	2.67	0.00
False Killer Whale	Inshore Archipelago	9777	0.61	--	--	0.08	0.69	0.00
Pygmy Killer Whale	Western N. Pacific	30214	0.69	0.57	0.02	--	1.28	0.00
Melon-Headed Whale	Western N. Pacific	36770	1.00	0.26	0.01	0.03	1.30	0.00
Short-Finned Pilot Whale	Western N. Pacific	53608	1.43	1.19	0.05	0.02	2.69	0.00
Risso's Dolphin	Western N. Pacific	83289	1.61	1.26	0.05	0.13	3.05	0.00
Common Dolphin	Western N. Pacific	3286163	0.18	0.15	0.01	0.08	0.42	0.00
Bottlenose Dolphin	Western N. Pacific	168791	0.71	0.41	0.04	0.01	1.37	0.00
Bottlenose Dolphin	Inshore Archipelago	105138	0.65	--	--	0.05	0.70	0.00
Spinner Dolphin	Western N. Pacific	1015059	0.01	0.00	0.00	--	0.01	0.00
Pantropical Spotted Dolphin	Western N. Pacific	438064	0.48	0.29	0.01	0.00	0.78	0.00
Striped Dolphin	Western N. Pacific	570038	0.33	0.28	0.01	0.02	0.64	0.00
Rough-Toothed Dolphin	Western N. Pacific	145729	0.42	0.37	0.02	0.03	0.84	0.00
Fraser's Dolphin	Western N. Pacific	220789	0.21	0.17	0.01	0.02	0.41	0.00
Pacific White-Sided Dolphin	Western N. Pacific	931000	0.20	0.24	0.01	0.01	0.46	0.00

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA).

Table 7. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected - Totals for USNS IMPECCABLE 2nd Year LOA

LOA 2—USNS IMPECCABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Fin Whale	***N. Pacific***	***9250***	***0.02***	***--***	***--***	***0.01***	***0.03***	***0.00***
Bryde's Whale	Western N. Pacific	22000	0.02	--	0.03	0.02	0.07	0.00
Minke Whale	Western N. Pacific	25049	0.14	--	0.17	0.07	0.38	0.00
N. Pacific Right Whale (spr/fall/win)	***Western N. Pacific***	***922***	***0.00***	***--***	***0.01***	***--***	***0.01***	***0.00***
Humpback Whale (winter only)	***Western N. Pacific***	***394***	***0.00***	***--***	***--***	***--***	***0.00***	***0.00***
Sperm Whale	***N. Pacific***	***102112***	***0.00***	***--***	***0.01***	***0.00***	***0.01***	***0.00***
Kogia	N. Pacific	350553	0.00	--	0.00	0.00	0.00	0.00
Cuvier's Beaked Whale	N. Pacific	90725	0.01	--	0.03	0.00	0.04	0.00
Blainville's Beaked Whale	N. Pacific	8032	0.03	--	0.03	0.02	0.08	0.00
Ginkgo-Toothed Beaked Whale	N. Pacific	22799	0.01	--	0.01	--	0.02	0.00
Killer Whale	Western N. Pacific	12256	0.00	--	0.02	--	0.02	0.00
False Killer Whale	Western N. Pacific	16668	0.10	--	0.09	0.02	0.21	0.00
False Killer Whale	Inshore Archipelago	9777	--	--	--	0.03	0.03	0.00
Pygmy Killer Whale	Western N. Pacific	30214	0.04	--	0.04	0.01	0.09	0.00
Melon-Headed Whale	Western N. Pacific	36770	0.01	--	0.02	0.03	0.06	0.00
Short-Finned Pilot Whale	Western N. Pacific	53608	0. 09	--	0.15	0.02	0.26	0.00
Risso's Dolphin	Western N. Pacific	83289	0.08	--	0.08	0.05	0.21	0.00
Common Dolphin	Western N. Pacific	3286163	0. 01	--	0.01	0.00	0.02	0.00
Bottlenose Dolphin	Western N. Pacific	168791	0.06	--	0.06	0.01	0.13	0.00
Bottlenose Dolphin	Inshore Archipelago	105138	--	--	--	0.05	0.05	0.00
Spinner Dolphin	Western N. Pacific	1015059	0.00	--	0.00	0.09	0.09	0.00
Pantropical Spotted Dolphin	Western N. Pacific	438064	0. 02	--	0.02	0.02	0.06	0.00
Striped Dolphin	Western N. Pacific	570038	0. 02	--	0.03	0.01	0.06	0.00
Rough-Toothed Dolphin	Western N. Pacific	145729	0.02	--	0.02	0.01	0.05	0.00
Fraser's Dolphin	Western N. Pacific	220789	0.01	--	0.01	0.01	0.03	0.00
Pacific White-Sided Dolphin	Western N. Pacific	931000	0. 01	--	0.01	0.00	0.02	0.00

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA).

Table 8. Post-Operational Estimated of Marine Mammal Stocks Potentially Affected - Totals for USNS ABLE 2nd Year LOA

LOA 2—USNS ABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Blue Whale	***Western N. Pacific***	***1548***	***0.33***	***--***	***--***	***--***	***0.33***	***0.00***
Fin Whale	***Hawaii***	***2099***	***0.86***	***--***	***--***	***--***	***0.86***	***0.00***
Bryde's Whale	Western N. Pacific	22000	--	0.08	0.02	--	0.10	0.00
Bryde's Whale	Hawaii	469	1.09	--	--	--	1.09	0.00
Minke Whale	Western N. Pacific	25049	--	0.51	0.11	--	0.62	0.00
Minke Whale	Hawaii	25000	0.02	--	--	--	0.02	0.00
N. Pacific Right Whale (spr/fall/win)	***Western N. Pacific***	***922***	***--***	***0.03***	***0.01***	***--***	***0.04***	***0.00***
Gray Whale (winter only)	***Western N. Pacific***	***100***	***--***	***0.00***	***--***	***--***	***0.00***	***0.00***
Sperm Whale	***N. Pacific***	***102112***	***--***	***0.04***	***0.01***	***--***	***0.05***	***0.00***
Sperm Whale	***Hawaii***	***6919***	***0.54***	***--***	***--***	***--***	***0.54***	***0.00***
Kogia	N. Pacific	350553	--	0.01	0.00	--	0.01	0.00
Kogia	Hawaii	24657	0.54	--	--	--	0.54	0.00
Cuvier's Beaked Whale	N. Pacific	90725	--	0.09	0.02	--	0.11	0.00
Cuvier's Beaked Whale	Hawaii	15242	0.54	--	--	--	0.54	0.00
Longman's Beaked Whale	Hawaii	1007	0.53	--	--	--	0.53	0.00
Blainville's Beaked Whale	N. Pacific	8032	--	0.09	0.02	--	0.11	0.00
Blainville's Beaked Whale	Hawaii	2872	0.54	--	--	--	0.54	0.00
Ginkgo-Toothed Beaked Whale	N. Pacific	22799	--	0.03	0.01	--	0.04	0.00
Killer Whale	Western N. Pacific	12256	--	0.05	0.01	--	0.06	0.00
Killer Whale	Hawaii	349	0.56	--	--	--	0.56	0.00
False Killer Whale	Western N. Pacific	16668	--	0.26	0.06	--	0.32	0.00
False Killer Whale	Hawaii	236	0.83	--	--	--	0.83	0.00
Pygmy Killer Whale	Western N. Pacific	30214	--	0.11	0.02	--	0.13	0.00
Pygmy Killer Whale	Hawaii	956	0.82	--	--	--	0.82	0.00
Melon-Headed Whale	Western N. Pacific	36770	--	0.05	0.01	--	0.06	0.00
Melon-Headed Whale	Hawaii	2950	0.80	--	--	--	0.80	0.00
Short-Finned Pilot Whale	Western N. Pacific	53608	--	0.43	0.09	--	0.52	0.00
Short-Finned Pilot Whale	Hawaii	8870	0.80	--	--	--	0.80	0.00
Risso's Dolphin	Western N. Pacific	83289	--	0.25	0.05	--	0.30	0.00
Risso's Dolphin	Hawaii	2372	1.06	--	--	--	1.06	0.00
Common Dolphin	Western N. Pacific	3286163	--	0.03	0.01	--	0.04	0.00
Bottlenose Dolphin	Western N. Pacific	168791	--	0.17	0.03	--	0.20	0.00
Bottlenose Dolphin	Hawaii	3215	1.02	--	--	--	1.02	0.00
Spinner Dolphin	Western N. Pacific	1015059	--	0.00	0.00	--	0.00	0.00

LOA 2—USNS ABLE								
Animal	Stock	# Animals in Stock	% Affected (w/mit) 120 – 180 dB					% Affected (w/mit) ≥ 180 dB
			Q1	Q2	Q3	Q4	AN	Annual Total
Spinner Dolphin	Hawaii	3351	0.98	--	--	--	0.98	0.00
Pantropical Spotted Dolphin	Western N. Pacific	438064	--	0.05	0.01	--	0.06	0.00
Pantropical Spotted Dolphin	Hawaii	8978	0.98	--	--	--	0.98	0.00
Striped Dolphin	Western N. Pacific	570038	--	0.10	0.02	--	0.12	0.00
Striped Dolphin	Hawaii	13143	0.98	--	--	--	0.98	0.00
Rough-Toothed Dolphin	Western N. Pacific	145729	--	0.07	0.01	--	0.08	0.00
Rough-Toothed Dolphin	Hawaii	8709	0.98	--	--	--	0.98	0.00
Fraser's Dolphin	Western N. Pacific	220789	--	0.03	0.01	--	0. 04	0.00
Fraser's Dolphin	Hawaii	10226	0.99	--	--	--	0. 99	0.00
Pacific White-Sided Dolphin	Western N. Pacific	931000	--	0.02	0.01	--	0.03	0.00
Hawaiian Monk Seal	***Hawaii***	***1302***	***0.24***	***--***	***--***	***--***	***0.24***	***0.00***

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA).

Table 9. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected - Totals for 2nd Year LOA

LOA 2—USNS ABLE & USNS IMPECCABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**Annual**	**Annual Total**
Blue Whale	***Western N. Pacific***	***1548***	***0.33***	***--***	***--***	***--***	***0.33***	***0.00***
Fin Whale	***N. Pacific***	***9250***	***0.02***	***--***	***--***	***0.01***	***0.03***	***0.00***
Fin Whale	***Hawaii***	***2099***	***0.86***	***--***	***--***	***--***	***0.86***	***0.00***
Bryde's Whale	Western N. Pacific	22000	0.02	0.08	0.05	0.02	0.17	0.00
Bryde's Whale	Hawaii	469	1.09	--	--	--	1.09	0.00
Minke Whale	Western N. Pacific	25049	0.14	0.51	0.28	0.07	1.00	0.00
Minke Whale	Hawaii	25000	0.02	--	--	--	0.02	0.00
N. Pacific Right Whale (spr/fall/win)	***Western N. Pacific***	***922***	***0.00***	***0.03***	***0.02***	***--***	***0.05***	***0.00***
Humpback Whale (winter only)	***Western N. Pacific***	***394***	***0.00***	***--***	***--***	***--***	***0.00***	***0.00***
Gray Whale (winter only)	***Western N. Pacific***	***100***	***--***	***0.00***	***--***	***--***	***0.00***	***0.00***
Sperm Whale	***N. Pacific***	***102112***	***0.00***	***0.04***	***0.02***	***0.00***	***0.06***	***0.00***
Sperm Whale	***Hawaii***	***6919***	***0.54***	***--***	***--***	***--***	***0.54***	***0.00***
Kogia	N. Pacific	350553	0.00	0.01	0.00	0.00	0.01	0.00
Kogia	Hawaii	24657	0.54	--	--	--	0.54	0.00
Cuvier's Beaked Whale	N. Pacific	90725	0.01	0.09	0.05	--	0.15	0.00
Cuvier's Beaked Whale	Hawaii	15242	0.54	--	--	--	0.54	0.00
Longman's Beaked Whale	Hawaii	1007	0.53	--	--	--	0.53	0.00
Blainville's Beaked Whale	N. Pacific	8032	0.03	0.09	0.05	0.02	0.19	0.00
Blainville's Beaked Whale	Hawaii	2872	0.54	--	--	--	0.54	0.00
Ginkgo-Toothed Beaked Whale	N. Pacific	22799	0.01	0.03	0.02	--	0.06	0.00
Killer Whale	Western N. Pacific	12256	0.00	0.05	0.03	--	0.08	0.00
Killer Whale	Hawaii	349	0.56	--	--	--	0.56	0.00
False Killer Whale	Western N. Pacific	16668	0.10	0.26	0.15	0.02	0.53	0.00
False Killer Whale	Inshore Archipelago	9777	--	--	--	0.03	0.03	0.00
False Killer Whale	Hawaii	236	0.83	--	--	--	0.83	0.00
Pygmy Killer Whale	Western N. Pacific	30214	0.04	0.11	0.06	0.01	0.22	0.00
Pygmy Killer Whale	Hawaii	956	0.82	--	--	--	0.82	0.00
Melon-Headed Whale	Western N. Pacific	36770	0.01	0.05	0.03	0.03	0.12	0.00
Melon-Headed Whale	Hawaii	2950	0.80	--	--	--	0.80	0.00
Short-Finned Pilot Whale	Western N. Pacific	53608	0.09	0.43	0.24	0.02	0.78	0.00
Short-Finned Pilot Whale	Hawaii	8870	0.80	--	--	--	0.80	0.00
Risso's Dolphin	Western N. Pacific	83289	0.08	0.25	0.13	0.05	0.51	0.00
Risso's Dolphin	Hawaii	2372	1.06	--	--	--	1.06	0.00

LOA 2—USNS ABLE & USNS IMPECCABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**Annual**	**Annual Total**
Common Dolphin	Western N. Pacific	3286163	0.01	0.03	0.02	0.00	0.06	0.00
Bottlenose Dolphin	Western N. Pacific	168791	0.06	0.17	0.09	0.01	0.33	0.00
Bottlenose Dolphin	Inshore Archipelago	105138	--	--	--	0.05	0.05	0.00
Bottlenose Dolphin	Hawaii	3215	1.02	--	--	--	1.02	0.00
Spinner Dolphin	Western N. Pacific	1015059	0.00	0.00	0.00	0.09	0.09	0.00
Spinner Dolphin	Hawaii	3351	0.98	--	--	--	0.98	0.00
Pantropical Spotted Dolphin	Western N. Pacific	438064	0.02	0.05	0.03	0.02	0.12	0.00
Pantropical Spotted Dolphin	Hawaii	8978	0.98	--	--	--	0.98	0.00
Striped Dolphin	Western N. Pacific	570038	0.02	0.10	0.05	0.01	0.18	0.00
Striped Dolphin	Hawaii	13143	0.98	--	--	--	0.98	0.00
Rough-Toothed Dolphin	Western N. Pacific	145729	0.02	0.07	0.03	0.01	0.13	0.00
Rough-Toothed Dolphin	Hawaii	8709	0.98	--	--	--	0.98	0.00
Fraser's Dolphin	Western N. Pacific	220789	0.01	0.03	0.02	0.01	0. 07	0.00
Fraser's Dolphin	Hawaii	10226	0.99	--	--	--	0. 99	0.00
Pacific White-Sided Dolphin	Western N. Pacific	931000	0.01	0.02	0.02	0.00	0.05	0.00
Hawaiian Monk Seal	***Hawaii***	***1302***	***0.24***	***--***	***--***	***--***	***0.24***	***0.00***

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA).

Table 10. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected - Totals for USNS IMPECCABLE 3rd Year LOA

LOA 3—USNS IMPECCABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Blue whale	***N. Pacific***	***9250***	***0.03***	***--***	***--***	***--***	***0.03***	***0.00***
Fin whale	***N. Pacific***	***9250***	***0.06***	***0.05***	***--***	***--***	***0.11***	***0.00***
Sei whale	***N Pacific***	***8600***	***0.10***	***--***	***--***	***--***	***0.10***	***0.00***
Bryde's whale	Western N. Pacific	22000	0.08	0.06	--	0.04	0.18	0.00
Minke whale	Western N. Pacific	25049	0.33	0.30	--	0.24	0.87	0.00
N. Pacific right whale (spr/fall/win)	***Western N. Pacific***	***922***	***0.02***	***--***	***--***	***0.01***	***0.03***	***0.00***
Humpback whale (winter only)	***Western N. Pacific***	***394 (1030)***	***0.00***	***1.78***	***--***	***--***	***1.78***	***0.00***
Sperm whale	***N. Pacific***	***102112***	***0.02***	***0.02***	***--***	***0.04***	***0.08***	***0.00***
Kogia	N. Pacific	350553	0.01	0.01	--	0.01	0.03	0.00
Baird’s beaked whale	Western N Pacific	8000	0.26	--	--	--	0.26	0.00
Cuvier's beaked whale	N. Pacific	90725	0.04	0.01	--	0.08	0.13	0.00
Blainville's beaked whale	N. Pacific	8032	0.04	0.12	--	0.09	0.25	0.00
Ginkgo-toothed beaked whale	N. Pacific	22799	0.03	0.04	--	0.03	0.10	0.00
Killer whale	Western N. Pacific	12256	--	--	--	0.04	0.04	0.00
Hubbs’ beaked whale	N Pacific	22799	0.02	--	--	--	0.02	0.00
False killer whale	Western N. Pacific	16668	0.32	0.40	--	0.24	0.96	0.00
Pygmy killer whale	Western N. Pacific	30214	0.11	0.16	--	0.10	0.37	0.00
Melon-headed whale	Western N. Pacific	36770	0.03	0.07	--	0.04	0.14	0.00
Short-finned pilot whale	Western N. Pacific	53608	0.34	0.33	--	0.39	1.06	0.00
Risso's dolphin	Western N. Pacific	83289	0.24	0.35	--	0.22	0.81	0.00
Common dolphin	Western N. Pacific	3286163	0.03	0.04	--	0.03	0.10	0.00
Bottlenose dolphin	Western N. Pacific	168791	0.18	0.24	--	0.15	0.57	0.00
Spinner dolphin	Western N. Pacific	1015059	0.00	0.00	--	0.00	0.00	0.00
Pantropical spotted dolphin	Western N. Pacific	438064	0. 09	0.08	--	0.05	0.22	0.00
Striped dolphin	Western N. Pacific	570038	0.05	0.08	--	0.09	0.22	0.00
Rough-toothed dolphin	Western N. Pacific	145729	0.08	0.11	--	0.06	0.25	0.00
Fraser's dolphin	Western N. Pacific	220789	0.04	0.05	--	0.03	0.12	0.00
Pacific white-sided dolphin	Western N. Pacific	931000	0.03	0.07	--	0.02	0.12	0.00

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA)

Table 11. Post-Operational Estimated of Marine Mammal Stocks Potentially Affected - Totals for USNS ABLE 3rd Year LOA

LOA 3—USNS ABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Fin whale	***N. Pacific***	***9250***	***--***	***--***	***0.06***	***--***	***0.06***	***0.00***
Bryde's whale	Western N. Pacific	22000	0.04	--	0.08	0.03	0.15	0.00
Minke whale	Western N. Pacific	25049	0.28	--	0.37	0.20	0.85	0.00
N. Pacific right whale (spr/fall/win)	***Western N. Pacific***	***922***	***0.02***	***--***	***--***	***0.01***	***0.03***	***0.00***
Sperm whale	***N. Pacific***	***102112***	***0.02***	***--***	***0.02***	***0.03***	***0.07***	***0.00***
Kogia	N. Pacific	350553	0.01	--	0.01	0.01	0.03	0.00
Cuvier's beaked whale	N. Pacific	90725	0.05	--	0.01	0.07	0.13	0.00
Blainville's beaked whale	N. Pacific	8032	0.05	--	0.15	0.07	0.27	0.00
Ginkgo-toothed beaked whale	N. Pacific	22799	0.02	--	0.05	0.03	0.10	0.00
Killer whale	N. Pacific	12256	0.03	--	--	0.04	0.07	0.00
False killer whale	N. Pacific	16668	0.14	--	0.49	0.20	0.83	0.00
Pygmy killer whale	Western N. Pacific	30214	0.06	--	0.20	0.08	0.34	0.00
Melon-headed whale	Western N. Pacific	36770	0.03	--	0.09	0.04	0.16	0.00
Short-finned pilot whale	Western N. Pacific	53608	0.23	--	0.40	0.33	0.96	0.00
Risso's dolphin	Western N. Pacific	83289	0.13	--	0.44	0.19	0.76	0.00
Common dolphin	Western N. Pacific	3286163	0.02	--	0.06	0.02	0.10	0.00
Bottlenose dolphin	Western N. Pacific	168791	0.09	--	0.30	0.13	0.52	0.00
Spinner dolphin	Western N. Pacific	1015059	0.00	--	0.00	0.00	0.00	0.00
Pantropical spotted dolphin	Western N. Pacific	438064	0.03	--	0.10	0.04	0.17	0.00
Striped dolphin	Western N. Pacific	570038	0.05	--	0.09	0.07	0.21	0.00
Rough-toothed dolphin	Western N. Pacific	145729	0.04	--	0.13	0.05	0.22	0.00
Fraser's dolphin	Western N. Pacific	220789	0.02	--	0.06	0.02	0. 10	0.00
Pacific white-sided dolphin	Western N. Pacific	931000	0.01	--	0.09	0.02	0.12	0.00

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA)

Table 12. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected - Totals for 3rd Year LOA

LOA 3—USNS ABLE & USNS IMPECCABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**Annual**	**Annual Total**
Blue whale	***N. Pacific***	***9250***	***0.03***	***--***	***--***	***--***	***0.03***	***0.00***
Fin whale	***N. Pacific***	***9250***	***0.06***	***0.05***	***0.06***	***--***	***0.17***	***0.00***
Sei whale	***N Pacific***	***8600***	***0.10***	***--***	***--***	***--***	***0.10***	***0.00***
Bryde's whale	Western N. Pacific	22000	0.12	0.06	0.08	0.04	0.30	0.00
Minke whale	Western N. Pacific	25049	0.61	0.30	0.37	0.44	1.72	0.00
N. Pacific right whale (spr/fall/win)	***Western N. Pacific***	***922***	***0.04***	***--***	***--***	***0.02***	***0.06***	***0.00***
Humpback whale (winter only)	***Western N. Pacific***	***394 (1030)***	***0.00***	***1.78***	***--***	***--***	***1.78***	***0.00***
Baird's beaked whale	Western N. Pacific	8000	0.26	--	--	--	0.26	0.00
Sperm whale	***N. Pacific***	***102112***	***0.04***	***0.02***	***0.02***	***0.07***	***0.15***	***0.00***
Kogia	N. Pacific	350553	0.02	0.01	0.01	0.02	0.06	0.00
Baird's beaked whale	Western N. Pacific	8000	0.26	--	--	--	0.26	0.00
Cuvier's beaked whale	N. Pacific	90725	0.09	0.01	0.01	0.15	0.25	0.00
Blainville's beaked whale	N. Pacific	8032	0.09	0.12	0.15	0.16	0.52	0.00
Ginkgo-toothed beaked whale	N. Pacific	22799	0.05	0.04	0.05	0.06	0.20	0.00
Hubbs' beaked whale	N. Pacific	22799	0.02	--	--	--	0.02	0.00
Killer whale	Western N. Pacific	12256	0.03	--	--	0.08	0.11	0.00
False killer whale	Western N. Pacific	16668	0.46	0.40	0.49	0.44	1.79	0.00
Pygmy killer whale	Western N. Pacific	30214	0.17	0.16	0.20	0.18	0.71	0.00
Melon-headed whale	Western N. Pacific	36770	0.06	0.07	0.09	0.08	0.30	0.00
Short-finned pilot whale	Western N. Pacific	53608	0.57	0.33	0.40	0.72	2.02	0.00
Risso's dolphin	Western N. Pacific	83289	0.37	0.35	0.44	0.41	1.57	0.00
Common dolphin	Western N. Pacific	3286163	0.05	0.04	0.06	0.05	0.20	0.00
Bottlenose dolphin	Western N. Pacific	168791	0.27	0.24	0.30	0.28	1.09	0.00
Spinner dolphin	Western N. Pacific	1015059	0.00	0.00	0.00	0.00	0.00	0.00
Pantropical spotted dolphin	Western N. Pacific	438064	0.12	0.08	0.10	0.09	0.39	0.00
Striped dolphin	Western N. Pacific	570038	0.10	0.08	0.09	0.16	0.43	0.00
Rough-toothed dolphin	Western N. Pacific	145729	0.12	0.11	0.13	0.11	0.47	0.00
Fraser's dolphin	Western N. Pacific	220789	0.06	0.05	0.06	0.05	0. 22	0.00
Pacific white-sided dolphin	Western N. Pacific	931000	0.04	0.07	0.09	0.04	0.24	0.00

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA)

Table 13. Post-Operational Estimated of Marine Mammal Stocks Potentially Affected - Totals for USNS ABLE 4th Year LOA

LOA 4—USNS ABLE								
Animal	Stock	# Animals in Stock	% Affected (w/mit) 120 – 180 dB					% Affected (w/mit) ≥ 180 dB
			Q1	Q2	Q3	Q4	AN	Annual Total
Blue whale	***Eastern N. Pacific***	***1186***	***0.14***	***--***	***--***	***--***	***0.14***	***0.00***
Fin whale	***N. Pacific***	***9250***	***0.10***	***0.05***	***--***	***--***	***0.15***	***0.00***
Sei whale	***N. Pacific***	***8600***	***0.06***	***--***	***--***	***--***	***0.06***	***0.00***
Bryde's whale	Western N. Pacific	20501	0.11	0.08	0.06	--	0.25	0.00
Minke whale	Western N. Pacific	25049	0.32	0.32	0.29	--	0.93	0.00
N. Pac right whale (Oct-May)	***Western N. Pacific***	***922***	***--***	***0.01***	***0.02***	***--***	***0.03***	***0.00***
Humpback whale (winter only)	***Western N. Pacific***	***1107***	***0.00***	***1.40***	***0.44***	***--***	***1.84***	***0.00***
Humpback whale (Oct-May)	***Central N. Pacific***	***10103***	***0.00***	***--***	***--***	***--***	***0.00***	***0.00***
Gray whale (winter only)	***Western N. Pacific***	***121***	***--***	***0.04***	***0.08***	***--***	***0.12***	***0.00***
Sperm whale	***N. Pacific***	***102112***	***0.04***	***0.01***	***0.02***	***--***	***0.07***	***0.00***
Kogia	N. Pacific	350553	0.05	0.01	0.00	--	0.06	0.00
Cuvier's beaked whale	N. Pacific	90725	0.11	0.01	0.03	--	0.15	0.00
Blainville's beaked whale	N. Pacific	8032	0.34	0.13	0.11	--	0.58	0.00
Ginkgo-toothed beaked whale	N. Pacific	22799	0.07	0.05	0.04	--	0.16	0.00
Longman's beaked whale	Central N. Pacific	1007	0.61	--	--	--	0.61	0.00
Killer whale	Central N. Pacific	349	0.90	--	0.02	--	0.92	0.00
False killer whale	Western N. Pacific	16668	0.55	0.34	0.19	--	1.08	0.00
False killer whale	Inshore Archipelago	9777	--	0.07	0.12	--	0.19	0.00
Pygmy killer whale	Western N. Pacific	30214	0.17	0.13	0.07	--	0.37	0.00
Melon-headed whale	Western N. Pacific	36770	0. 33	0.13	0.16	--	0.62	0.00
Short-finned pilot whale	Western N. Pacific	53608	0.40	0.29	0.26	--	0.95	0.00
Risso's dolphin	Western N. Pacific	83289	0. 38	0.40	0.35	--	1.13	0.00
Common dolphin	Western N. Pacific	3286163	0.04	0.05	0.04	--	0.13	0.00
Bottlenose dolphin	Western N. Pacific	168791	0.24	0.20	0.11	--	0.55	0.00
Bottlenose dolphin	Inshore Archipelago	105138	--	0.11	0.21	--	0.32	0.00
Spinner dolphin	Western N. Pacific	1015059	0.01	0.21	0.38	--	0.60	0.00
Pantropical spotted dolphin	Western N. Pacific	438064	0.21	0.11	0.12	--	0.44	0.00
Striped dolphin	Western N. Pacific	570038	0.10	0.08	0.09	--	0.27	0.00
Rough-toothed dolphin	Western N. Pacific	145729	0.12	0.11	0.08	--	0.31	0.00
Fraser's dolphin	Western N. Pacific	220789	0.05	0.05	0.04	--	0.14	0.00
Fraser's dolphin	Central N. Pacific	10226	1.07	--	--	--	1.07	0.00
Pacific white-sided dolphin	Western N. Pacific	931000	0.07	0.06	0.03	--	0.16	0.00

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA)

Table 14. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected - Totals for USNS EFFECTIVE 4th Year LOA

LOA 4—USNS EFFECTIVE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Bryde's whale	Western N. Pacific	20501	--	--	--	0.07	0.07	0.00
Minke whale	Western N. Pacific	25049	--	--	--	0.44	0.44	0.00
N. Pacific right whale (Oct-May)	***Western N. Pacific***	***922***	--	--	--	***0.00***	***0.00***	***0.00***
Sperm whale	***N. Pacific***	***102112***	--	--	--	***0.06***	***0.06***	***0.00***
Kogia	N. Pacific	350553	--	--	--	0.02	0.02	0.00
Cuvier's beaked whale	N. Pacific	90725	--	--	--	0.15	0.15	0.00
Blainville's beaked whale	N. Pacific	8032	--	--	--	0.16	0.16	0.00
Ginkgo-toothed beaked whale	N. Pacific	22799	--	--	--	0.06	0.06	0.00
Killer whale	Western N. Pacific	12256	--	--	--	0.08	0.08	0.00
False killer whale	Western N. Pacific	16668	--	--	--	0.44	0.44	0.00
Pygmy killer whale	Western N. Pacific	30214	--	--	--	0.17	0.17	0.00
Melon-headed whale	Western N. Pacific	36770	--	--	--	0.08	0.08	0.00
Short-finned pilot whale	Western N. Pacific	53608	--	--	--	0.72	0.72	0.00
Risso's dolphin	Western N. Pacific	83289	--	--	--	0.41	0.41	0.00
Common dolphin	Western N. Pacific	3286163	--	--	--	0.05	0.05	0.00
Bottlenose dolphin	Western N. Pacific	168791	-`-	--	--	0.28	0.28	0.00
Spinner dolphin	Western N. Pacific	1015059	--	--	--	0.00	0.00	0.00
Pantropical spotted dolphin	Western N. Pacific	438064	--	--	--	0.09	0.09	0.00
Striped dolphin	Western N. Pacific	570038	--	--	--	0.16	0.16	0.00
Rough-toothed dolphin	Western N. Pacific	145729	--	--	--	0.11	0.11	0.00
Fraser's dolphin	Western N. Pacific	220789	--	--	--	0.05	0.05	0.00
Pacific white-sided dolphin	Western N. Pacific	931000	--	--	--	0.04	0.04	0.00

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA)

Table 15. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected - Totals for USNS IMPECCABLE 4th Year LOA

LOA 4—USNS IMPECCABLE								
Animal	Stock	# Animals in Stock	% Affected (w/mit) 120 – 180 dB					% Affected (w/mit) ≥ 180 dB
			Q1	Q2	Q3	Q4	AN	Annual Total
Fin whale	***N. Pacific***	***9250***	***0.01***	***0.05***	***0.01***	***--***	***0.07***	***0.00***
Bryde's whale	Western N. Pacific	20501	0.02	0.09	0.03	--	0.14	0.00
Minke whale	Western N. Pacific	25049	0.08	0.43	0.14	--	0.65	0.00
N. Pacific right whale (Oct-May)	***Western N. Pacific***	***922***	***--***	***0.01***	***0.01***	***--***	***0.02***	***0.00***
Humpback whale (winter only)	***Western N. Pacific***	***1107***	***0.00***	***1.78***	***--***	***--***	***1.78***	***0.00***
Gray whale (winter only)	***Western N. Pacific***	***121***	***--***	***--***	***0.00***	***--***	***0.00***	***0.00***
Sperm whale	***N. Pacific***	***102112***	***0.00***	***0.04***	***0.02***	***--***	***0.06***	***0.00***
Kogia	N. Pacific	350553	0.00	0.01	0.00	--	0.01	0.00
Cuvier's beaked whale	N. Pacific	90725	0.00	0.05	0.02	--	0.07	0.00
Blainville's beaked whale	N. Pacific	8032	0.03	0.17	0.05	--	0.25	0.00
Ginkgo-toothed beaked whale	N. Pacific	22799	0.01	0.06	0.02	--	0.09	0.00
Killer whale	Western N. Pacific	12256	--	0.02	0.01	--	0.03	0.00
False killer whale	Western N. Pacific	16668	0.10	0.54	0.05	--	0.69	0.00
False killer whale	Inshore Archipelago	9777	--	--	0.08	--	0.08	0.00
Pygmy killer whale	Western N. Pacific	30214	0.04	0.21	0.02	--	0.27	0.00
Melon-headed whale	Western N. Pacific	36770	0.02	0.10	0.09	--	0.21	0.00
Short-finned pilot whale	Western N. Pacific	53608	0.08	0.52	0.11	--	0.71	0.00
Risso's dolphin	Western N. Pacific	83289	0.09	0.48	0.17	--	0.74	0.00
Common dolphin	Western N. Pacific	3286163	0.01	0.06	0.02	--	0.09	0.00
Bottlenose dolphin	Western N. Pacific	168791	0.06	0.33	0.03	--	0.42	0.00
Bottlenose dolphin	Inshore Archipelago	105138	0.00	0.00	0.14	--	0.14	0.00
Spinner dolphin	Western N. Pacific	1015059	0.00	0.00	0.26	--	0.26	0.00
Pantropical spotted dolphin	Western N. Pacific	438064	0.02	0.11	0.06	--	0.19	0.00
Striped dolphin	Western N. Pacific	570038	0.02	0.12	0.04	--	0.18	0.00
Rough-toothed dolphin	Western N. Pacific	145729	0.03	0.11	0.03	--	0.17	0.00
Fraser's dolphin	Western N. Pacific	220789	0.01	0.06	0.03	--	0.10	0.00
Pacific white-sided dolphin	Western N. Pacific	931000	0.02	0.08	0.00	--	0.10	0.00

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA).

Table 16. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected - Totals for 4th Year LOAs

LOA 4—USNS ABLE, USNS EFFECTIVE, & USNS IMPECCABLE								
Animal	**Stock**	**# Animals in Stock**	**% Affected (w/mit) 120 – 180 dB**					**% Affected (w/mit) ≥ 180 dB**
			Q1	**Q2**	**Q3**	**Q4**	**AN**	**Annual Total**
Blue whale	***Eastern N. Pacific***	***1186***	***0.14***	***--***	***--***	***--***	***0.14***	***0.00***
Fin whale	***N. Pacific***	***9250***	***0.11***	***0.10***	***0.01***	***--***	***0.22***	***0.00***
Sei whale	***N. Pacific***	***8600***	***0.06***	***--***	***--***	***--***	***0.06***	***0.00***
Bryde's whale	Western N. Pacific	20501	0.13	0.17	0.09	0.07	0.46	0.00
Minke whale	Western N. Pacific	25049	0.40	0.75	0.43	0.44	2.02	0.00
N. Pac right whale (Oct-May))	***Western N. Pacific***	***922***	***--***	***0.02***	***0.03***	***0.00***	***0.05***	***0.00***
Humpback whale (winter only)	***Western N. Pacific***	***1107***	***0.00***	***3.18***	***0.44***	***--***	***3.62***	***0.00***
Humpback whale (Oct-May)	***Central N. Pacific***	***10103***	***0.00***	***--***	***--***	***--***	***0.00***	***0.00***
Gray whale (winter only)	***Western N. Pacific***	***121***	***--***	***0.04***	***0.08***	***--***	***0.12***	***0.00***
Sperm whale	***N. Pacific***	***102112***	***0.04***	***0.05***	***0.04***	***0.06***	***0.19***	***0.00***
Kogia	N. Pacific	350553	0.05	0.02	0.00	0.02	0.09	0.00
Cuvier's beaked whale	N. Pacific	90725	0.11	0.06	0.05	0.15	0.37	0.00
Blainville's beaked whale	N. Pacific	8032	0.37	0.30	0.16	0.16	0.99	0.00
Ginkgo-toothed beaked whale	N. Pacific	22799	0.08	0.11	0.06	0.06	0.31	0.00
Longman's beaked whale	Central N. Pacific	1007	0.61	--	--	--	0.61	0.00
Killer whale	Western N. Pacific	12256	--	0.02	0.01	0.08	0.11	0.00
Killer whale	Central N. Pacific	349	0.90	--	0.02	--	0.92	0.00
False killer whale	Western N. Pacific	16668	0.65	0.88	0.24	0.44	2.21	0.00
False killer whale	Inshore Archipelago	9777	--	0.07	0.20	--	0.27	0.00
Pygmy killer whale	Western N. Pacific	30214	0.21	0.34	0.09	0.17	0.81	0.00
Melon-headed whale	Western N. Pacific	36770	0.35	0.23	0.25	0.08	0.91	0.00
Short-finned pilot whale	Western N. Pacific	53608	0.48	0.81	0.37	0.72	2.38	0.00
Risso's dolphin	Western N. Pacific	83289	0.47	0.88	0.52	0.41	2.28	0.00
Common dolphin	Western N. Pacific	3286163	0.05	0.11	0.06	0.05	0.27	0.00
Bottlenose dolphin	Western N. Pacific	168791	0.30	0.53	0.14	0.28	1.25	0.00
Bottlenose dolphin	Inshore Archipelago	105138	0.00	0.11	0.35	--	0.46	0.00
Spinner dolphin	Western N. Pacific	1015059	0.01	0.21	0.64	0.00	0.86	0.00
Pantropical spotted dolphin	Western N. Pacific	438064	0.23	0.22	0.18	0.09	0.72	0.00
Striped dolphin	Western N. Pacific	570038	0.12	0.20	0.13	0.16	0.61	0.00
Rough-toothed dolphin	Western N. Pacific	145729	0.15	0.22	0.11	0.11	0.59	0.00
Fraser's dolphin	Western N. Pacific	220789	0.06	0.11	0.07	0.05	0.29	0.00
Fraser's dolphin	Central N. Pacific	10226	1.07	--	--	--	1.07	0.00
Pacific white-sided dolphin	Western N. Pacific	931000	0.09	0.14	0.03	0.04	0.30	0.00

Note: Bolded and italicized species (animals) are listed under the Endangered Species Act (ESA)

Exposure within the 180-dB LFA Migration Zone

As reported in the annual reports (DoN, 2008; 2009b; 2010; 2011e), post-operational incidental harassment assessments demonstrate that there were no marine mammal exposures to RLs at or above 180 dB.

These findings are supported by the results from the visual, passive acoustic and active acoustic monitoring efforts discussed in Subsection 4.2. As noted below, a review of recent stranding data did not indicate any stranding events associated with the times and locations of LFA operations.

Exposure between 120 and 180 dB

The percentage of marine mammal stocks estimated to be exposed to LFA transmissions between 120 and 180 dB (RL) for post-operational estimates are shown in Tables 4 through 16. These tables confirm that the post-operational estimates are below 12 percent annually for any marine mammal stock, the maximum percentage authorized under the conditions of the LOAs.

4.4 Incident Monitoring—Marine Mammal Strandings and Unusual Mortality Events

During the period of this report, the Navy monitored and reviewed data on marine mammal strandings from federal, state, and international organizations involved in marine mammal and sea turtle stranding incident monitoring. This review of recent stranding data did not indicate any stranding events associated with the times and locations of LFA operations in the northwestern Pacific Ocean or waters south of Hawaii. In the Final Comprehensive Report (DoN, 2007c) of the initial Rule (NOAA, 2002b), it was concluded that SURTASS LFA sonar had not been implicated in any known strandings based on operations in a relatively limited area of the Northwestern Pacific Ocean and adjacent seas (Sea of Japan, East China Sea and South China Sea). This was supported by both national and international reports (ICES, 2005; Cox et al., 2006).

The SURTASS LFA Sonar FSEIS (DoN, 2007a) and the initial Final Comprehensive Report (DoN, 2007c) covered global mass strandings of marine mammals through 2005. This document covers those global mass stranding events that have occurred from 2006 through early 2010 near the SURTASS LFA sonar operating areas. Although the documentation process for this analysis has endeavored to be as comprehensive as possible, some mass stranding events may have been missed. No worldwide agency, organization, or group compiles or maintains a database of global mass stranding information and some local or regional mass stranding events are probably not well publicized and may have been missed, especially if they occur in remote geographic locations.

Globally from 2006 through early 2010, at least 27 mass strandings of 11 marine mammal species occurred. For this impact assessment, these 27 mass stranding and mortality events were researched and analyzed to substantiate if any occurred within or near SURTASS LFA sonar operating areas. Additionally, marine mammal stranding records from Japan were analyzed for spatial or temporal correlations to LFA sonar operations. The results are discussed below.

2009 Philippines Stranding Events

Of the 27 global, mass stranding events from 2006 through early 2010, only one event occurred near any of the SURTASS LFA sonar operating areas. In February of 2009, as many as 200 melon-headed whales, live and dead, stranded in the shallow waters of the Bataan Peninsula near the mouth of Manila Bay in the Philippines. Few of the stranded whales died, with most surviving after having been refloated and returned to deeper water. Manila Bay and the stranding site are located on the western or South China Sea side of Luzon Island, Philippines. In March 2009, another mass stranding of 100 to 200 live melon-headed whales occurred in the Philippines, off Odiongan in Romblon. Aragones et al. (2010) attributes these mass strandings in the Philippines possibly to the illegal practice of dynamite fishing or to the strong upwelling and longshore currents produced during the northeast monsoon season. Credible informants confirmed that several fishing operations used dynamite to stun pelagic fishes in the deep waters offshore of the Zambales and Bataan provinces the night prior to the February 2009 mass stranding in Bataan (Aragones et al., 2010). The acoustic trauma associated with being in proximity to dynamite blasts in deep water may have resulted in the stranding of the melon-headed whales. Aragones et al., (2010) also found that strandings over an 11-year period in the Philippines peaked during the northeast monsoon season, which occurs from November through March.

Prior to and during the February and March 2009 stranding events, neither of the SURTASS LFA sonar vessels, which are stationed in the northwestern Pacific, was actively transmitting. The last active LFA sonar transmission prior to the February stranding event occurred in December 2008 in a body of water isolated from the South China Sea.

Japanese Stranding Records

The Natural Museum of Nature and Science (NMNS) of Tokyo supports a database of marine mammal strandings, which provides marine mammal stranding records (only the species and date of strandings), for all Japanese prefectures through 2008 (NMNS, 2009). Although SURTASS LFA sonar vessels do not operate in proximity to Japanese coastal waters, a review of the stranding records from the coastal prefectures that could have potentially been exposed to LFA sonar transmissions was conducted. Sufficient data were not available to perform a quantitative analysis of the Japanese stranding data in conjunction with the dates of LFA sonar transmissions in the region adjacent to Japanese waters, but a qualitative analysis was conducted. Stranding records from 2006 through 2008 for periods of up to seven days following LFA sonar transmissions offshore from Japan were reviewed. The results of this qualitative analysis indicated that no increase in the stranding rate was associated with the periods when LFA sonar transmissions were occurring offshore from eastern Japan compared to periods when LFA sonar was not transmitting. Strandings that occurred during sonar transmissions to seven days after transmissions ceased were no higher than periods when LFA sonar was not transmitting. There were at least nine periods when LFA sonar was transmitting when no strandings occurred. In addition, in some prefectures, only very shallow water species such as finless porpoises ever stranded. These species occur inshore or in coastal waters and are unlikely to be exposed to LFA sonar transmissions.

Conclusions—Marine Mammal Mass Stranding and Unusual Mortality Events

The use of SURTASS LFA sonar was not associated with any of the reported 27 mass stranding events or UMEs that occurred globally between 2006 and early 2010. There is no evidence that LFA sonar transmissions resulted in any difference in the stranding rates of marine mammals in Japanese coastal waters adjacent to LFA sonar operating areas. As has been reported previously (DoN, 2001; 2006c; and 2007a) and has been further documented here, the employment of SURTASS LFA sonar is not expected to result in any sonar-induced strandings of marine mammals. Given the large number of natural factors that can result in marine mammal mortality, the high occurrence of marine mammal strandings, and the many years of LFA sonar operations without any reported associated stranding events, the likelihood of LFA sonar transmissions causing marine mammals to strand is negligible.

4.5 Assessment of Cumulative Impacts to Marine Mammal Stocks

Four areas were evaluated for the incremental cumulative effects of SURTASS LFA sonar operations with "past, present, and reasonably foreseeable future actions." These include:

- Anthropogenic oceanic noise levels;
- Injury and lethal takes from anthropogenic causes;
- Socioeconomics; and
- Concurrent SURTASS LFA sonar and mid-frequency active (MFA) sonar operations.

The potential for cumulative effects to marine mammals from SURTASS LFA sonar transmissions have been analyzed in the FSEIS (DoN, 2007) and updated in the DSEIS/SOEIS (DoN, 2011a). A scientific assessment of cumulative impacts to marine mammal stocks over the period of the regulation is provided below.

4.5.1 Cumulative Effects from Anthropogenic Oceanic Noise

The potential cumulative effects issue associated with SURTASS LFA sonar operations is the addition of underwater sound to oceanic ambient noise levels, which in turn could affect marine animals. Anthropogenic sources of ambient noise that are most likely to have contributed to increases in ambient noise levels are commercial shipping, offshore oil and gas exploration and drilling, and naval and other use of sonar (ICES, 2005; MMC, 2007).

A report of the Interagency Task Force on Anthropogenic Sound and the Marine Environment of the Joint Subcommittee on Ocean Science & Technology (JSOST) states that the Marine Mammal Commission (MMC), National Oceanic and Atmospheric Administration (NOAA), and the U.S. Fish and Wildlife Service (USFWS) are:

> "…broadening their focus and expertise, based on the increasing realization that sound sources such as large vessels, pile driving, offshore energy development, navigational and/or imaging sonars, and oceanographic research sources may be of concern in addition to the naval and geophysical sound sources currently

receiving the greatest attention. While some of these sources may lack the instantaneous output power of some of the powerful active sonars and seismic airgun sources, many of them occur in far greater numbers and cover much greater geographical ranges and deployment times than more intense, acute sounds. The potential for impact from certain lower-power but more ubiquitous sources is increasingly being considered and scientific measurements are required to inform these considerations." (Southall et al., 2009)

The potential effects that up to four SURTASS LFA sonars may have on the overall oceanic ambient noise level are reviewed in the following contexts:

- Recent reports on ambient sound levels in the world's oceans;
- Operational parameters of the SURTASS LFA sonar system, including proposed mitigation;
- Contribution of SURTASS LFA sonar to oceanic noise levels relative to other human-generated sources of oceanic noise; and
- Cumulative effects from concurrent LFA/MFA sonar operations.

4.5.1.1 Oceanic Noise Levels

Ambient noise is the typical or persistent environmental background noise that is present throughout the ocean; it is generated by both natural and anthropogenic sources. The U.S. Marine Mammal Commission, in a recently published document on underwater sound in the marine environment, classifies ambient noise into three broad categories: natural biotic, which can include marine animals, fish, and invertebrates; natural abiotic, such as seismic disturbances; and anthropogenic, which includes noise from shipping vessels and seismic surveying (Bradley and Stern, 2008). Thus, any potential for cumulative effects should be put into the context of recent changes to ambient sound levels in the world's oceans. Sources of oceanic ambient noise, both natural and man-made are presented in the SURTASS LFA sonar FOEIS/EIS (DoN, 2001) and updated in the DSEIS/SOEIS (DoN, 2011a). Research and statements made regarding changes in oceanic noise levels before 2001 can be found in the FOEIS/EIS (DoN, 2001). The SURTASS LFA sonar FSEIS complements those data with information from 2001 through 2005 (DoN, 2007a).

Andrew et al. (2002) compared ocean ambient sound from the 1960s with the 1990s for a receiver off the California coast. The data showed an increase in ambient noise of approximately 10 dB SPL in the frequency range of 20 to 80 Hz and 200 and 300 Hz, and about 3 dB SPL at 100 Hz over a 33-year period. A possible explanation for the rise in ambient noise is the increase in shipping noise. More recently, McDonald et al. (2006) compared northeast Pacific Ocean ambient noise levels over the past four decades, from continuous measurements west of San Nicolas Island, California. Ambient noise levels at 30 to 50 Hz were 10 to 12 dB SPL higher in 2003 to 2004 than in 1964 to 1966, suggesting an increase in the rate of average noise of 2.5 to 3 dB SPL per decade. Above 50 Hz, the noise level differences between recording periods gradually diminished to a rise of 1 to 3 dB SPL at 100 to 300 Hz. McDonald et al. (2006) cite commercial shipping as the most plausible explanation for the measured increases.

The number of commercial vessels plying the world's oceans approximately doubled between 1965 and 2003, and the gross tonnage quadrupled, with a corresponding increase in horsepower (McDonald et al., 2006). Clark et al. (2009) demonstrated that acoustic communications space for the highly endangered North Atlantic right whale is seriously compromised by anthropogenic noise from commercial shipping traffic.

In a recent study, Di Iorio and Clark (2010) found that blue whales increase their rate of social calling in the presence of seismic exploration sparkers (plasma sound sources), which presumably represented a compensatory behavior to elevated ambient noise levels from seismic surveys.

As noted above, oceanic ambient noise levels are increasing due to the global escalation in numbers of anthropogenic sources. There is increasing scientific evidence indicating effects on marine mammals from this escalation. In a study by Parks et al. (2007), evidence was provided of a behavioral change in sound production of the North and South Atlantic right whales, which was correlated with increased underwater ambient noise levels. This indicated that right whales might shift their call frequency to compensate for the increasing band-limitations caused by background noise. Holt et al. (2009) studied the effects of anthropogenic sound exposure on the endangered Southern Resident killer whales in Puget Sound, reporting that these whales increased their call amplitude by 1 dB for every 1 dB increase in background noise (1 to 40 kHz).

4.5.1.2 SURTASS LFA Sonar Combined with Other Human-Generated Sources of Oceanic Noise

The potential for cumulative effects from SURTASS LFA transmissions is analyzed in relation to overall oceanic ambient noise levels, including the potential for LFA sound to add to overall ambient levels of anthropogenic noise. Increases in ambient noise levels have the potential to cause masking and decrease the distances that underwater sound can be detected by marine animals. These effects have the potential to cause a long-term decrease in a marine mammal's efficiency at foraging, navigating, or communicating (ICES, 2005). NRC (2003) discussed acoustically-induced stress in marine mammals. NRC stated that sounds resulting from one-time exposure are less likely to have population-level effects than sounds that animals are exposed to repeatedly over extended periods of time. NRC (2005) proposed an alternative terminology for what "stress" refers to, which considers energy budgets and life-history events, based on McEwen and Wingfield (2003). It focuses on the concept of allostatic[13] load, which was adapted from the cardiovascular field and was introduced for more broad application in McEwen and Stellar (1993).

[13] Allostasis refers to the physiological and behavioral mechanisms used by an organism to support homeostasis (the stability of the physiological systems that maintain life) in the face of normal and relatively predictable life-history events, such as migration, mating, rearing young, and seasonal changes in resource availability; and unpredictable events such as decreases in oceanic productivity and increases in human disturbances; and more permanent handicaps, such as injuries, parasites, and contaminant loads.

Ambient Noise Levels and Masking

Broadband, continuous low-frequency ambient noise is more likely to affect marine mammals than narrowband, low duty cycle SURTASS LFA sonar. Moreover, the bandwidth of any SURTASS LFA sonar transmitted signal is limited (approximately 30 Hz), the average maximum pulse length is 60 seconds, signals do not remain at a single frequency for more than 10 seconds, and during an operation the system is off nominally 90 to 92.5% of the time. Most mysticete vocalizations are in the low frequency band below 1 kHz, and it is generally believed that their frequency band of best hearing is below 1 kHz, where their calls have the greatest energy (Clark, 1990; Edds-Walton, 2000; Ketten, 2000). However, with the nominal duty cycle of 7.5 to 10%, masking by LFA would only occur over a very small spatial and temporal scale. For these reasons, any masking effects from SURTASS LFA sonar are expected to be negligible.

As presented in the FSEIS (DoN, 2007a), increases in anthropogenic oceanic sound sources most likely to contribute to increased noise in order of importance are: commercial shipping, offshore oil and gas exploration and drilling, and naval and other uses of sonar (Hildebrand, 2005). This is supported by the findings of Andrew et al. (2002) and McDonald et al. (2006) discussed above. The SURTASS LFA Sonar FOEIS/EIS, FSEIS, and DSEIS/SOEIS analyzed the potential effects of four SURTASS LFA sonar systems. The use of SURTASS LFA sonar is not scheduled to increase past the originally analyzed four systems during the next five–year regulation under the MMPA. Therefore, LFA transmissions did not significantly increase anthropogenic oceanic noise during the period of the current Rule (NOAA, 2007a) and likewise will not significantly increase overall oceanic noise in the period of the requested follow-on rule in the next five years over that of the previous analyses.

4.5.2 Cumulative Effects to Marine Mammals due to Injury and Lethal Takes

The second area for potential cumulative effects to marine mammal populations is through injury and lethal takes. In order to evaluate the effects of SURTASS LFA sonar operations, it is necessary to place it in perspective with other anthropogenic impacts on marine resources.

4.5.2.1 Bycatch

Culik (2010) stated in his report compiled for the United Nations Environmental Programme (UNEP) Convention on Migratory Species that the major threat faced by odontocetes is by-catch in fisheries operations, which is affecting 86% of toothed whale species. Read et al. (2006) estimated the annual global bycatch for the period 1990 to 1994 to be 653,365 marine mammals (307,753 cetaceans and 345,611 pinnipeds). They also reported that the mean annual marine mammal bycatch in U.S. fisheries between 1990 and 1999 was 6,215, with the number trending downward throughout the decade due to the implementation of bycatch mitigation measures and, coincidentally, due to measures put in place to protect fisheries stocks.

Increases in underwater ambient noise levels have the potential to mask an animal's ability to detect objects, such as fishing gear, thus increasing their susceptibility to bycatch. However, because LFA transmissions are intermittent and will not significantly increase anthropogenic oceanic noise, cumulative effects from masking by LFA signals are not a reasonably foreseeable significant adverse effect on marine animals.

4.5.2.2 Ship Strikes

NMFS convened a workshop to identify and assess technologies to reduce ship strikes of large whales 8 to 10 July 2008, in Providence, RI. The workshop objectives were to: 1) identify existing or emerging technologies that might be useful in reducing ship strikes; 2) assess the feasibility of each in reducing ship strikes; and 3) identify research and development timelines needed to make a given technology useful in reducing the threat. The outcome of the workshop was a report that stated:

> "…the problem of ship strikes is a complex one; there are no easy technological "fixes;" no technology exists, or is expected to be developed in the foreseeable future that will completely ameliorate, or reduce to zero the chances of, ship strikes of large whales; and no single technology will fit all situations. Reducing the co-occurrence of whales and vessels is likely the only sure means of reducing ship strikes, but it is not possible in many locations…Technologies applicable to reducing ship strikes are limited almost entirely to those that enhance whale detection…Depending on systems used, costs can be relatively high and false positives could be problematic…In all cases, studies are needed to confirm that any technology developed and used for this purpose are clearly capable of reducing strikes and to ensure that added environmental impacts are not introduced." (Silber et al., 2009)

A review of ship strike data found that the probability of injury or death increased with speed and generally occurred when ships were travelling at 14 kts or faster (Laist et al., 2001). Ship strikes are generally not an issue for SURTASS LFA sonar vessels because of their slow operational speed (nominally 3 kts) and transit speed (10 to 12 kts).

4.5.2.3 Lethal Whale Takes

Based on evaluation in this document, the FOEIS/EIS, and the FSEIS, the operation of SURTASS LFA sonar with monitoring and mitigation has not resulted in any lethal takes. This is supported by the fact that SURTASS LFA sonar has been operating since 2003 in the northwestern Pacific Ocean with no reported Level A (MMPA) harassment takes or strandings associated with its operations (DoN, 2008; 2009b; 2010; 2011e). Moreover, there has been no new information or data that contradict the FOEIS/EIS and FSEIS findings that the potential effects from SURTASS LFA sonar operations on any stock of marine mammals from injury (non-auditory or permanent loss of hearing) are considered not more than negligible. Since there are no reasonably foreseeable effects from LFA operations that would lead to injury or lethal takes of marine animals, there are no cumulative effects in this area due to SURTASS LFA sonar operations.

4.5.3 Cumulative Effects to Socioeconomic Resources

The potential effects of SURTASS LFA sonar operations on commercial and recreational fisheries, other recreational activities, and research and exploration were addressed in the SURTASS LFA sonar FOEIS/EIS (DoN, 2001) and FSEIS (DoN, 2007a) and recently updated in the DSEIS/SOEIS (DoN, 2011a). The conclusion was that these activities would not be substantially affected. Therefore, the potential for cumulative effects from LFA transmissions on socioeconomic activities are not a reasonably foreseeable significant adverse impact.

4.5.4 Cumulative Effects from Concurrent LFA and MFA Sonar Operations

In 2007, the SURTASS LFA Sonar FSEIS stated:

> "If SURTASS LFA sonar operations were to occur concurrent with other military and commercial sonar systems, synergistic effects are not probable because of differences between these systems. In order for the sound fields to converge, the multiple sources would have to transmit exactly in phase (at the same time), requiring similar signal characteristics, such as time of transmissions, depth, frequency, bandwidth, vertical steering angle, waveform, wavetrain, pulse length, pulse repetition rate, and duty cycle. The potential for this occurring is small." (DoN, 2007a)."

The DSEIS/SOEIS (DoN, 2011a) provides an extensive analysis regarding the potential for impacts when SURTASS LFA sonar and MFA sonar are used simultaneously or in rapid succession during the same naval exercise/operation.

Although the SURTASS LFA and MFA (AN/SQS 53C and AN/SQS 56) sonars are similar in the underlying transmission types, specifically frequency-modulated (FM) sweeps and continuous wave (CW) transmissions, LFA and MFA sonars are dissimilar in other respects (e.g., pulse length, inter-pulse time, center frequency, bandwidth, source depth). The duty cycle, (i.e., the amount of time *during sonar operations* that the sonar is actually transmitting), is different for SURTASS LFA sonar as opposed to MFA sonar. During SURTASS LFA sonar operations, LFA sonar transmits approximately 10% of the time (1 minute out of 10). During MFA sonar operations, MFA sonar transmits approximately 1.7% of the time (1 second out of 60)[14]. This means that for any given period of time that both SURTASS LFA and MFA sonars are operating concurrently, the LFA 60-sec transmission will be overlapped by 1 sec of MFA transmission, or 1.7% of the 60-sec LFA ping (1 sec/60 sec). During the 10-min LFA transmission cycle, the most an animal could be simultaneously exposed from both transmissions is 1 sec for every 600 sec, or about 0.17%[15] of the time that both sonars are operating.

To address the issue of whether the combined risk from concurrent SURTASS LFA and MFA sonar operations could be more than the sum of the impacts of both systems due to potential synergistic[16] effects, the Navy has conducted additional, more sophisticated analyses in the DSEIS/SOEIS (DoN, 2011a). These are described briefly below and more detail can be found in subchapter 4.7.4 and Appendix E of the DSEIS/SOEIS (DoN, 2011a).

[14] MFA sonar operating characteristics are based on the Navy's AN/SQS 53C sonar. The nominal sonar ping is approximately 1 second every 60 to 90 seconds (Nissen, 2011). For analysis, 1 sec/60 sec was used as it is the most conservative.

[15] MFA overlaps 1 sec for every 10 min (600 sec) of LFA duty cycle (1 sec/600 sec = 0.0017).

[16] Synergism, in general, may be defined as two or more agents working together to produce a result not obtainable by any of the agents independently.

4.5.4.1 Potential for MMPA Level A Impacts from Combined Effects

The ocean volume potentially affected by Level A received levels (RLs) for each source are relatively small, being 1 km (0.54 nmi) radius or less, based on current NMFS-published Rules (NOAA, 2007c, 2009b, 2009c, and 2009d). For a variety of tactical and safety reasons, however, it is not reasonably foreseeable that SURTASS LFA and MFA sonars would operate at distances closer than 9.3 km (5 nmi) to each other. It is therefore not reasonably foreseeable that the Level A volumes for SURTASS LFA and MFA sonars would ever overlap. The statistical probability of an MFA Level B RL intensifying to a Level A RL when combined simultaneously with a SURTASS LFA sonar Level B RL is also exceedingly low (DoN, 2011a).

Sequential, as opposed to simultaneous, exposures of a single marine mammal to a SURTASS LFA sonar transmission at a RL immediately below Level A and then an MFA transmission at a RL immediately below Level A (or vice versa), could hypothetically result in exposure above 180 dB re 1 µPa (rms) (RL). However, this hypothetical possibility is exceedingly small, given: 1) the low probability that SURTASS LFA and MFA sonars would be operating concurrently in the first place; 2) the low duty cycles of each source, even when such concurrent operations are occurring (0.17% of the time); 3) the fact that both systems would have to be operating close enough to each other for the animal to swim to both exposure points in a short enough period to have experienced, but not recovered from, the impact of the first exposure before experiencing the second exposure; 4) the fact that both the SURTASS LFA and MFA vessels are moving in two dimensions and the animal is moving in three dimensions; and 5) the fact that the exposed animal would have to elude detection by the multiple mitigation regimes for both SURTASS LFA and MFA sonars to be near enough to the Level A volumes of both sonars to experience near-Level A exposures.

4.5.4.2 Potential for MMPA Level B Impacts from Combined Effects

To analyze the possibility for Level B effects of the improbable scenario (simultaneous, or near-simultaneous, MFA and LFA transmissions) occurring, the Navy used two separate methodologies, a parametric analysis and an Acoustic Integration Model© (AIM) analysis, which use the previously established risk continuum for SURTASS LFA sonar (DoN, 2001 and 2007a). The risk continuum methodology for SURTASS LFA sonar was applied here to facilitate a complex analytic process with two dissimilar sonar systems.

The risk continuum for SURTASS LFA sonar was initially developed for determining the risk from SURTASS LFA sonar (DoN, 2001). An exposure of 165 dB SPL (re 1 µPa) returns an associated risk of 0.5 (50%) from the risk continuum function; whereas 150 and 180 dB SPL (re 1 µPa) return 0.025 (2.5%) and 0.95 (95%) risk, respectively (Figure 6).

- **Parametric analysis**

Parametric analysis is a methodology to describe and examine the relationship between different parameters (e.g., in this case acoustic transmission loss as a function of range and depth) and the variable (e.g., potential acoustic effect on marine mammals) that it/they influence or affect. Parametric analysis is derived from "dimensional analysis", which is defined as:

"...the mathematics of dimensions and quantities and provides procedural techniques whereby the variables that are assumed to be significant in a problem can be formed into dimensionless parameters, the number of parameters being less than the number of variables." (Avallone and Baumeister, 1987)

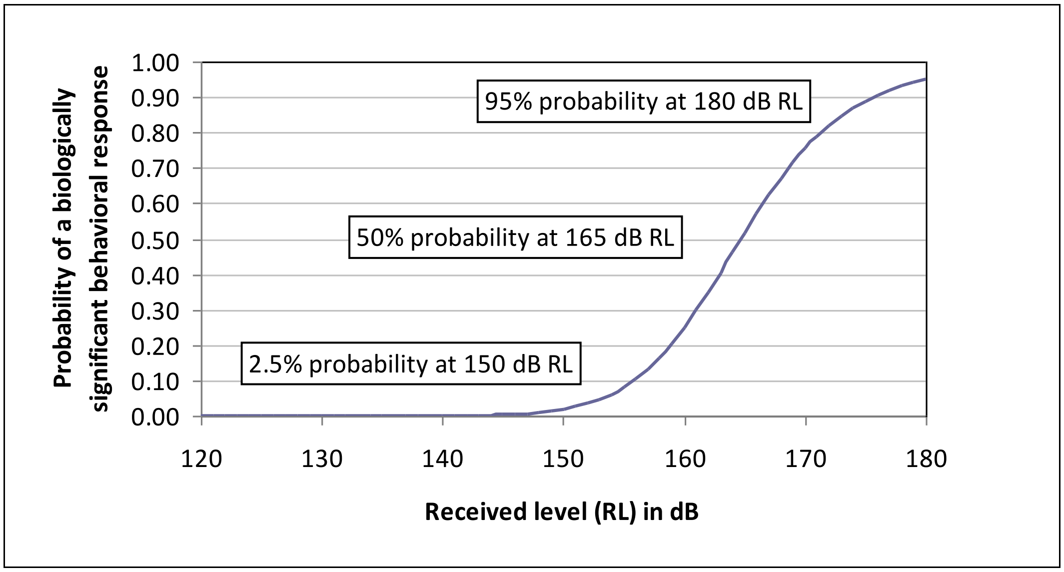

Figure 6. The SURTASS LFA Sonar Risk Continuum Function.

The advantage of this type of analysis is the reduction of a large number of variables into a smaller, more manageable, number of parameters. This kind of analysis has been in use for over 100 years and is well accepted in the scientific community. One example is the use of a properly scaled ship model to identify the force needed to propel the actual full-size ship through the water, including the size of the engines needed to do so. One of the key inputs is the ratio of inertia and viscous forces using the "Reynolds Number[17]," a key dimensionless number used in naval architecture, aeronautics, and anywhere fluid flow is important.

This analysis identified appropriate metrics for each of the important parameters (e.g., difference in source level [SL], distance between sources, different propagation conditions, Level B harassment criteria, etc.). Then, using such metrics, the risk for multiple animal depths and a variety of sonar separation ranges in static conditions (i.e., a series of "snapshots" of single ping risk for each source, and for the combined sources, with the source vessels in specific locations, was examined. The analysis assumed a convergence zone (CZ) propagation condition (where sound waves in the ocean refract downward and then rise back to the surface at regular intervals known as convergence zones) because it is the most probable sound propagation path that would be encountered with concurrent SURTASS LFA and MFA sonar operations. Details of this analysis are provided in Appendix E, along with discussions of other propagation conditions (i.e., bottom bounce, surface duct). In summary, this parametric analysis demonstrates that

[17] In fluid mechanics, the Reynolds number (Re) is a dimensionless number that gives a measure of the ratio of inertial forces to viscous forces and consequently quantifies the relative importance of these two types of forces for given flow conditions.

concurrent MFA/SURTASS LFA sonar operations produce a zero increase in risk over that from summing the risk of the two sources operating independently.

- **Acoustic Integration Model© (AIM) analysis**

This approach (similar to that used for specific operations of SURTASS LFA sonar) used AIM to develop the sound-source exposure history for individual animals in a multiple-source exposure scenario. To estimate the acoustic exposure an animal is likely to receive while the sources are transmitting, the 3-dimensional movement of animals and the acoustic fields to which they would be exposed were modeled based on nominal transmissions of the MFA and SURTASS LFA sonars. The sound fields around each source were estimated based on: 1) acoustic parameters of the SURTASS LFA sonar; 2) acoustic parameters of the MFA sonar; and 3) underwater acoustic propagation models to predict underwater sound transmissions for CZ and surface duct scenarios. To estimate the risk of MMPA Level B harassment from each acoustic source, the acoustic exposures an animal receives were used to calculate a single ping equivalent, which is input into the SURTASS LFA sonar risk continuum to estimate Level B harassment (Figure 6). The single ping equivalent RLs were then evaluated for each source separately, and combined. In summary, the model analysis demonstrated that the result of concurrent MFA/SURTASS LFA sonar operations produces a zero increase in risk over that from summing the risk of the two sources operating independently.

- **Conclusion**

The results of the parametric analysis and the model analysis are consistent—concurrent MFA/SURTASS LFA sonar operations produce no risk greater than that obtained by simply adding the risks from the individual sources. Therefore, two separate analytic approaches have concluded that there is no potential increase in risk for Level B harassment from concurrent MFA/SURTASS LFA sonar operations.

4.5.5 Summary of Potential Cumulative Impacts

The operations of up to four SURTASS LFA sonars were evaluated for the potential for cumulative effects in the following foreseeable areas:

- Anthropogenic oceanic noise levels;
- Injury and lethal takes from anthropogenic causes;
- Socioeconomics; and
- Cumulative effects from concurrent LFA and MFA sonar operations.

Given the information provided in this section, the potential for cumulative effects from the operations of up to four SURTASS LFA sonars has been addressed by limitations proposed for employment of the system (i.e., geographical restrictions and monitoring mitigation). Even if considered in combination with other underwater sounds, such as commercial shipping, other operational, research, and exploration activities (e.g., acoustic thermometry, hydrocarbon exploration and production), recreational water activities, commercial and military sonars, and naturally-occurring sounds (e.g., storms, lightning strikes, subsea earthquakes, underwater volcanoes, whale vocalizations, etc.), the proposed four SURTASS LFA sonar systems do not add appreciably to the underwater sounds to which fish, sea turtles and marine mammal stocks are exposed. Moreover, SURTASS LFA sonar will cause no lethal takes of marine mammals or other marine animals. Analysis of the potential impacts from concurrent LFA and MFA sonar operations demonstrates that the overall risks for Level A and Level B impacts are no greater than the risks obtained by simply adding the risks from individual LFA and MFA sources.

Even though an animal's exposure to LFA signals may be more than one time, the intermittent nature of the LFA signal, its low duty cycle, and the fact that both the vessel and animal are moving, provide a very small chance that LFA exposure for individual animals and stocks would be repeated over extended periods of time, such as those caused by shipping noise. The intermittent nature of LFA transmissions are demonstrated by actual operational data provided in this document. As shown in Table 3, there are on average about 17 SURTASS LFA missions per year. The maximum annual transmission time was 135.8 hours, which occurred the 1st year, and is less than 2 percent per annum.

SURTASS LFA transmissions have not contributed significantly to overall anthropogenic oceanic noise levels, not caused injury or mortality, and not caused effects from stress. Therefore, cumulative effects from the operation of up to four SURTASS LFA sonar systems are not a reasonably foreseeable significant adverse impact on marine animals.

4.6 Monitoring and Research

NMFS's current Final Rule (NOAA, 2007a) and the LOAs (NOAA, 2007c; 2008; 2009a; 2010; 2011), included the conduct of additional research that would help to increase the knowledge of marine mammal species and provide scientific data on the potential effects from SURTASS LFA sonar and other anthropogenic sources.

The Department of the Navy is committed to demonstrating environmental stewardship while executing its national defense mission, and is responsible for compliance with a suite of federal environmental and natural resources laws and regulations that apply to the marine environment. For example, the MMPA implementing regulations (216.104(a)(13)) require that an applicant for an MMPA authorization provide NMFS with a monitoring plan that will result in an increased understanding of the species and the impact that the proposed activity will have on those species. In the current Final Rule (NOAA, 2007a) and the LOAs (NOAA, 2007c; 2008; 2009; 2010; 2011), NMFS recommended that the Navy conduct, or continue to conduct, the following types of monitoring/studies, which would be appropriate under the MMPA:

1. Systematically observe SURTASS LFA sonar training exercises for injured or disabled marine mammals;
2. Compare the effectiveness of the three forms of mitigation (visual, passive acoustic, HF/M3 sonar);
3. Conduct research on the responses of deep-diving odontocete whales to LF sonar signals;
4. Conduct research on the habitat preferences of beaked whales;
5. Conduct passive acoustic monitoring using bottom-mounted hydrophones before, during, and after LF sonar operations for the possible silencing of calls of large whales;
6. Continue to evaluate the HF/M3 mitigation sonar; and
7. Continue to evaluate improvements in passive sonar capabilities.

Under current MMPA authorizations covering SURTASS LFA sonar, the Navy has conducted monitoring/studies pertinent to LFA (Table 17). Table 17 also addresses the monitoring/studies pertinent to LFA that the Navy is planning under the forthcoming MMPA authorization.

Table 17 Status of Navy-Funded Monitoring/Studies Regarding SURTASS LFA Sonar		
NMFS Monitoring/Study Topics	**Current Monitoring/Study Status**	**Monitoring/Study Plans Under New MMPA Authorization**
<u>Injured/disabled Marine Animals</u> Systematically observe SURTASS LFA sonar training exercises for injured or disabled marine animals	This monitoring study is ongoing based on the mitigation and reporting requirements under the under the 2007 to 2012 Rule. As reported in the annual reports for the first four LOA periods (DoN, 2008, 2009b, 2010; 2011e), post-operational incidental harassment assessments demonstrated that there were no known marine mammal exposures to RLs at or above 180 dB. These findings are supported by the results from the visual, passive acoustic and active acoustic monitoring efforts discussed in the four annual reports for the period 16 August 2007 to 15 August 2011 under the current Rule. In addition, a review of recent marine mammal strandings did not indicate any stranding events associated with the times and locations of SURTASS LFA sonar operations (see Subsection 4.4).	Navy will continue this monitoring/study during the entire 5-year MMPA authorization, including annual reports and review of marine mammal strandings to determine if any may have been associated with the times and locations of SURTASS LFA sonar operations.
<u>Mitigation Effectiveness</u> Compare the effectiveness of the three forms of mitigation (visual, passive acoustic monitoring, HF/M3 sonar)	A summary of mitigation effectiveness was provided in Subchapter 4.1.8 of the Final Comprehensive Report (DoN, 2007c) for the 2002 to 2007 Rule. Under the current Rule, the Navy is also required to summarize the effectiveness of the mitigation in a final comprehensive report. Therefore, data collection and analyses are continuing as part of the reporting requirements of the Long Term Monitoring (LTM) Program. Results of this effort for the period of this report are provided in Subsection 4.2.	Navy will continue to provide a summary of mitigation effectiveness in their A`nnual and Final Comprehensive Reports.

Table 17 Status of Navy-Funded Monitoring/Studies Regarding SURTASS LFA Sonar		
NMFS Monitoring/Study Topics	**Current Monitoring/Study Status**	**Monitoring/Study Plans Under New MMPA Authorization**
Passive Acoustic Monitoring Conduct passive acoustic monitoring using bottom-mounted hydrophones before, during, and after LF sonar operations for the possible silencing of calls of large whales	The Navy has and is continuing to sponsor multi-year studies regarding the acoustic monitoring of marine mammals using fixed passive acoustic monitoring systems in the North Atlantic Ocean (NORLANT). During four of these monitoring/study efforts (NORLANT 2004, 2005, 2006-01, 2006-02), no variations in normal behavior patterns for fin, blue, or humpback whales were noted in response to anthropogenic LF sounds. The fifth NORLANT monitoring/study effort was completed in 2007 (NORLANT 2007). During this period, seismic airguns were the most prevalent anthropogenic noise. The reports for these tasks are classified; unclassified summary reports have been produced. During the period of this report, the collection of cross spectral matrix (CSM) data from the arrays has continued. These data will be used to count fin and humpback whale calls and estimate their population. Observations of CSM data over time can also note the interaction and influence of noise sources (seismic profilers, storms, shipping, fishing activity, naval activities) on large whale behavior.	Navy will continue to sponsor multi-year studies regarding the acoustic monitoring of marine mammals using fixed passive acoustic monitoring systems in the North Atlantic Ocean; and will expand the acoustic monitoring studies to include fixed passive acoustic monitoring systems, and SURTASS in the North Pacific Ocean, as feasible.

Table 17 Status of Navy-Funded Monitoring/Studies Regarding SURTASS LFA Sonar		
NMFS Monitoring/Study Topics	**Current Monitoring/Study Status**	**Monitoring/Study Plans Under New MMPA Authorization**
Evaluate HF/M3 Continue to evaluate the HF/M3 sonar	The HF/M3 sonar has been upgraded for integration into the installations of Compact Low Frequency Active (CLFA) sonar on the T-AGOS 19 Class vessels. The first installation of the upgraded HF/M3 sonar was onboard the USNS ABLE (T-AGOS 20). The USNS EFFECTIVE (T-AGOS 21), which is currently undergoing initial at sea testing, is also equipped with the upgraded HF/M3 sonar. Evaluation of the HF/M3 sonar is part of the at sea testing and will be documented in the unclassified final comprehensive reports. The USNS VICTORIOUS (T-AGOS 19), which is scheduled to commence initial at sea testing in late 2012, will also be equipped with the upgraded HF/M3 sonar. Evaluation of the HF/M3 sonar will be part of the at sea testing and will be documented in the unclassified final comprehensive reports.	Navy will continue to evaluate the HF/M3 sonar, reporting its findings in the unclassified final comprehensive reports.
Improvements in Passive Sonar Continue to evaluate improvements in passive sonar capabilities	Advances in the development of passive acoustic technology include the development of SURTASS Twin-Line (TL-29A), a shallow water variant of the SURTASS system, which provides improved littoral capability. The USNS ABLE (T-AGOS 20), USNS EFFECTIVE (T-AGOS 21), and USNS IMPECCABLE (T-AGOS 23) have the TL-29A twin-line passive arrays. The USNS VICTORIOUS (T-AGOS 19) will also have the TL-29A passive array. The integrated common processor (ICP) has been, or is scheduled to be, installed on the SURTASS LFA/CLFA sonar vessels. The ICP uses enhanced signal processing and automation to get accurate, actionable information on undersea threats to operational decision makers. The capability of passive acoustic sensors is also benefiting from increased processing power in computers and by networking, which is incorporating data from a variety of acoustic and non-acoustic sensors, and sources to construct a more complete battlefield picture (Friedman, 2007c).	Navy will continue to evaluate improvements in passive sonar capabilities that relate to SURTASS performance capabilities which, in turn, could possibly equate to lower LFA transmission requirements.

4.6.1 Research

The Department of the Navy sponsors significant research and monitoring projects for marine living resources to study the potential effects of its activities on marine mammals. These funding levels have increased in recent years to $31M in FY 2009 and $32M in FY 2010 for marine mammal research and monitoring activities at universities, research institutions, federal laboratories, and private companies. Navy-funded research has produced, and is producing, many peer-reviewed articles in professional journals as demonstrated in Table 18. Publication in open professional literature thorough peer review is the benchmark for the quality of the research. This ongoing marine mammal research includes hearing and hearing sensitivity, auditory effects, dive and behavioral response models, noise impacts, beaked whale global distribution, modeling of beaked whale hearing and response, tagging of free-ranging marine animals at-sea, and radar-based detection of marine mammals from ships.

The Navy notes that research and evaluation is being carried out on various monitoring and mitigation methods, including passive acoustic monitoring (PAM). The results from this research could be applicable to SURTASS LFA sonar passive acoustic monitoring.

Table 18. Department of the Navy Sponsored Monitoring and Research

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- Cranford, T.W., P. Krysl, and J.A. Hildebrand. 2008. Acoustic pathways revealed: simulated sound transmission and reception in Cuvier's beaked whale (*Ziphius cavirostris*). Bioinspiration & Biomimetics 3(1):016001. 10 pp.
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- Zimmer, W.M.X., J. Harwood, P.L. Tyack, M.P. Johnson, and P.T. Madsen. 2008. Passive acoustic detection of deep-diving beaked whales. Journal of the Acoustical Society of America 124(5):2823-2832.

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4.6.2 Research on Fish

The Navy has funded independent research to examine whether exposure to high-intensity, low frequency sonar, such as SURTASS LFA sonar, will affect fish, a prey species for marine mammals (Popper, et al. 2005a, 2007; Halvorsen et al., 2006; Kane et al., 2010). Dr. Arthur Popper (University of Maryland), an internationally recognized fish acoustics expert, investigated the effects of exposure to LFA sonar on hearing, the structure of the ear, and selected non-auditory systems of the rainbow trout (*Onchorynchus mykiss*) (a hearing non-specialist related to several endangered salmonids) and channel catfish (*Ictalurus punctatus*) (a hearing specialist) using an element of the standard SURTASS LFA source array (Popper et al., 2005a, 2007; Halvorsen et al., 2006). Hearing sensitivity was measured using auditory brainstem response (ABR), effects on inner ear structure were examined using scanning electron microscopy, effects on non-auditory tissues were analyzed using general pathology and histopathology, and behavior was observed with video monitoring. Additional studies on the immediate effects on inner ear and non-auditory tissues were done with a hybrid sunfish species (*Lepomis* sp.) (Kane et al., 2010).

Exposure to 193 dB re 1 µPa (rms) RL in the LFA frequency band for 324 seconds resulted in a TTS of 20 dB at 400 Hz in rainbow trout, with less TTS at 100 and 200 Hz (Popper et al, 2007). TTS in catfish ranged from 6 to 12 dB at frequencies from 200 to 1000 Hz (Popper et al., 2005a). Both species recovered from hearing loss in several days. Inner ear sensory tissues appeared unaffected by acoustic exposure. The sunfish showed no threshold shift (Halvorsen et al., 2006).

Gross pathology of the three fish species indicated no damage to non-auditory tissues, including the swim bladder. Histopathology was done on all major body tissues (brain, swim bladder, heart, liver, gonads, blood, etc.) and no differences were found among sound-exposed, control, or baseline fish (Kane et al., 2010). There was no fish mortality attributable to sound exposure, even up to four days post-exposure. Each species showed initial movement responses at sound onsets and changed position relative to the sound source during exposures. The sound levels (up to 193 dB re 1 µPa [rms] RL) used in these experiments approached those that fish would encounter very close to an active SURTASS LFA sonar source array (within approximately 200 m [656 ft]). However, the exposure during the experiments was very likely more substantial than any a fish would encounter in that the fish were exposed to multiple replicates of very intense sounds, whereas any fishes in the wild would encounter sounds from a moving source, and successive emissions from the source would decrease in intensity as the distance between the ship and exposed fish increased.

The conclusion from the SURTASS LFA sonar study demonstrated that LFA exposure to 193 dB re 1 µPa (rms) RL had no real adverse effects on the fish tested. Therefore, it is concluded that the potential for a fish or schools of fish to be injured (thus impacting fish stocks) by exposure to SURTASS LFA sonar signals above 193 dB re 1 µPa (rms) RL (within approximately 200 m [656 ft] of the SURTASS LFA sonar operational array) is considered negligible.

4.7 Assessment of New Passive Technologies

In the preamble to the Final Rule (NOAA, 2007a), the Navy was required to provide a comprehensive analysis on the advancements of alternative (passive) technologies as a replacement for LFA sonar. Historically (e.g., from the 1940's through about 1990 [DoN, 2011f]), passive sonars have been the dominant means used by U.S. Naval forces to conduct long-range surveillance and initial classification of enemy sonar threats. These systems were developed to counter an open ocean threat presented during the Cold War by the former Soviet Union. Passive systems have the benefit of stealth, emitting no noise that may be detected by enemy forces. They were a particularly effective tool against relatively noisy Soviet submarines and allowed effective, accurate tracking at significant distance (Tyler, 1992; Miasnikov, 1994).

While passive sonar systems operated effectively against the Cold War submarine threat, improvements in submarine design and the widespread use of "quieting" technology have reduced their effectiveness (Tyler, 1992; Miasnikov, 1994). These "quieting" technologies, which include hull coatings, sound isolation mounts, and improved propeller design, have becoming increasingly common as upgrades to older boats (Naval Doctrine Command, 1997) or in the newer boat that have rapidly replaced the older vessels starting in the 1980's and continuing through the present time (Benedict, 2005). The world of ASW is governed by physics, which often dictates solutions; passive technologies are becoming exponentially less effective—as submarine noise decreases by half, it becomes ten times more difficult to detect—to a large extent we have to do detection by active means (Burgess, 2005).

The primary threat facing naval forces today comes from an increasing number of advanced diesel-electric submarines. Aided by technologies such as air-independent propulsion (AIP), many of these submarines are able to remain submerged for longer periods of time while operating with increasing effectiveness. Also, their self-noise may be at a level below that of a nuclear submarine. These submarines are operated by numerous coastal nations and, while not all are state-of-the-art, they pose a significant threat to U.S. and allied forces in coastal and littoral areas (Friedman, 2004).

Additionally, the updated and improved weapon, fire-control and communication systems that these boats now routinely employ have substantially improved lethality and operational ranges of these vessels. This further complicates and degrades the ability of passive systems to successfully operate against them by increasing the volume of the ocean where they can operate and yet still reach potential targets with their weapons (Benedict, 2005).

The U.S. military anticipates that future naval conflicts are most likely to occur within littoral or coastal areas. This is a further complication to the Naval ASW mission and a distinct change from the Cold War era, where conflicts were most likely to occur in mid-ocean areas. Littoral areas have highly variable and frequently high underwater background noise; largely, this is a result of commercial shipping, and difficult underwater acoustic propagation conditions (Farrell, 2003). Since these potential littoral areas can typically be assumed to be surrounding the threat country or one of its neighbors (a likely victim of the hypothetical threat country's aggression), the expected transit time for the threat submarine is expected to be minimal (i.e., significantly less than that needed for US passive acoustic assets to arrive in theater). Therefore it is highly unlikely that these submarines would be detected during the transit to the contested area. When combined with the increased on-station duration of these submarines due to AIP systems, and their extremely quiet profile in this type of a situation, a passive acoustic system is confronted with an extremely difficult, if not impossible scenario (Benedict, 2005 and DoN, 2011f).

Each of these factors is reducing the effective range of current and foreseeable passive sonar detection capabilities. With passive sonar alone, it is likely that U.S. Forces would not have adequate time to react and defend against enemy submarine threats or to beat an enemy to a contested piece of the ocean.

4.7.1 Why Passive Sonar Alone Cannot Meet the Need/Shortcomings of Passive Sonar Technology

Passive sonar technology is dependent on the emitted noise of a target. This sound may be in the form of noise created by the movement of the hull or propellers through water, the sound of cooling pumps or other machinery, or of an active sonar pulse produced by the target (Watts, 2003). Various techniques are used to detect and identify the sounds. Certain sound characteristics allow sonar systems to determine the class of ship and/or its speed. Under preferable circumstances, passive sonar can be effective at detecting and identifying submarine targets.

There are, however, a number of significant shortcomings that limit the current and future usefulness of passive sonar. The predominant factor affecting passive sonar usefulness, especially in the littoral, is the fact that over the past decades submarines have become quieter, while ambient noise levels in littoral ocean areas have increased markedly (Ort et al., 2003). As the technology improved, the predominant sources of submarine noise (i.e., hull flow noise, propeller noise, and propulsion machinery noise) were reduced by up to 30 dB between 1960 and 1990 (Tyler, 1992). Toward the end of the Cold War passive sonars were relying increasingly on 'non-traditional' sound signatures to identify submarine threats (Friedman, 2004). Since the early 1990s, this trend has continued and with the advent of AIP systems, perhaps as much as an additional 10-20 dB have been reduced from submarine noise signatures.

Several papers (Tyler, 1992; Miasnikov, 1994; Ort et al., 2003) quantitatively address the effectiveness of passive sonars (in an unclassified manner) in light of decreasing submarine noise and increasing littoral ambient noise. Their discussions form the basis of the following brief analysis, which uses the standard passive sonar equation (Urick, 1983):

$$(SL - TL) - (NL - DI) = DT$$

where:
SL = source level,
TL = one way transmission loss,
NL = ambient noise level,
DI = directivity index of array, and
DT = detection threshold

This equation can be re-arranged to determine the allowable TL for a given set of submarine SLs, ambient noise levels (NL), directivity indexes (DI) and detection thresholds for the passive sonar operators and their equipment (DT).

$$SL - NL + DI - DT = TL$$

Inherent in this equation is the strong requirement that the “signatures” of the threat submarine be known and understood. This knowledge significantly influences the detection threshold (DT) term of this equation. Essentially, the passive sonar operator needs to know what he is looking for in order to find it. However, as these submarine signatures become quieter, the opportunities to gather this knowledge are also decreased, thus not only adversely affecting the source level (SL) term of the equation, but also having a secondary effect on the DT term too (Benedict, 2005). Further complicating this issue is the fact that there are numerous combinations of submarine platforms and the systems that they employ that are now available on the international scene, and each of these combinations potentially needs to be known.

The table below shows the hypothetical allowable TLs for a 1960 and 2006 diesel submarine. This table includes the following reasonable assumptions: 1) the maximum value in a nominal 200-300 Hz frequency band is utilized for all SL and NL values, 2) the 1960 submarine had source levels similar to the World War II diesel submarines cited in Urick (1983), 3) the source level for the quieted diesel was conservatively reduced by 40 dB, 4) ambient noise is from the Wenz curves for moderate shipping and 11-16 knot wind speed (Urick, 1983), and for a conservative estimate, no increase is applied for the 2006 value, 5) array DI has improved by 5 dB accounting for improved hydrophones and array design, and 6) DT has improved by 10 dB based on improved signal processing and displays only, and it may be optimistic based on the assumption that the prerequisite submarine signature are known (see previous paragraph).

	SL	**NL**	**DI**	**DT**	**TL**
1960 sample case	155	75	15	15	80
2006 sample case	115	75	20	5	55

By assuming spherical spreading (i.e., 20 log [range]) for the first 1,000 m (3281 ft) and cylindrical spreading (i.e., 10 log [range]) beyond that range, these TLs can be converted into approximate detection ranges for the two sonar sample cases identified above. The 1960 diesel submarine could be detected out to approximately 100 km (52 nm), while the 2006 submarine might be detected out to 0.9 km (0.5 nm). Essentially, the 2006 submarine could approach the passive sonar ship close enough to launch torpedoes or missiles, without that ship knowing of their presence, while the 1960 sonar system would have detected the submarine long before it was within weapons range. Therefore, by 2006, passive sonar systems alone are not sufficient to meet the new quiet diesel threat. Today, with the inclusion of even quieter and more capable AIP submarines and weapon systems into the scenario, the deficiency of passive sonar systems has continued to increase.

Efforts have been made to improve the sensitivity of passive receivers through the use of more powerful sound processors and improved hydrophone design, which attempt to extract information from even the weakest acoustic signal emanating from a submarine. Self-noise, generated by machinery aboard the passive sonar vessel, or by the movement of water around it, greatly affects hull-mounted passive sonar. This problem has been reduced through improved vessel and propeller design, and further combated with the extensive use of passive towed array sonar (PTAS).

PTAS is deployable at a long distance behind the ship, and thus it is less affected by the ship's self-noise (however it is still limited by the ambient noise level). Additionally, it can achieve longer range detection by operating at a lower frequency, where losses from underwater sound propagation are lower. PTAS, however, is subject to a number of disadvantages, including, "being unable to determine the range of a contact, ambiguity in bearing, [and] directional uncertainty because of sideways movement of the array and towing cable" (Watts, 2003). Use of a towed array also affects the minimum water depth and maximum speed at which a towing ship is able to operate.

As noted earlier in Subsection 1.2.2, advances in passive acoustic technology have led to the development of SURTASS Twin-Line (TL-29A) horizontal line array (HLA), a shallow water variant of the single line SURTASS system. The TL-29A delivers enhanced capabilities, such as its ability to be towed in shallow water environments in the littoral zones, to provide significant directional noise rejection, and to resolve bearing ambiguities without having to change vessel course. The SURTASS TL-29A HLA provides improved littoral capability.

The passive capability of the USNS IMPECCABLE (T-AGOS 23) was recently upgraded with the installation of the TL-29A array. The three VICTORIOUS Class vessels, equipped with CLFA, are outfitted with the newer SURTASS TL-29A passive arrays.

4.7.2 Summary

The SURTASS LFA Sonar vessels are currently equipped with the TL-29A passive HLA, which is the best technology available. There are no new passive technology advancements that can meet the purpose and need as stated in the SURTASS LFA FOEIS/EIS (DoN, 2001) and the Draft SEIS/SOEIS (2011a) without the LFA augmentation. Based on the continued advancements in submarine quieting techniques and the increase in oceanic ambient noise levels, the present state of passive sonar technology alone cannot meet this threat.

5.0 CONCLUSIONS

During the four LOAs under the current Rule for the Taking of Marine Mammals Incidental to the Navy Operations of SURTASS LFA Sonar (NOAA, 2007a), the Navy considers that it has met all of the requirements under Part 216 Subpart Q of the regulations and the LOAs, as issued. These include all mitigation and monitoring requirements, required reporting, and timely renewal applications for annual LOAs. In addition, this final comprehensive report is required to provide an analysis of all monitoring and research conducted during the period of these regulations, an estimate of cumulative impacts on marine mammal stocks, and an analysis on the advancement of alternative (passive) technologies as a replacement for LFA sonar. This report provides an unclassified analysis of SURTASS LFA sonar operations from the R/V *Cory Chouest*, USNS ABLE, USNS EFFECTIVE and the USNS IMPECCABLE for the four LOAs (16 August 2007 through 15 August 2011). During the fifth annual LOA period, an LOA was also issued to the USNS VICTORIOUS (T-AGOS 19), but the vessel did not operate during the period of this report.

An evaluation of mitigation effectiveness demonstrated that the overall effectiveness exceeded the original estimates. Visual and LF passive acoustic monitoring showed low probability of detection as predicted, but the effectiveness of active acoustic monitoring (HF/M3 sonar) proved to be consistent with the values in the FOEIS/EIS (DoN, 2001).

As reported in the annual reports (DoN, 2008; 2009b; 2010, 2011e), post-operational incidental harassment assessments demonstrated that there were no known marine mammal exposures to RLs at or above 180 dB.

The use of SURTASS LFA sonar was not associated with any of the reported 27 mass stranding events or UMEs that occurred globally between 2006 and early 2010. There is no evidence that LFA sonar transmissions resulted in any difference in the stranding rates of marine mammals in Japanese coastal waters adjacent to LFA sonar operating areas. As has been reported previously (DoN, 2001; 2006c; and 2007a) and has been further documented here, the employment of SURTASS LFA sonar is not expected to result in any sonar-induced strandings of marine mammals. Given the large number of natural factors that can result in marine mammal mortality, the high occurrence of marine mammal strandings, and the many years of LFA sonar operations without any reported associated stranding events, the likelihood of LFA sonar transmissions causing marine mammals to strand is negligible.

The post-operational estimates of the percentage of marine mammal stocks exposed to LFA transmissions between 120 and 180 dB were below, in most cases well below, the maximum 12 percentage authorized in current Rule and LOAs for any marine mammal stock.

SURTASS LFA transmissions have not contributed significantly to overall anthropogenic oceanic noise levels and have not caused any known injury or mortality. Furthermore, there is no evidence that LFA sonar has caused effects from stress. Therefore, it is logical to assume that cumulative effects from intermittent LFA transmissions are not a reasonably foreseeable significant adverse impact.

Navy-sponsored research has been accomplished in accordance with the requirements of NMFS's Letters of Authorization and Final Rule as summarized in Table 18.

An assessment of new passive technologies demonstrates that the purpose and need as stated in the SURTASS LFA FOEIS/EIS (DoN, 2001), FSEIS (DoN, 2007a), and the Draft SEIS/SOEIS (2011a) remain valid. Passive sonar alone cannot meet the need in a threat environment where submarines are becoming quieter and ambient oceanic noise levels are increasing. Presently, there are no advancements in passive technologies that even approach the level of detection provided by LFA.

In conclusion, the operations of the SURTASS LFA systems, with appropriate mitigation measures, have caused no measurable environmental effects in the oceanic areas where SURTASS LFA/CLFA sonar systems have operated over the period of this report. Therefore, in accordance with the findings of the SURTASS LFA Sonar FSEIS (DoN, 2007a), the SURTASS LFA Sonar DSEIS/SOEIS (DoN, 2011a) and this report, the Navy believes that the continuation of LFA operations under new rule making is warranted.

6.0 REFERENCES

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APPENDIX A

Stipulation Settlement Agreement Order U.S. District Court, Northern District of California, San Francisco Division, Civ. Action No. 07-4771-EDL, 12 August 2008

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UNITED STATES DISTRICT COURT
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SAN FRANCISCO DIVISION

NATURAL RESOURCES DEFENSE COUNCIL, INC., et al., Plaintiffs, v. CARLOS GUTIERREZ, SECRETARY OF THE UNITED STATES DEPARTMENT OF COMMERCE, et al. Defendants.	Civ. Action No. 07-4771-EDL STIPULATED SETTLEMENT AGREEMENT [~~PROPOSED~~] ORDER Judge: Hon. Elizabeth D. Laporte

Pursuant to the Court’s February 6, 2008 Opinion and Order Granting in Part Plaintiffs’ Motion for Preliminary Injunction ("Opinion and Order") and Order Referring Case for Settlement Conference, the parties, Defendants United States Navy ("Navy") and National Marine Fisheries Service ("NMFS") and the Natural Resources Defense Council, Inc. ("NRDC") on behalf of itself and other Plaintiffs, attended settlement conferences on March 26, 2008, and May 27, 2008, before Magistrate Judge Spero to meet and confer on the precise terms of a preliminary injunction consistent with the Court's Opinion and Order. During mediation, the parties agreed to settle the case in its entirety on the terms memorialized in this Stipulation. In the event that any party seeks to alter the agreed upon operating areas described in paragraph 4 and in Tabs 1-4, paragraph 6 of the Stipulation establishes a procedure for the parties to meet and confer with the assistance of a court-designated mediator. Accordingly, the parties agree to the following:

WHEREAS in 2002, Plaintiffs NRDC, International Fund for Animal Welfare, The Humane Society of The United States, Cetacean Society International, League for Coastal Protection, Ocean Futures Society, and Jean-Michel Cousteau filed suit in this Court alleging that Defendants had violated the Marine Mammal Protection Act ("MMPA"), National Environmental Policy Act ("NEPA"), Endangered Species Act ("ESA"), and Administrative Procedure Act ("APA") by publishing a Final Rule under the MMPA, 67 Fed. Reg. 46712 (July 16, 2002), and issuing a Record of Decision ("ROD") under NEPA, 67 Fed. Reg. 48145 (July 23, 2002), regarding the Navy's use of Surveillance Towed Array Sensor System Low Frequency Active ("SURTASS LFA") sonar;

WHEREAS on October 31, 2002, the Court granted in part and denied in part Plaintiffs' motion for a preliminary injunction and on August 26, 2003, granted in part and denied in part Plaintiffs' motion for summary judgment and ordered the parties to meet and confer on the precise terms of the permanent injunction;

WHEREAS on October 8, 2003, the parties filed a joint stipulation regarding the permanent injunction and use of SURTASS LFA in the western Pacific Ocean, which the Court approved on October 14, 2003;

WHEREAS both the July 16, 2002 Final Rule and the permanent injunction expired by their own terms on August 15, 2007;

WHEREAS in April 2007, the Navy published a Final Supplemental Environmental Impact Statement ("SEIS") and on August 15, 2007, signed a ROD under NEPA regarding the Navy's use of SURTASS LFA sonar;

WHEREAS on August 15, 2007, Plaintiffs filed a motion for leave to file a supplemental complaint in the foregoing action, alleging that Defendants had failed to meet their obligations under NEPA and the permanent injunction;

WHEREAS on August 15, 2007, NMFS issued a Final Rule under the MMPA, 72 Fed. Reg. 46846 (August 21, 2007), 50 C.F.R. Part 216 Subpart Q (Taking of Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar) ("Final Rule"), and on August 15, 2007, NMFS issued Letters of Authorization ("LOAs") to the Navy pursuant to the Final Rule;

WHEREAS the Navy and NMFS consulted under the ESA, and on August 15, 2007, NMFS issued biological opinions concluding that the Navy's use of SURTASS LFA sonar was not likely to jeopardize the continued existence of any endangered or threatened species and was not likely to adversely affect any designated critical habitat;

WHEREAS, after stipulating with Defendants on August 28, 2007, to file a new complaint and to withdraw their pending motion requesting leave of the Court to file supplemental pleadings in the prior action, Plaintiffs filed the above-captioned lawsuit on September 17, 2007, challenging Defendants' actions under the MMPA, NEPA, ESA, and APA, and subsequently moved for preliminary injunctive relief;

WHEREAS to avoid unnecessary emergency litigation and to ensure that the Court had sufficient time to render a decision on Plaintiffs' motion for preliminary injunction, on August 28, 2007, the parties agreed via e-mail correspondence, and stipulated on October 5, and December 19, 2007, to extend the terms of the October 8, 2003 permanent injunction, as amended in 2005, "with the exception that [the Navy] may operate the LFA sonar system within the coastal exclusion zones set forth in that injunction only when necessary to continue tracking an existing underwater contact detected outside the exclusion zone or when operationally necessary to detect a new underwater contact that would place the LFA sonar system within the coastal exclusion zone to maximize opportunities for detection," until the earlier of the Court's decision on Plaintiffs' motion or a date certain specified in the stipulation;

WHEREAS the Court's February 6, 2008 Opinion and Order granted in part and denied in part Plaintiffs' Motion for Preliminary Injunction, and ordered the parties to meet and confer on the precise terms of a preliminary injunction consistent with the Court's Opinion and Order;

WHEREAS the parties attended settlement conferences on March 26, 2008, and May 27, 2008, before Magistrate Judge Spero;

WHEREAS Plaintiffs and Defendants, through their authorized representatives, and without any admission or final adjudication of the issues of fact or law with respect to Plaintiffs' claims, have reached a settlement resolving the claims raised in Plaintiffs' Complaint;

WHEREAS all parties agree that settlement of this action in this manner is in the public interest and is an appropriate way to resolve the dispute between them;

THE PARTIES THEREFORE STIPULATE AS FOLLOWS:

1. The parties agree that all negotiations leading up to this Stipulation are confidential. The parties further agree that this Stipulation supersedes all prior stipulations regarding injunctive relief entered into by the parties in this case.

2. The parties agree that this Stipulation shall remain in effect until the earliest of the following: (a) a modification by the Court, either as the Court elects or pursuant to a noticed motion or stipulation by the parties, that this Stipulation has been superseded by subsequent relevant events or authority, including but not limited to the outcome of further negotiations described in paragraph 6 below; (b) the expiration of the Final Rule, 72 Fed. Reg. 46846 (August 21, 2007), 50 C.F.R. Part 216 Subpart Q; or (c) the issuance of a new final rule and regulations that supersede the Final Rule.

3. The parties agree that the Final Rule will be remanded voluntarily without vacatur for reconsideration in light of the Court's conclusions in the February 6, 2008 Opinion and Order, and that Defendants will conduct their activities pursuant to this Stipulation during the period that the Stipulation is in effect. Nothing in this Stipulation shall be construed to modify or limit the discretion afforded to NMFS under the MMPA, NEPA, and ESA or principles of administrative

law on remand; nor shall the Stipulation, or the dismissal with prejudice required by it, operate to modify or limit Plaintiffs' rights or arguments with respect to NMFS's actions on remand, including seeking potential judicial review of such actions in a new civil action. No provision of this Stipulation shall be interpreted as or constitute a commitment or requirement that the United States is obligated to pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341, or any other provisions of law. No provision of this Stipulation shall be interpreted as or constitute a commitment or requirement that Plaintiffs or Defendants take actions in contravention of, or waive any rights under, the MMPA, NEPA, ESA, APA, or any other law or regulation, either substantive or procedural. However, the parties waive their rights to seek appellate review of the Court's February 6, 2008 Opinion and Order and this Stipulation.

4. Except as provided for in paragraph 5 below, the parties agree that the attached maps and associated text (Tabs 1-4) will govern the Navy's use of SURTASS LFA sonar for testing, training, and military operations under the current LOAs and any future LOAs issued during the pendency of the Stipulation. In the event of a discrepancy between the maps and the associated text, the associated text controls. For the Western Pacific operating area, the Navy will ensure that its use of SURTASS LFA sonar for testing, training, and military operations does not result in received sound pressure levels exceeding 180 dB at a distance less than the specified distances from coastlines or baselines drawn between islands in an archipelagic chain as defined in Tab 2; however, this limitation shall not apply to the circumstances described in paragraph 5.

5. The parties agree that the Navy may operate the SURTASS LFA sonar system outside the agreed upon operating areas described in Tabs 1-4, but within the areas authorized under the current LOA for the Western Pacific operating area and future LOAs for the Western Pacific and Hawaiian operating areas, when necessary to continue tracking an existing underwater contact or when operationally necessary to detect a new underwater contact to maximize opportunities for detection. This exception applies to operations only, and does not apply to any testing or training activities, including multinational training exercises such as the Rim of the Pacific Exercise ("RIMPAC").

6. The parties agree that if either Plaintiffs or Defendants seek an alteration to the agreed-upon operating areas described in Tabs 1-4, the parties shall first engage in a meet-and-confer process with the assistance of a court-designated mediator. This meet-and-confer process shall be subject to the Opinion and Order and any subsequent relevant opinions, orders, or other applicable authority. If the meet-and-confer process does not yield an agreement, any party may apply to the Court for resolution of the dispute.

7. Use of SURTASS LFA sonar pursuant to this Stipulation shall remain subject to the current Final Rule and applicable LOAs issued by NMFS. In the event of a conflict between this Stipulation and any LOA issued under the current Final Rule, the more restrictive condition, provision, or requirement will apply.

8. Defendants agree to pay Plaintiffs a reasonable amount for their costs of litigation (including reasonable attorneys' fees). The parties agree to employ good faith efforts to reach an expeditious negotiated resolution of the amount of such costs and fees. By this agreement, Defendants do not waive any right to contest specific fees or expenses claimed by either Plaintiffs or the Plaintiffs' counsel, including hourly rates, in this litigation or in any future litigation. Pursuant to Civil Local Rule 6-2, the parties stipulate that the deadlines established by the Equal Access to Justice Act ("EAJA"), 28 U.S.C. § 2412, shall govern any application of attorneys' fees and costs in this matter, notwithstanding any deadline provisions of the Civil Local Rules, including Local Rule 54-1 and 54-6. Pursuant to EAJA, 28 U.S.C. § 2412, if a negotiated resolution is not arrived at by that time, an initial application for attorneys' fees and costs will be made within 30 days of the Court's entry of Plaintiffs' request for dismissal with prejudice to be filed pursuant to Paragraph 11 below. Plaintiffs shall then have up to 120 days following the filing of an initial EAJA application to file any supplementary or modified applications, related pleadings to advance the adjudication of the application, and/or supporting materials they deem appropriate. The length of any brief or memorandum of points and authorities filed in support of Plaintiffs' EAJA application shall be governed by the Civil Local Rules. If Plaintiffs' initial EAJA application is filed within 30 days of the Court's entry of Plaintiffs' request for dismissal with prejudice, Defendants hereby agree not to argue that any supplementary or modified

applications, related pleadings and/or supporting materials filed within the 120 days following the filing of an initial EAJA application are untimely, should have been filed with the initial EAJA application or, except as provided above, are otherwise out of order.

9. This Stipulation is not to be construed as a concession by either party as to (a) the potential impacts on marine mammals or other animals of operating SURTASS LFA sonar, (b) the absence or presence of marine mammals or other animals in any areas depicted in the attached maps, or (c) the validity of any other fact or legal position concerning the claims or defenses in this action. This Stipulation applies to the SURTASS LFA sonar system and is not intended to serve as precedent in any future rulemaking, in any other geographical areas, or regarding any other Navy activities, including the use of any other sonar system.

10. Nothing in this Stipulation shall prevent any party from filing an application with the Court at any time to seek relief from its terms. Before any such application is filed, the parties shall meet and confer in good faith.

11. Upon notification of approval of this Stipulation by the Court, Plaintiffs shall, within no more than 15 days, submit a request that the Court dismiss the Complaint with prejudice. During the time period between the filing of this Stipulation and the Court's dismissal of the Complaint with prejudice, the parties hereby agree not to file any pleadings or motions in this matter that are not expressly contemplated by this Stipulation. Notwithstanding the dismissal of Plaintiffs' Complaint, the parties agree that the Court shall retain jurisdiction for the purpose of resolving attorneys' fees and cost reimbursement issues under EAJA in the event that the parties do not reach a negotiated resolution thereof, to oversee compliance with the terms of this Stipulation, and to resolve any future disputes concerning the interpretation or implementation of the Stipulation or motions to modify its terms.

Dated: August 8, 2008

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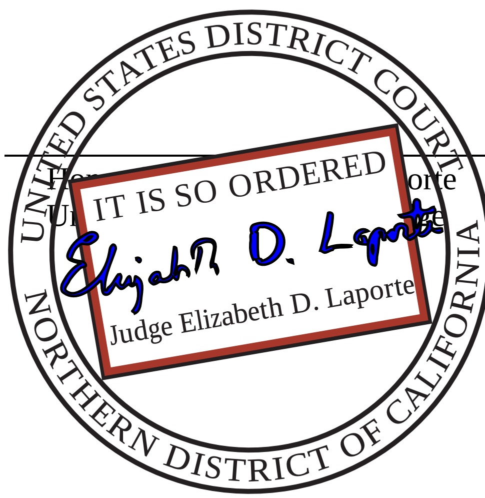
I hereby attest that I have on file all holograph signatures for any signatures indicated by a "conformed" signature (/s/) within this efiled document.

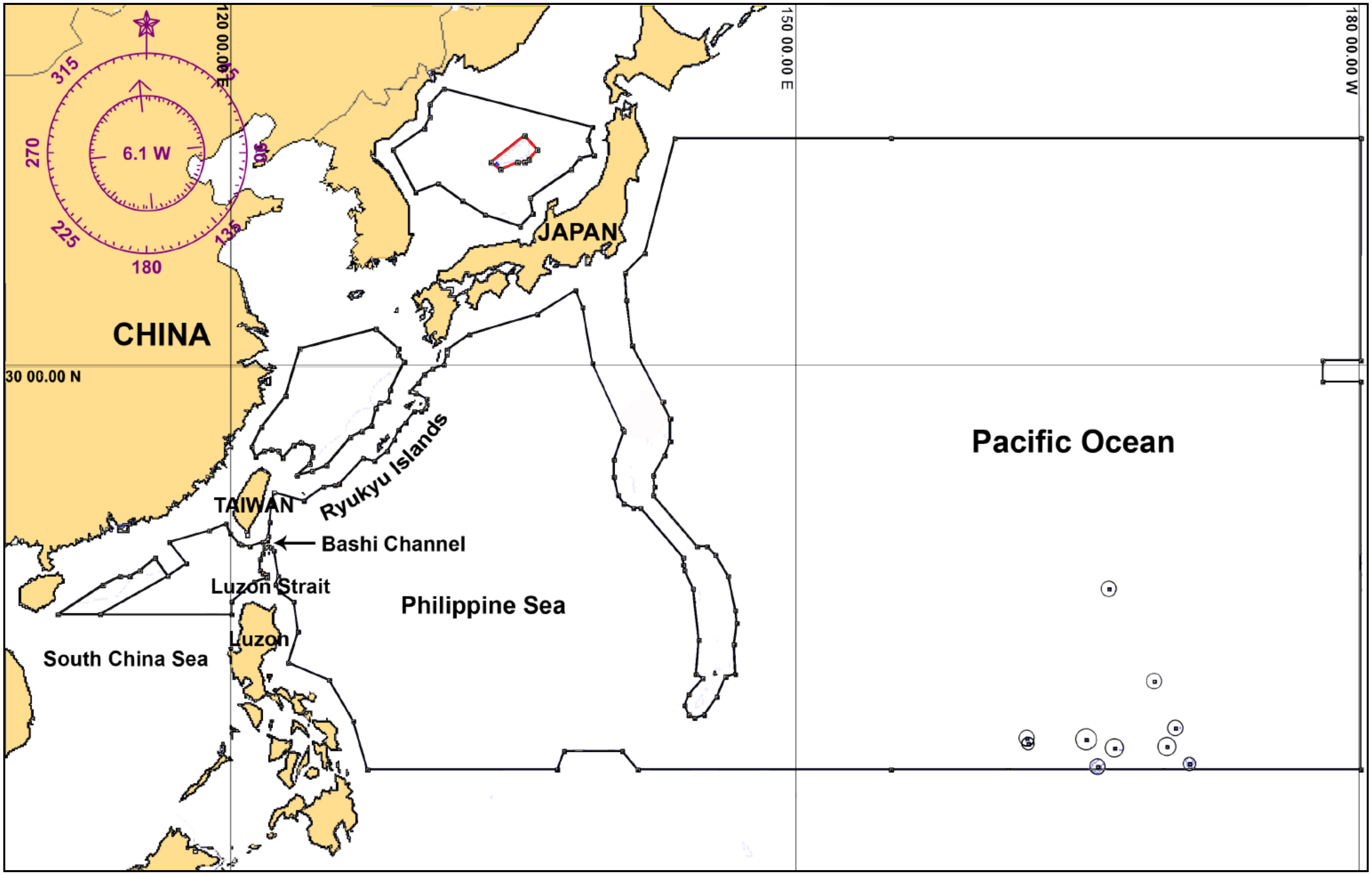
By: /s/ Robin Stafford
Robin Stafford

PURSUANT TO STIPULATION, IT IS SO ORDERED.

Dated: August 12, 2008. By: ______________________



Tab 1: Western Pacific



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Tab 2: Western Pacific

(1) PHILIPPINE SEA AREA - OPERATIONS AUTHORIZED YEAR ROUND. Note: Between 17° 09.8' N., 123° 32.2' E and 30° 50.6' N., 131° 25.4' E., boundaries for the Philippine Sea are defined as set forth in coordinate sets (3) through (5); i.e., the Ryukyu Island Chain, the Luzon Strait, and Taiwan.

LATITUDE	LONGITUDE
17 09.8 N	123 32.2 E
15 33.5 N	123 00.9 E
14 41.2 N	125 07.7 E
12 31.3 N	126 28.6 E
10 00.0 N	127 09.5 E
10 00.0 N	137 16.0 E
11 00.0 N	137 37.0 E
11 00.0 N	140 44.6 E
10 00.0 N	141 31.9 E
10 00.0 N	180 00.0 E
29 20.0 N	180 00.0 E
29 20.0 N	178 00.0 E
30 20.0 N	178 00.0 E
30 20.0 N	180 00.0 E
40 00.0 N	180 00.0 E
40 00.0 N	143 32.7 E
35 09.6 N	141 55.4 E
34 17.2 N	140 55.2 E
33 06.7 N	140 58.4 E
31 02.2 N	141 17.3 E
28 24.4 N	142 52.1 E
27 10.0 N	140 44.8 E
30 10.7 N	139 10.3 E
32 45.7 N	138 35.4 E
33 34.3 N	138 14.5 E
32 29.3 N	136 12.3 E
31 34.6 N	132 38.6 E
30 50.6 N	131 25.4 E

(2) PHILIPPINE SEA EXCLUSION ZONE - NO OPERATIONS

LATITUDE	LONGITUDE
28 24.4 N	142 52.1 E
27 39.4 N	143 15.9 E
26 33.3 N	143 16.6 E
25 51.3 N	142 57.4 E
24 54.2 N	142 22.7 E
24 22.9 N	142 26 2 E
23 57.5 N	142 24.2 E
21 26.0 N	144 44.6 E
21 24.5 N	145 13.5 E
21 01.1 N	145 43.5 E
19 55.5 N	146 21.7 E
18 14.8 N	146 46.6 E
17 33.4 N	146 49.8 E
16 30.0 N	146 42.4 E
15 00.0 N	146 43.0 E
14 51.2 N	146 13.5 E
13 47.4 N	145 44.3 E
12 50.1 N	145 04.4 E
12 40.5 N	144 35.8 E
12 52.2 N	144 14.9 E
13 19.9 N	144 01.1 E
13 57.6 N	144 15.4 E
14 45.4 N	145 01.0 E
15 00.0 N	144 37.4 E
16 44.9 N	144 46.6 E
19 17.6 N	144 31.1 E
20 15.0 N	144 00.7 E
20 32.5 N	143 56.1 E
20 50.2 N	143 59.3 E
23 20.0 N	141 41.6 E
23 19.3 N	141 18.8 E
23 31.0 N	140 50.2 E
23 55.9 N	140 31.0 E
24 51.7 N	140 15.3 E
25 39.0 N	140 18.3 E
27 10.0 N	140 44.8 E
30 10.7 N	139 10.3 E

(3) WESTERN PHILIPPINE SEA AREA - RYUKYU ISLAND CHAIN - OPERATIONS AUTHORIZED YEAR ROUND

LATITUDE	LONGITUDE
24 07.2 N	122 13.8 E
23 42.3 N	123 49.3 E
24.22.6 N	124 51.2 E
24 25.9 N	125 28.4 E
24 29.8 N	125 42.7 E
25 44.4 N	126 57.6 E
25 35.7 N	127 35.4 E
26 03.2 N	128 13.1 E
26 37.6 N	128 37.5 E
27 06.0 N	128 50.8 E
27 27.3 N	129 12.5 E
27 57.2 N	129 39.6 E
27 59.1 N	130 01.8 E
28 05.7 N	130 16.3 E
28 18.5 N	130 22.4 E
28 32.9 N	130 21.5 E
28 49.1 N	129 46.2 E
28 52.4 N	129 31.0 E
28 54.8 N	129 26.9 E
29 15.2 N	129 53.1 E
29 39.3 N	130 11.9 E
29 57.1 N	130 39.4 E
30 09.4 N	131 13.8 E
30 40.0 N	131 25.9 E
30 50.6 N	131 25.4 E
31 34.6 N	132 38.6 E

(4) WESTERN PHILIPPINE SEA AREA - LUZON STRAIT (INCLUDING BASHI CHANNEL) - OPERATIONS AUTHORIZED YEAR ROUND

LATITUDE	LONGITUDE
15 33.5 N	123 00.9 E
17 09.8 N	123 32.3 E
18 39.6 N	123 18.9 E
19 09.5 N	122 31.0 E
19 32.2 N	122 18.3 E
19 55.8 N	122 29.3 E
21 15.4 N	122 15.1 E
21 23.0 N	122 06.7 E
21 25.3 N	121 55.0 E
21 20.6 N	121 42.2 E
21 05.5 N	121 35.7 E
20 47.3 N	121 28.6 E
20 14.3 N	121 27.8 E
20 04.1 N	121 37.6 E
20 00.0 N	121 50.8 E
19 50.7 N	121 51.2 E
19 37.9 N	121 12.1 E
18 39.1 N	119 58.1 E
18 00.0 N	119 56.4 E

(5) WESTERN PHILIPPINE SEA AREA - TAIWAN - OPERATIONS AUTHORIZED YEAR ROUND

LATITUDE	LONGITUDE
22 34.1 N	119 41.6 E
22 04.9 N	119 53.0 E
21 33.1 N	120 22.2 E
21 28.3 N	120 31.6 E
21 26.6 N	120 56.6 E
21 39.1 N	121 39.6 E
21 43.5 N	121 49.9 E
21 55.6 N	121 55.5 E
22 38.6 N	122 01.9 E
23 26.6 N	122 03.2 E
24 07.2 N	122 13.8 E
23 42.3 N	123 49.3 E

(6) SEA OF JAPAN - NO OPERATIONS MAY THRU JULY

LATITUDE	LONGITUDE
42 00.0 N	131 14.9 E
40 28.7 N	139 10.7 E
39 58.3 N	138 57.5 E
39 18.1 N	139 13.9 E
39 13.4 N	138 27.5 E
38 43.6 N	138 03.1 E
37 33.6 N	135 51.5 E
36 53.0 N	135 57.6 E
36 18.2 N	135 19.2 E
36 48.9 N	133 27.8 E
37 24.1 N	132 13.0 E
38 07.6 N	130 57.8 E
37 45.7 N	129 43.1 E
39 31.2 N	128 33.2 E
40 25.3 N	130 12.2 E
40 51.4 N	130 28.4 E
41 24.1 N	130 28.9 E

(7) SEA OF JAPAN - YAMATO RISE - NO OPERATIONS

LATITUDE	LONGITUDE
40 05.9 N	135 31.3 E
39 34.0 N	136 12.0 E
39 06.0 N	135 45.4 E
39 01.9 N	135 32.9 E
39 02.4 N	135 11.6 E
38 41.8 N	134 15.0 E
39 01.9 N	133 42.9 E

(8) EAST CHINA SEA AREA - OPERATIONS AUTHORIZED YEAR ROUND

LATITUDE	LONGITUDE
31 49.2 N	127 40.3 E
30 55.6 N	128 50.1 E
30 36.6 N	128 49.5 E
30 18.0 N	129 09.4 E
28 56.1 N	128 22.3 E
28 23.6 N	128 20.8 E
28 23.2 N	127 52.5 E
28 03.7 N	127 38.8 E
27 18.5 N	127 25.9 E
27 00.5 N	126 53.1 E
26 45.7 N	126 17.0 E
25 24.0 N	124 59.3 E
25 08.7 N	124 14.0 E
24 54.1 N	123 25.7 E
25 27.9 N	124 05.0 E
25 48.9 N	124 15.8 E
26 16.2 N	124 14.7 E
26 29.1 N	123 39.5 E
26 20.4 N	123 17.6 E
25 44.5 N	122 42.6 E
26 03.9 N	122 25.3 E
26 10.2 N	122 06.9 E
26 04.6 N	121 42.8 E
25 46.3 N	121 17.3 E
26 16.9 N	121 03.3 E
27 11.8 N	121 33.8 E
28 41.6 N	122 47.9 E
30 54.3 N	123 33.5 E

(9) SOUTH CHINA SEA AREA - OPERATIONS AUTHORIZED YEAR ROUND

LATITUDE	LONGITUDE
18 39.1 N	119 58.1 E
18 00.0 N	119 56.4 E
18 00.0 N	112 58.9 E
19 55.9 N	116 35.5 E
20 35.8 N	117 32.2 E
21 40.2 N	116 38.4 E
22 10.8 N	118 46.4 E
22 34.1 N	119 41.6 E
22 04.9 N	119 53.0 E

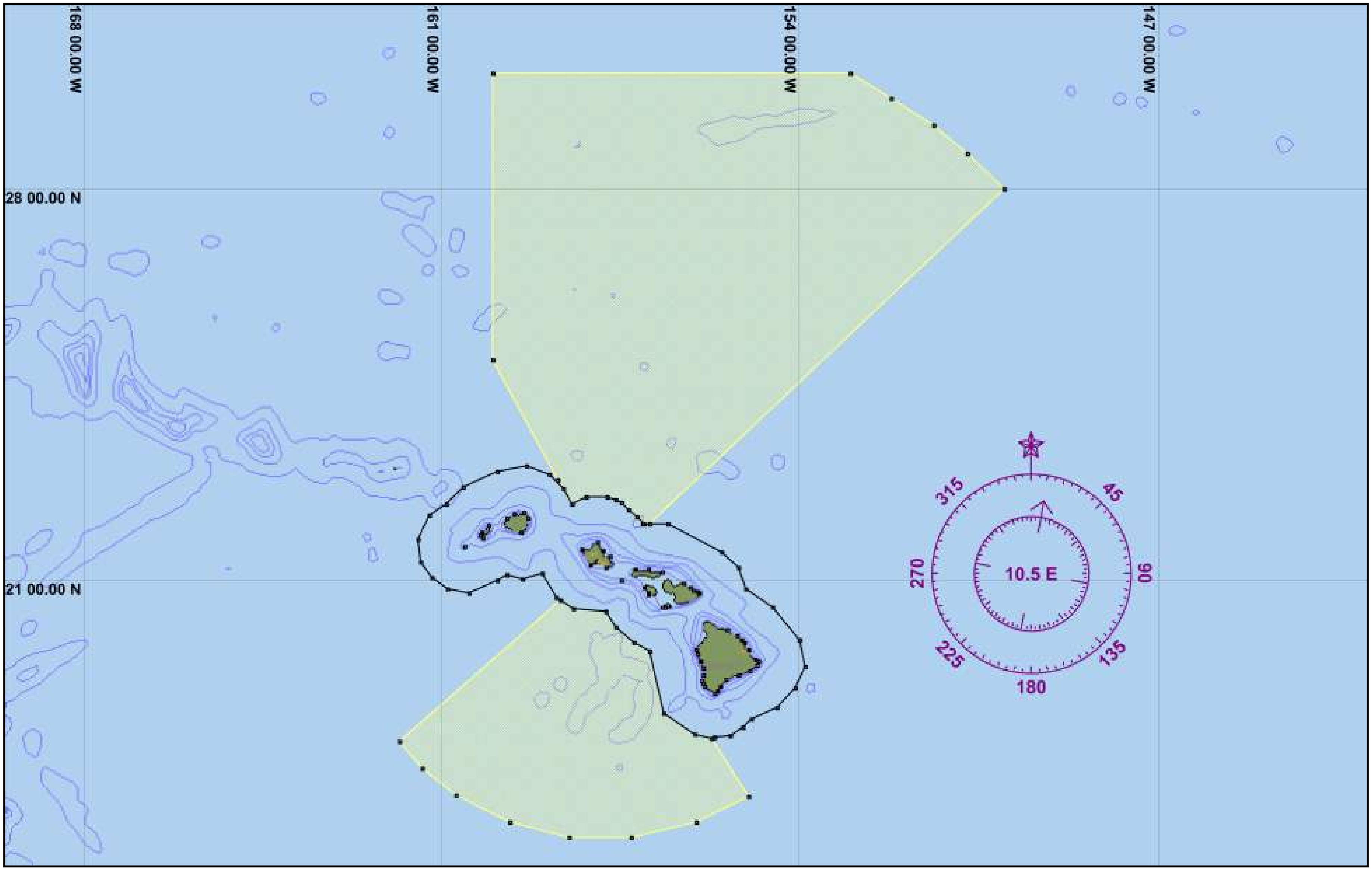
(10) SOUTH CHINA SEA - NO OPERATIONS NOV THRU APR

LATITUDE	LONGITUDE
18 00.0 N	112 58.9 E
18 00.0 N	110 43.5 E
19 30.2 N	113 06.3 E
19 58.1 N	114 03.7 E
19 56.0 N	114 32.1 E
20 14.3 N	115 02.9 E
20 54.1 N	115 53.2 E
19 55.9 N	116 35.5 E

(11) YEAR ROUND OPERATIONS AUTHORIZED OUTSIDE OF RADII FOR THE FOLLOWING ISLANDS IN THE NORTHWESTERN PACIFIC WITHIN THE PHILIPPINE SEA AREA.

LOCATION	LATITUDE (N)	LONGITUDE (E)	RADIUS (NM)
WAKE	19 17.978	166 37.113	30
SIBYLLA	14 36.072	169 00.399	30
BIKAR	12 11.703	170 06.769	30
TAKA/UTRIK	11 11.141	169 43.444	35
MEJIT	10 16.993	170 53.053	30
WOTHO	10 10.639	166 01.002	30
RONGELAP	11 09.158	166 53.636	35
BIKINI	11 36.512	165 23.887	40
ENEWATAK	11 20.015	162 19.518	30
ENJEBI	11 39.878	162 14.245	30

Tab 3: Hawaii


168 00.00 W
161 00.00 W
154 00.00 W
147 00.00 W
28 00.00 N
21 00.00 N
315
45
270
90
225
135
180
10.5 E

Tab 4. Hawaii

Operations are authorized year round

Hawaii North	
Latitude	Longitude
30 00.0N	160 00.0W
30 00.0N	153 00.0W
29 34.2N	152 13.1W
29 06.0N	151 23.5W
28 37.2N	150 42.4W
28 00.0N	150 00.0W
22 03.4N	156 55.5W
22 02.5N	157 03.5W
22 09.9N	157 11.5W
22 18.7N	157.21.2W
22 25.5N	157 28.8W
22 29.1N	157.36.3W
22 32.6N	157 45.9W
22 32.6N	158 10.3W
22 24.5N	158 27.2W
22 42.0N	158 36.5W
22 49.8N	158 44.1W
25 00.0N	160.00.0W

Hawaii South	
Latitude	Longitude
18 01.5N	161 50.3W
20 39.6N	158 41.2W
20 29.6N	158 25.0W
20 26.5N	157 47.5W
20 09.6N	157 35.6W
19 51.6N	157 14.4W
19 42.9N	156 56.5W
18 33.2N	156 38.9W
18 09.1N	156 03.0W
18 04.7N	155 42.4W
17 00.0N	155 00.8W
16 30.3N	156 01.4W
16 13.0N	157 17.3W
16 13.5N	158 30.6W
16 30.3N	159 39.7W
17 00.8N	160 43.5W
17 30.7N	161 23.1W