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Chief of Naval Operations Instruction 5090.1C

Pursuant to
National Environmental Policy Act
Section 102(2)(C)
and
Executive Order 12114

EXECUTIVE SUMMARY
DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/SUPPLEMENTAL OVERSEAS ENVIRONMENTAL IMPACT STATEMENT FOR SURVEILLANCE TOWED ARRAY SENSOR SYSTEM LOW FREQUENCY ACTIVE (SURTASS LFA) SONAR

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Abstract

This Draft Supplemental Environmental Impact Statement/Supplemental Overseas Environmental Impact Statement (DSEIS/SOEIS) evaluates the potential environmental impacts of employing the Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) sonar. It has been prepared by the Department of the Navy in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA) and Presidential Executive Order (EO) 12114 (Environmental Effects Abroad of Major Federal Actions). The Navy currently plans to operate up to four SURTASS LFA sonar systems for routine training, testing and military operations. Based on current U.S. Navy national security and operational requirements, routine training, testing and military operations using these sonar systems could occur in the Pacific, Atlantic and Indian Oceans, and the Mediterranean Sea. Vessels equipped with, or to be equipped with, SURTASS LFA sonar systems are the USNS IMPECCABLE (T-AGOS 23) and USNS VICTORIOUS (T-AGOS 19) class ocean surveillance vessels. In addition to the No Action Alternative, the DSEIS/SOEIS analyzed two additional alternatives. The analysis of these three alternatives is intended to address concerns of the U.S. District Court for the Northern District of California in its 6 February 2008 opinion and order in relation to compliance with NEPA, Endangered Species Act (ESA), and Marine Mammal Protection Act (MMPA); as well as to fulfill the Navy's responsibilities under NEPA with regard to providing additional information related to the proposed action. The DSEIS/SOEIS considers mitigation measures, including the practicability of greater coastal standoff range where the continental shelf extends further than the current coastal standoff range of 22 kilometers (12 nautical miles), the designation of additional offshore biologically important areas, and further analysis of potential cumulative impacts with concurrent use of SURTASS LFA sonar with other active sonar sources

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EXECUTIVE SUMMARY

This 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[1] 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), which were filed with the United States (U.S.) Environmental Protection Agency in January 2001 and April 2007, respectively. 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.)[2]; 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[3].

To meet long-range submarine detection capabilities necessary to provide U.S. forces with the time to react to and defend against potential undersea threats, the Navy developed the SURTASS LFA sonar system. The proposed action herein is the employment by the U.S. Navy of up to four SURTASS LFA sonar systems for routine training, testing, and military operations[4] in the oceanic areas as presented in Figure ES-1. Based on current U.S. national security and operational requirements, routine training, testing and military operations using these sonar systems could occur in the Pacific, Atlantic, and Indian Oceans, and the Mediterranean Sea. To reduce potential adverse effects on the marine environment, areas would be excluded, as necessary, to prevent 180-decibel (dB) sound pressure level (SPL) or greater within a specific geographic range of land, and in offshore biologically important areas (OBIA) during biologically important seasons, and to prevent greater than 145-dB SPL at known recreational and commercial dive sites.

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 @ 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 µPa²-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 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; 2007a).**

[1] In this DSEIS/SOEIS, "SURTASS LFA sonar systems" refers to both the LFA and compact LFA (CLFA) systems, each having similar acoustic operating characteristics.

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

[3] 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).

[4] The phrase "military operations" does not include use of SURTASS LFA sonar in armed conflict, or direct combat support operations or use of SURTASS LFA sonar during periods of heightened threat conditions, as determined by the National Command Authorities.

The purpose of the SURTASS LFA sonar Draft SEIS/SOEIS is 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.

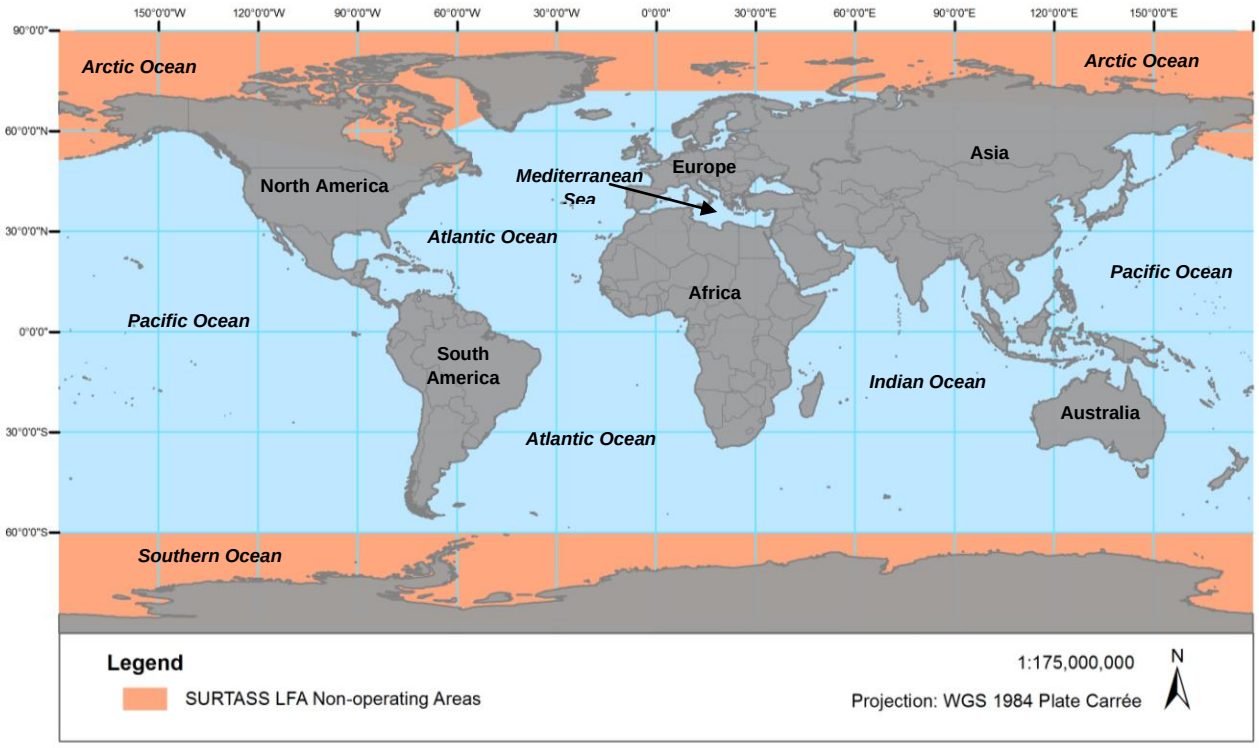

Figure ES-1. Potential areas of operation for SURTASS LFA sonar.

The Navy is the lead agency, with the National Marine Fisheries Service (NMFS) as the cooperating agency, in accordance with NEPA regulations (40 CFR §1501.6). 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 (*Federal Register* (FR) (74 (12):3574) (DoN, 2009a). In the NOI the Navy and NMFS solicited scoping comments on the above topics to include OBIAs, greater coastal standoff, and cumulative effects. At the end of the 45-day public scoping period, no comments had been received.

In response to the Court ruling on the motion for preliminary injunction, the Deputy Assistant Secretary of the Navy for Environment (DASN(E)), on 14 November 2008, determined that the purposes of NEPA and Executive Order 12114 would be furthered by the preparation of additional supplemental analyses in the form of a new SEIS/SOEIS.

The initial FOEIS/EIS for SURTASS LFA sonar was completed in January 2001 by the Department of the Navy (DON) with NMFS as a cooperating agency in accordance with the requirements of NEPA and EO 12114. DASN(E) signed the Record of Decision (ROD) on 16 July 2002 (FR 67(141):48145), authorizing the operational employment of SURTASS LFA sonar systems contingent upon issuance by NMFS of

letters of authorization (LOA) under the MMPA and incidental take statements (ITS) under the ESA for each vessel.

In order to improve military readiness, the Department of Defense (DoD) asked Congress to amend several provisions of environmental laws as they applied to military training and testing activities. These legislative amendments were provided by Congress as parts of the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2003 (Public Law 107-314) and the NDAA for FY 2004 (Public Law 108-136).

The term "military readiness activity" is defined in NDAA for FY 2003 (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 have determined that the Navy's SURTASS LFA sonar testing, training, and military operations that are the subject of NMFS' July 16, 2002, Final Rule constitute a military readiness activity 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."

The provisions of the NDAA that specifically relate to SURTASS LFA sonar concern revisions to the MMPA, as summarized below:

- Overall – Changed the MMPA definition of "harassment," adjusted the permitting system to better accommodate military readiness activities, and added a national defense exemption[5].
- Amended definition of "harassment" as it applies to military readiness activities and scientific activities conducted on behalf of the Federal government.
- Level A "harassment" defined as any act that injures or has the *significant* potential to injure a marine mammal or marine mammal stock in the wild.
- Level B "harassment" defined as any act that disturbs or is *likely to disturb* a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering *to a point where the patterns are abandoned or significantly altered*.
- Secretary of Defense may invoke a national defense exemption not to exceed two years for DoD activities after conferring with the Secretary of Commerce and the Secretary of Interior, as appropriate.
- NMFS' determination of "least practicable adverse impact on species or stock" must include consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.
- Eliminated the "small numbers" and "specified geographic region" requirements from the incidental take permitting process for military readiness activities.

The DSEIS/SOEIS focuses on DASN(E) direction for supplemental analyses, to include:

- Further analysis of potential additional OBIAs in regions of the world where the Navy intends to use SURTASS LFA sonar systems for routine training, testing and military operations;

[5] SURTASS LFA sonar has never been employed under this national defense exemption.

- Further analysis of whether using a greater coastal standoff range where the continental shelf extends further than the current coastal standoff range (22 km [12 nmi]) is practicable for SURTASS LFA sonar; at least in some locations; and
- Further analysis of potential cumulative impacts with concurrent use of SURTASS LFA sonar with other active sonar sources.

Additional Draft SEIS/SOEIS analyses include:

- Updating literature reviews, especially for fish, sea turtles, and marine mammals;
- New subchapter on protected habitats, including ESA Critical Habitat, Essential Fish Habitat, and Marine Protected Areas;
- Updated literature review on commercial fisheries, marine mammal strandings, cumulative effects from anthropogenic oceanic noise, cumulative effects on socioeconomic resources; and
- Mitigation measures: changes due to increased number of OBIAs.

The information in the FOEIS/EIS (DoN, 2001) and FSEIS (DoN, 2007a) remains valid, except as noted or modified in this DSEIS/SOEIS. The contents of the FOEIS/EIS and FSEIS are incorporated into this DSEIS/SOEIS by reference, except as noted or modified.

ES.1 PURPOSE AND NEED

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[6]. In order to be prepared for all potential threats, the Navy must maintain ASW core competency through continual training in open-ocean and littoral environments.

The challenges faced by the U.S. Navy today are very different from those faced at the end of the Cold War nearly 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 less well-understood and defined strategies and goals (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; 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. These are discussed in Subchapter 1.1.4. Of the technologies evaluated, LFA 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. SURTASS LFA sonar is

[6] See Subchapter 1.1.3 for the definition of "littoral."

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.

The proposed action meets the need of the U.S. 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).

ES.2 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

SURTASS LFA sonars are long-range systems operating in the LF band (below 1,000 Hz). These systems are composed of both active and passive components (Figure ES-2). SONAR is an acronym for SOund NAvigation and Ranging, and its definition includes any system that uses underwater sound, or acoustics, for observations and communications. Sonar systems are used for many purposes, ranging from commercial off-the-shelf (COTS) "fish finders" to military ASW systems for detection and classification of submarines. There are two basic types of sonar:

- Passive sonar detects the sound created by an object (source) in the water. This is a one-way transmission of sound waves traveling through the water from the source to the receiver and is the same as people hearing sounds that are created by another source and transmitted through the air to the ear.
- Active sonar detects objects by creating a sound pulse, or "ping," that is transmitted through the water and reflects off the target, returning in the form of an echo. This is a two-way transmission (source to reflector to receiver). Some marine mammals locate prey and navigate utilizing this form of echolocation.

ES.2.1 PROPOSED ACTION

The proposed action herein is the U.S. Navy employment of up to four SURTASS LFA sonar systems in the oceanic areas as presented in Figure ES-1. Based on current operational requirements, routine training, testing and military operations using these sonar systems could occur in the Pacific, Atlantic, and Indian Oceans, and the Mediterranean Sea.

LFA systems were initially installed on two SURTASS vessels: R/V *Cory Chouest*, which was retired in 2008, and USNS IMPECCABLE (T-AGOS 23). As future undersea warfare requirements continue to transition to littoral ocean regions, the introduction of a compact active system deployable on SURTASS ships was needed. 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) in 2008 and at-sea-testing commenced in August 2008. 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.
- Lighter-weight design with mission weight of 64,410 kilograms (kg) (142,000 pounds [lb]) vice 155,129 kg (324,000 lb) mission weight of LFA).

With the R/V *Cory Chouest's* retirement in FY 2008, two systems are currently operational. At present, there is one SURTASS LFA sonar system onboard USNS IMPECCABLE (T-AGOS 23) and one SURTASS CLFA sonar system onboard the USNS ABLE (T-AGOS 20). Two additional CLFA systems are planned for the T-AGOS 19 Class. Late in FY 2011, the CLFA system onboard the USNS

EFFECTIVE (T-AGOS 21) commenced at-sea testing and training. The CLFA system to be installed onboard the USNS VICTORIOUS (T-AGOS 19) is scheduled for at-sea testing and training in FY 2012. Therefore, no more than four systems are expected to be in use through FY 2016, and thus this DSEIS/SOEIS considers the employment of up to four systems.

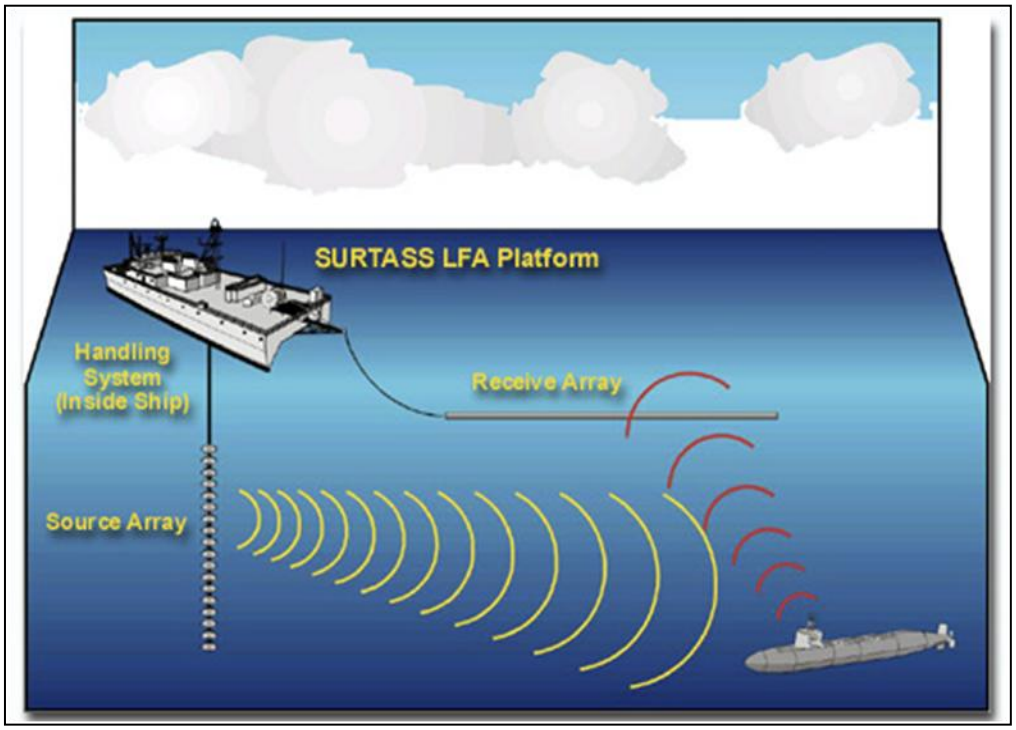

Figure ES-2. SURTASS LFA sonar systems.

The operational characteristics of CLFA are comparable to the existing LFA system as presented in Subchapter 2.1 of the FOEIS/EIS, FSEIS and this document. Therefore, the potential impacts from CLFA are expected to be similar to, and not greater than, the effects from the existing SURTASS LFA sonar system. Hence, for this analysis, the term LFA will be used to refer to both the existing LFA system and/or the compact (CLFA) system, unless otherwise specified.

The active component of the existing SURTASS LFA sonar system, LFA, is an active adjunct to the SURTASS passive capability and is planned for use when passive system performance is 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 under an ocean surveillance vessel, such as the USNS IMPECCABLE (T-AGOS 23) and the VICTORIOUS class (T-AGOS 19) (Figure ES-2). 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 the active component (LFA) are:

- The source is a vertical line array (VLA) of up to 18 source projectors suspended below the vessel. LFA's transmitted beam is omnidirectional (360 degrees) in the horizontal, with a narrow vertical beamwidth that can be steered above or below the horizontal.

- The source frequency is between 100 and 500 Hz. A variety of signal types can be used, including continuous wave (CW) and frequency-modulated (FM) signals.
- The source level (SL) of an individual source projector of the SURTASS LFA sonar array is approximately 215 dB re 1 µPa at 1 m (rms) or less. As measured by sound pressure level (SPL), the sound field of the array can never be higher than the SL of an individual source projector.
- The typical LFA signal is not a constant tone, but rather a transmission of various waveforms that vary in frequency and duration. A complete sequence of sound transmissions is referred to as a wavetrain (also known as a ping). These wavetrains last between 6 and 100 seconds with an average length of 60 seconds. Within each wavetrain the duration of each continuous frequency sound transmission is no longer than 10 seconds.
- Average duty cycle (ratio of sound "on" time to total time) is less than 20%. The typical duty cycle, based on historical LFA operational parameters (2003 to 2009), is nominally 7.5 to 10%.
- The time between wavetrain transmissions is typically from 6 to 15 minutes.

The passive, or listening, part of the system is SURTASS, which 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 development of the 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 $1/5^{th}$ 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 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, which are, or will be, equipped with CLFA, will be 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 processed and evaluated to identify and classify potential underwater threats.

ES.2.2 ALTERNATIVES

NEPA requires federal agencies to prepare an EIS that discusses the environmental effects of a reasonable range of alternatives (including the No Action Alternative). These alternatives are described in Subchapter 2.6 of this DSEIS/SOEIS. The FOEIS/EIS initially analyzed all potential technologies, both acoustic and non-acoustic, and determined that only active sonar (specifically LFA) would meet the purpose and need. In addition to the No Action Alternative, analyses in this document are provided for two alternatives. The analyses of these alternatives are intended to take into account the additional analysis contained in this DSEIS/SOEIS on the issue of OBIAs and coastal standoff ranges. Alternatives 1 and 2 also include the same mitigation measures presented in the FSEIS Subchapters 2.4, 5.1, 5.2, and 5.3, which are incorporated herein by reference.

The alternatives considered in this DSEIS/SOEIS are:

- No Action;
- Alternative 1—Same as the 2007 FSEIS Preferred Alternative; and
- Alternative 2—Alternative 1 with new OBIA list (total 21) (the Navy's preferred alternative).

ES.3 AFFECTED ENVIRONMENT

The environments that could potentially be affected by Navy employment of the SURTASS LFA sonar system, include:

- **Marine Environment**, including ambient noise in the oceans, physical environmental factors affecting underwater acoustic propagation, and ocean acoustic regimes;
- **Marine Organisms,** including marine mammals and threatened and endangered species; and
- **Socioeconomic**, including commercial and recreational fisheries, other recreational activities, and research and exploration activities.

ES.3.1 MARINE ENVIRONMENT

There have been no significant changes to the knowledge or understanding in the marine environment, underwater acoustic propagation, or propagation modeling. The information in Subchapter 3.1 (Marine Environment) in the FOEIS/EIS remains valid, and its contents are incorporated herein by reference.

Anthropogenic sounds that could affect underwater ambient noise levels arise from the following general types of activities in and near the sea, any combination of which can contribute to the total noise at any one place and time. These noises include:

- Transportation (ship-generated noise);
- Dredging;
- Construction;
- Hydrocarbon and mineral exploration and recovery;
- Geophysical (seismic) surveys;
- Sonars;
- Explosions; and
- Ocean science studies.

The dominant source of anthropogenic sound in the sea stems from the propulsion of ships (Tyack, 2008). At the lower frequencies, the dominant source of this noise is the cumulative effect of ships that are too far away to be heard individually, but because of their great number, contribute substantially to the average noise background. Shipping noise centers in the 20 to 200 Hz frequency band, and is increasing yearly (Ross, 2005). Ross (1976) estimated that between 1950 and 1975 shipping had caused a rise of 10 dB SPL in ambient ocean noise levels, and he predicted that the level would increase by another 5 dB SPL by the beginning of the 21st century. Andrew et al. (2002) collected ocean ambient sound data from 1994 to 2001 using a receiver on the continental slope off Point Sur, California. These data were compared to measurements made from 1963 to 1965 by an identical receiver. The data demonstrated an increase in ambient noise over the 33-year period of approximately 10 dB SPL in the frequency range of 20 to 80 Hz, primarily due to commercial shipping. There were also increases as large as 9 dB SPL in the frequency range from 100 Hz up to 400 Hz, for which the cause was less obvious (Andrews et al., 2002). McDonald et al. (2006a) compared data sets from 1964 to 1966 and 2003 to 2004 for continuous measurements west of San Nicolas Island, California and found an increase in ambient noise levels of 10 to 12 dB SPL at 30 to 50 Hz.

When combined with the naturally occurring and other man-made noise in the world's oceans, SURTASS LFA sonar barely contributes a measurable portion of the total acoustic energy. This and LFA's low duty cycle (LFA is transmitting only 7.5 to 10% of the time during the projected maximum 432 hours of operations per vessel annually) support the conclusion that the operation of up to four SURTASS LFA sonar systems will not be expected to significantly add to oceanic ambient noise.

ES.3.2 SCIENTIFIC SCREENING OF MARINE ANIMAL SPECIES FOR POTENTIAL SENSITIVITY TO LF SOUND

Marine species must be able to hear underwater LF sound and/or have some organ or tissue capable of changing sound energy into mechanical effects to be affected by LF sound. In order to be affected by LF sound, the organ or tissue must have an acoustic impedance different from water, where impedance is the product of density (kg/m^3 or lb/yd^3) and sound speed (m/sec or ft/sec). Thus, many organisms would be unaffected, even if they were in areas of LF sound, because they do not have an organ or tissue with acoustic impedance different from water. These factors immediately limit the types of organisms that could be adversely affected by LF sound. In other words, to be evaluated for potential impact in this DSEIS/SOEIS, the marine species must: 1) occur within the same ocean region and during the same time of year as the SURTASS LFA sonar operation, 2) possess some sensory mechanism that allows it to perceive the LF sounds, and/or 3) possess tissue with sufficient acoustic impedance mismatch to be affected by LF sounds. Species that did not meet these criteria were excluded from consideration. Species that met the screening selection were fish, sea turtles, and marine mammals.

The process by which a marine species' potential to be affected by SURTASS LFA sonar is discussed in Subchapter 3.2.1 of the FSEIS. Except as noted in Chapter 3 of this DSEIS/SOEIS, there have been no significant changes to the knowledge or understanding relating to species screening. The information in Subchapter 3.2.1 (Species Screening) in the FSEIS remains valid, and the contents are incorporated herein by reference.

ES.3.3 MARINE ORGANISMS

A thorough review of available literature on fish, sea turtles, and marine mammals was conducted with emphasis on data developed after the completion of the FSEIS in 2007. These data are presented in this DSEIS/SOEIS, Subchapter 3.2.

ES.3.4 SOCIOECONOMIC

A thorough review of available literature on commercial and recreational fisheries, recreational activities, and research and exploration activities was conducted with emphasis on data developed after the completion of the FSEIS in 2007. These data are presented in this DSEIS/SOEIS, Subchapter 3.3.

ES.4 SEIS/SOEIS ANALYTICAL PROCESS

The basis for the analysis presented in this DSEIS/SOEIS is consistent with the FOEIS/EIS and the FSEIS, and has been updated based on the best available literature, the Long Term Monitoring Program of current SURTASS LFA sonar operations, and continuing research. Further, no new data contradict any of the assumptions or conclusions presented in Chapter 4 of both the FOEIS/EIS and FSEIS; hence, their contents are incorporated herein by reference.

For SURTASS LFA sonar alternatives, potential impacts should be reviewed in the context of the basic operational characteristics of the system:

- A maximum of four systems, with the potential to be deployed in the Pacific-Indian Ocean area and in the Atlantic Ocean-Mediterranean Sea area.
- The USNS IMPECCABLE (T-AGOS 23) is equipped with a SURTASS LFA sonar system. Three additional VICTORIOUS class (T-AGOS 19) platforms have been equipped with or, are scheduled to be outfitted with, compact LFA systems (see Subchapter 2.1). These vessels are, or will be, U.S. Coast Guard-certified for operations. In addition, they will operate in accordance with all applicable Federal and U.S. Navy rules and regulations related to environmental compliance. SURTASS LFA sonar vessel movements are not unusual or extraordinary and are part of routine

operations of seagoing vessels. Therefore, there should be no unregulated environmental impacts from the operation of the SURTASS LFA sonar vessels.

- At-sea missions would be temporary in nature. Of an estimated maximum 294 underway days per year per vessel, the SURTASS LFA sonar would be operated in the active mode a maximum of 240 days. During these 240 days, active transmissions would occur for a maximum of 432 cumulative hours per year per vessel. Average duty cycle (ratio of sound "on" time to total time) of the SURTASS LFA sonar active transmission mode, based on historical LFA operational parameters since 2003, is nominally 7.5 to 10%. That is, 7.5 to 10% of the time the LFA transmitters could be on; and 90 to 92.5% of the time the LFA transmitters would be off, thus adding no sound into the water. On an annual basis, each SURTASS LFA vessel is limited to transmitting no more than 4.9% of the time (432 hrs/8,760 hrs).

The types of potential effects on marine animals from SURTASS LFA sonar operations can be broken down into several categories:

- **Non-auditory injury**: This includes the potential for resonance of the lungs/organs, tissue damage, and mortality. For the purposes of the SURTASS LFA sonar analyses presented in this DSEIS/SOEIS, all marine animals exposed to underwater sound with ≥180 dB re 1 µPa (rms) SPL received level (RL) are evaluated as if they are injured (Level A "harassment" under the MMPA). Even though actual injury would not occur unless animals were exposed to sound at a level greater than this value (Southall et al., 2007), the analysis in this document will continue to define LFA's injury level as ≥180 dB re 1 µPa (rms) RL. This should be viewed as a conservative value, used to maintain consistency in the analytical methodologies previously utilized in SURTASS LFA sonar environmental impact statements (DoN, 2001 and 2007a), in incidental take applications under the MMPA, and in consultations under the Endangered Species Act (ESA).
- **Permanent threshold shift (PTS)**: A severe situation occurs when underwater sound intensity is very high or of such long duration that the result is a permanent hearing loss on the part of the listener, which is referred to as PTS. This constitutes Level A "harassment" under the MMPA, as does any other injury to a marine mammal. The intensity and duration of an underwater sound that will cause PTS varies across species and even among individual animals. PTS is a consequence of the death of the sensory hair cells of the auditory epithelia of the ear and a resultant loss of hearing ability in the general vicinity of the frequencies of stimulation (Salvi et al., 1986; Myrberg, 1990; Richardson et al., 1995). PTS results in a permanent elevation in hearing threshold—an unrecoverable reduction in hearing sensitivity (Southall et al., 2007).
- **Temporary threshold shift (TTS)**: Underwater sounds of sufficient loudness can cause a temporary condition known as TTS in which an animal's hearing is impaired for a period of time. After termination of the sound, normal hearing ability returns over a period that may range anywhere from minutes to days, depending on many factors, including the intensity and duration of exposure to the sound. Hair cells may be temporarily affected by exposure to the sound, but they are not permanently damaged or killed. Thus, TTS is not considered an injury (Richardson et al., 1995; Southall et al., 2007), although during a period of TTS, animals may be at some disadvantage in terms of detecting predators or prey.
- **Behavioral change**: Various vertebrate species are affected by the presence of intense underwater sounds in their environment (Salvi et al., 1986; Richardson et al., 1995). Behavioral responses to these sounds vary from subtle changes in surfacing and breathing patterns, to cessation of vocalization, to active avoidance or escape from regions of high sound levels (Wartzok, et al., 2004). For military readiness activities, such as the use of SURTASS LFA sonar, Level B "harassment" under the MMPA is defined as any act that disturbs or is likely to disturb a marine mammal by causing disruption of natural behavioral patterns to a point where the patterns

are abandoned or significantly altered. Behaviors include migration, surfacing, nursing, breeding, feeding, and sheltering. The National Research Council (NRC, 2005) discusses biologically significant behaviors and possible effects. It states that an action or activity becomes biologically significant to an individual animal when it affects the ability of the animal to grow, survive, and reproduce. These are the effects on individuals that can have population-level consequences and affect the viability of the species (NRC, 2005). While sea turtles and fish do not fall under MMPA harassment definitions, like marine mammals, it is possible that loud sounds could disturb the behavior of fish and sea turtles, resulting in similar consequences as for marine mammals.

- **Masking**: The presence of intense underwater sounds in the environment can potentially interfere with an animal's ability to hear sounds of relevance to it. This effect, known as "auditory masking," could interfere with the animal's ability to detect biologically-relevant sounds, such as those produced by predators or prey, thus increasing the likelihood of the animal not finding food or being preyed upon.

ES.4.1 POTENTIAL IMPACTS ON FISH STOCKS

Since the original FOEIS/EIS and the subsequent FSEIS, there have been a number of useful studies on the potential effects of underwater sound on fish, including sharks, and several other pertinent studies that have come forth. This DSEIS/SOEIS provides summaries of the recent research and updates the analysis of the potential effects of the proposed alternatives based on the following SURTASS LFA sonar operational parameters:

- Small number of SURTASS LFA sonar systems to be deployed;
- Geographic restrictions imposed on system employment;
- Narrow bandwidth of SURTASS LFA sonar active signal (approximately 30 Hz);
- Slowly moving ship, coupled with low system duty cycle, would mean that fish would spend less time in the LFA mitigation zone (180-dB SPL sound field); therefore, with a ship speed of less than 9.3 km/hr (5 kt), the potential for animals being in the sonar transmit beam during the estimated 7.5 to 10% of the time the sonar is actually transmitting is very low; and
- Small size of the LFA mitigation zone (180-dB SPL sound field) relative to fisheries provinces and open ocean areas.

Due to the lack of more definitive data on fish/shark stock distributions in the open ocean, it is not feasible to estimate the percentage of a stock that could be located in a SURTASS LFA sonar operations area at a potentially vulnerable depth during an LFA sound transmission.

There have been several studies on the effects of both Navy sonar and seismic airguns[7] that are relevant to potential effects of SURTASS LFA sonar on Osteichthyes (bony fish). In the most pertinent of these, the Navy funded independent scientists to analyze the effects of SURTASS LFA sonar on fish. Results from this study were originally presented in the FSEIS. The findings from this study have been presented at conferences, peer-reviewed and published in scientific journals (Popper et al., 2005a, 2007; Halvorsen et al., 2006). These results have now been updated with a related study that examined in detail the effects of SURTASS LFA sonar on fish physiology (Kane et al., 2010). Several other studies have assessed the effects of seismic airguns on fish. Thus, while most research before 2001 studied the effects of sounds using pure tones of much longer duration than the SURTASS LFA sonar signals, many

[7] Seismic airguns differ from SURTASS LFA sonar in that they generally transmit in the 5 to 20 Hz frequency band and their typical airgun array firing rate is once every 9 to 14 seconds, but for very deep water surveys, the rate could be once every 42 sec. Airgun acoustic signals are typically measured in peak-to-peak pressures, which are generally higher than continuous sound levels from other ship and industrial noise. Broadband SLs of 248 to 255 dB SPL (peak-to-peak) are typical for a full-scale array but can be as high as 259 dB SPL. Airgun onset is generally much more rapid (sharper) than that of sonar.

of the more recent studies provide insight into the impact of each of these sounds on fish. With the caveat that only a few species have been examined in these studies, the investigations found little or no effect of high intensity sounds on a number of taxonomically and morphologically diverse species of fish; and there was no mortality as a result of sound exposure, even when fish were maintained for days post-exposure.

The Navy-funded study on the effects of SURTASS LFA sonar sounds on three species of fish (rainbow trout, channel catfish, and hybrid sunfish), also examined long-term effects on sensory hair cells of the ear. In all species, even up to 96 hours post-exposure, there were no indications of damage to sensory cells (Popper et al., 2005a, 2007; Halvorsen et al., 2006).

If SURTASS LFA sonar operations occur in proximity to fish stocks, members of some fish species could potentially be affected by LFA sounds. Even then, the impact on fish is likely to be minimal to negligible, since only an inconsequential portion of any fish stock would be present within the 180-dB SPL sound field at any given time. Moreover, recent results from direct studies of the effects of LFA sounds on fish (Popper et al., 2005a, 2007; Halvorsen et al., 2006; Kane et al., 2010) provide evidence that SURTASS LFA sonar sounds at relatively high received levels (up to 193 dB re 1 µPa [rms] SPL) have minimal impact on at least the species of fish that have been studied. Nevertheless, the 180-dB SPL criterion is maintained for the analyses presented in this DSEIS/SOEIS, with emphasis that this value is *highly conservative* and protective of fish.

ES.4.2 POTENTIAL IMPACTS ON SEA TURTLE STOCKS

There are very few studies of the potential effects of underwater sound on sea turtles and most of these examined the effects of sounds of much longer duration or of different types (e.g., seismic airgun) than the SURTASS LFA sonar signals. This DSEIS/SOEIS provides summaries of the recent research and updates the analysis of the potential effects of the proposed alternatives based on the following SURTASS LFA sonar operational parameters:

- Small number of SURTASS LFA sonar systems to be deployed;
- Geographic restrictions imposed on system employment;
- Narrow bandwidth of the SURTASS LFA sonar active signal (approximately 30 Hz);
- Slowly moving ship, coupled with low system duty cycle, would mean that a sea turtle would spend less time in the LFA mitigation zone (180-dB SPL sound field); therefore, with a ship speed of less than 5 kt, the potential for animals being in the sonar transmit beam during the estimated 7.5 to 10% of the time the sonar is actually transmitting is very low; and
- Small size of the LFA mitigation zone (180-dB SPL sound field) relative to open ocean areas.

Due to the lack of more definitive data on sea turtle stock distributions in the open ocean, it is not feasible to estimate the percentage of a stock that could be located in a SURTASS LFA sonar operations area at a potentially vulnerable depth, during an LFA sound transmission. Data on sea turtle sound production and hearing are very limited. The best available data on sea turtle hearing are presented in Chapter 3 of this document. Further, there are no new data that contradict any of the assumptions or conclusions regarding potential effects to sea turtles in Subchapter 4.2 of the FSEIS, which is incorporated herein by reference.

Sea turtles could be affected if they are inside the LFA mitigation zone (180-dB sound field) during a SURTASS LFA sonar transmission. However, given that received levels from SURTASS LFA sonar operations would be below 180 dB re 1 µPa (rms) SPL within 22 km (12 nmi) or greater distance of any coastlines and OBIAs, effects to a sea turtle stock could occur only if a significant portion of the stock encountered the SURTASS LFA sonar vessel in the open ocean. Further, the majority of sea turtle species inhabit the earth's oceanic temperate zones, where sound propagation is predominantly characterized by downward refraction (higher transmission loss, shorter range), rather than ducting (lower transmission loss, longer range) which is usually found in cold-water regimes. These factors, plus the low

distribution and density of sea turtles at ranges from the coast greater than 22 km (12 nmi), equate to a very small probability that a sea turtle could be found inside the LFA mitigation zone during a SURTASS LFA sonar transmission.

In the unlikely event that SURTASS LFA sonar operations coincide with a sea turtle "hot spot," the narrow bandwidth (approximately 30 Hz) of the SURTASS LFA sonar signal, the fact that the ship is always moving (coupled with low system duty cycle [estimated 7.5 to 10%], which means sea turtles would have less opportunity to be located in the LFA mitigation zone during a transmission), and the monitoring mitigation incorporated into the alternatives (visual and active acoustic [HF] monitoring) would minimize the probability of any effects on sea turtles in the vicinity. Therefore, the potential for SURTASS LFA sonar operations to expose sea turtle stocks to injurious (non-auditory and/or PTS) sound levels is considered negligible. For the same reasons, the potential for SURTASS LFA sonar to cause TTS and/or behavioral changes in sea turtles must also be considered negligible. Any masking effects would be considered temporary and not significant.

ES.4.3 POTENTIAL IMPACTS ON MARINE MAMMALS

Potential effects on marine mammals from SURTASS LFA sonar operations include: 1) non-auditory injury; 2) permanent loss of hearing; 3) temporary loss of hearing; 4) behavioral change; and 5) masking. Richardson et al. (1995) provided the most comprehensive review of contemporary knowledge on the sources and effects of underwater anthropogenic sound on marine mammals, and Nowacek et al. (2007) provide a more recent review of the effects of underwater anthropogenic sound on cetaceans. Nowacek et al. (2007) included an update on the documented behavioral, acoustic and some physiological responses of cetaceans to man-made noise. They focused on literature that reported quantitatively on the sound field and some indicator of response. Southall et al. (2007) reported on the results from a panel of acoustic research experts in the behavioral, physiological, and physical disciplines. The panel's purpose was to review the expanding literature on marine mammal hearing, and physiological and behavioral responses to anthropogenic sound, with the objective of proposing exposure criteria for certain effects. More recently, Hatch et al. (2008) and Clark et al. (2009) have addressed the issue of acoustic masking and presented metrics for quantifying the influences of anthropogenic noise sources on whales that communicate in the LF band.

These papers, additional literature reviews, and research indicate that there are no new data that contradict any of the assumptions or conclusions in the FOEIS/EIS and the FSEIS. Thus, the findings presented in the FOEIS/EIS and the FSEIS regarding potential impacts on marine mammals remain valid and are incorporated by reference herein. This DSEIS/SOEIS provides a summary of the recent literature reviews and the overall potential for impacts of SURTASS LFA sonar operations on marine mammals.

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 negligible, and the potential effects on the stock of any marine mammal from temporary loss of hearing or behavioral change (significant change in a biologically important behavior) are considered minimal. Any auditory masking in marine mammals due to LFA sonar signal transmissions is not expected to be severe and would be temporary. The likelihood of LFA sonar transmissions causing marine mammals to strand is negligible.

ES.4.4 RISK ASSESSMENT APPROACH FOR SURTASS LFA SONAR OPERATIONS

The goal of the risk assessment is to analyze the proposed action and alternatives for the employment by the U.S. Navy of up to four SURTASS LFA sonar systems for routine training, testing, and military operations in oceanic areas (Figure ES-1). Based on current U.S. national security and operational

requirements, routine training, testing and military operations using these sonar systems could occur in the Pacific, Atlantic, and Indian Oceans, and the Mediterranean Sea. These potential operating areas are the same as those assessed in the FOEIS/EIS and FSEIS except for additional OBIAs. To reduce adverse effects on the marine environment, areas would be excluded as necessary to prevent 180-dB SPL RL or greater within a specific geographic range of land and in OBIAs during biologically important seasons, and to prevent greater than 145-dB SPL RL at known recreational and commercial dive sites.

Risk assessments must provide decision-makers and regulators results that demonstrate:

- Under the MMPA, the least practicable adverse impacts on marine mammals while including consideration of personnel safety, practicability of implementation, and impact on the effectiveness of military readiness activities; and
- Under the ESA, employment of SURTASS LFA sonar is not likely to jeopardize the continued existence of threatened/endangered marine species or adversely affect critical habitats.

Since it was neither reasonable nor practicable to model all areas of the world's oceans in which SURTASS LFA sonar could operate, the initial risk assessment in the FOEIS/EIS analyzed 31 potential operating sites. This initial analytical process was refined to provide sensitivity and risk analyses sufficient to identify and select potential SURTASS LFA sonar mission areas with minimal marine mammal/animal activity consistent with the Navy's operational readiness requirements. These analyses were used to provide NMFS with reasonable and realistic pre- and post-operational risk estimates for marine mammal stocks in the proposed SURTASS LFA sonar operating areas. This process was documented in the FSEIS.

The modeling of the 31 sites represented the upper bound of potential impacts (both in terms of possible underwater acoustic propagation conditions, and marine mammal population and density) that could be expected from operation of the SURTASS LFA sonar system. The conservative assumptions of the FOEIS/EIS and FSEIS are still valid. Moreover, there are no new data that contradict any of the assumptions or conclusions made in the FOEIS/EIS and FSEIS.

In this DSEIS/SOEIS's supplemental analysis, 19 additional potential SURTASS LFA sonar operating sites have been analyzed. These sites were chosen because they represent, based on today's political climate, areas where SURTASS LFA sonar could potentially conduct testing, training, or military operations during the 5-year period of the next MMPA Rule.

Under the MMPA Rule, the Navy must apply for annual LOAs. In these applications, the Navy projects where it intends to operate for the period of the next annual LOAs, and provides NMFS with reasonable and realistic risk estimates for marine mammal stocks in the proposed SURTASS LFA sonar mission areas. The LOA application analytical process uses a conservative approach by integrating mission planning needs and a cautious assessment of the limited data available on specific marine mammal populations, seasonal habitat, and activity. Because of the use of conservative assumptions, it is likely that the aggregate effect of such assumptions is an overestimation of risk—a prudent approach for environmental conservation when there are data gaps and other sources of uncertainty. The total annual risk for each stock of marine mammal species is estimated by summing a particular species' risk estimates within that stock, across SURTASS LFA sonar mission areas. Each stock, for a given species, is then examined. Based on this approach, the highest total annual estimated risk (upper bound) for marine mammal species' stocks are provided in the LOA applications.

Information on how the density and stock/abundance estimates are derived for the selected SURTASS LFA sonar mission areas is provided in the LOA applications. These data are derived from current, available published source documents, and provide general information for each mission area with species-specific information on the marine mammals that could potentially occur in that area, including estimates for their stock/abundance and density.

ES.4.4.1 COURT'S CONCERNS

The following three areas address the primary concerns of the Court in its 6 February 2008 Opinion and Order, in relation to compliance with NEPA, ESA and MMPA.

Additional Offshore Biologically Important Areas (OBIA)

Offshore biologically important areas are defined in the FOEIS/EIS as those areas of the world's oceans outside the coastal standoff range 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. This definition remains valid and will be used in this document for the purpose of considering any potential additional OBIAs associated with marine mammals that are LF hearing specialists (i.e., marine species sensitive to SURTASS LFA sonar). The analysis of the OBIAs (for marine mammals and the potential for non-marine mammal OBIAs) is presented in Chapter 4 of this document.

As a result of this further analysis, NMFS and the Navy concluded that there was adequate basis to designate 21 SURTASS LFA sonar marine mammal OBIAs (Table ES-1). The Navy also reviewed the potential OBIAs to assess personnel safety, practicality of implementation, and impacts of the effectiveness on military readiness activities to include SURTASS LFA sonar testing, training, and military operations. No issues were found that would affect the practical implementation of the SURTASS LFA sonar marine mammal OBIA geographic restrictions. These OBIAs, as part of the overall mitigation measures, will reduce incidental takings by SURTASS LFA sonar and, consistent with the current 2007 Rule, are not intended to apply to other Navy activities and sonar operations.

Table ES-1. 21 SURTASS LFA sonar marine mammal OBIAs nominated by NMFS and the Navy.

1. Georges Bank, east of Cape Cod, Massachusetts	12. Piltun and Chayvo Offshore Feeding Grounds—Sea of Okhotsk
2. Roseway Basin, Nova Scotia south coast	13. Coastal Waters off Madagascar
3. Great South Channel, Gulf of Maine, and Stellwagen National Marine Sanctuary	14. Madagascar Plateau and Ridge
4. SE U.S. Right Whale Seasonal Habitat, Florida east coast	15. Ligurian-Corsican-Provencal Basin, Mediterranean Sea
5. North Pacific Right Whale Critical Habitat—Gulf of Alaska	16. Penguin Bank—Hawaiian Islands Humpback Whale National Marine Sanctuary
6. Silver and Navidad Banks, Dominican Republic	17. Costa Rica Dome, Costa Rica west coast
7. Coastal Waters of Gabon, Congo and Equatorial Guinea, Africa west coast	18. Great Barrier Reef, Australia north coast—16°S to 21°S
8. Patagonian Shelf Break, Argentina east coast	19. Bonney Upwelling, Australia south coast
9. Southern Right Whale Seasonal Habitat, Argentina	20. Head of Swatch-of-No-Ground—Bay of Bengal, India
10. Central California National Marine Sanctuaries,	21. Olympic Coast National Marine Sanctuary, The Prairie, Barkley and Nitnat Canyons, Washington State west coast
11. Antarctic Convergence Zone	

Practicability of greater coastal standoff range where the continental shelf extends further than current coastal standoff range (22 km [12 nmi])

The Navy also considered whether using a greater coastal standoff range in some locations where the continental shelf (≤ 200 m [656 ft] depth) extends farther than the current 22 km (12 nmi) coastal standoff range, is practicable. This analysis was effectively combined with the OBIA analysis, because as part of the OBIA analysis NMFS and the Navy considered the biological importance of coastal areas outside the current coastal standoff range. For example, of the initial listing of 73 recommended OBIAs by NMFS' expert panelists, 32 were either completely or partially within shelf waters and outside of the current coastal standoff range. After analyses and rankings, NMFS and the Navy agreed on the proposed final 21 SURTASS LFA sonar marine mammal OBIAs. Nearly all of the revised/additional OBIAs are either located completely or partially within shelf waters but outside (or seaward of) the current coastal standoff range. Therefore, the coastal standoff range for this analysis will remain at 22 km (12 nmi).

Potential cumulative impacts with concurrent use of SURTASS LFA sonar with other active sonar sources

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 (see Table 4-28). In addition to these multiple dissimilarities, 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)[8]. 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%[9] of the time that both sonars are operating.

The ocean volumes of Level A RLs for each source are relatively small (1 km [0.54 nmi] radius or less). It is not reasonably foreseeable that SURTASS LFA and MFA sonars would operate simultaneously within ranges less than 9.3 km (5 nmi). Thus, it is not reasonably foreseeable that the Level A volumes of the two sonars could ever overlap during simultaneous transmissions (see Subchapter 4.7.4.1).

The results of two separate analysis methodologies, parametric analysis and underwater acoustic model analysis, were consistent—concurrent MFA/SURTASS LFA sonar operations produce no level B harassment 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. Thus, the conclusion in the FSEIS that the potential for this occurring is small, remains valid, and should be considered very conservative.

ES.4.4.2 MARINE MAMMAL STRANDINGS

The use of SURTASS LFA sonar was not associated with any of the reported 27 mass stranding events or unusual mortality events (UME) that occurred globally between 2006 and early 2010. There is no evidence that SURTASS LFA sonar transmissions resulted in any difference in the stranding rates of

[8] 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.

[9] MFA overlaps 1 sec for every 10 min (600 sec) of LFA duty cycle (1 sec/600 sec = 0.0017 or 0.17%).

marine mammals in Japanese coastal waters adjacent to SURTASS LFA sonar operating areas. As has been reported previously (DoN, 2001 and 2007a) and has been further documented in this DSEIS/SOEIS, 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 SURTASS LFA sonar operations without any reported associated stranding events, the likelihood of SURTASS LFA sonar transmissions causing marine mammals to strand is negligible.

ES.4.5 SOCIOECONOMICS

This DSEIS/SOEIS addresses the potential impact to commercial and recreational fisheries, other recreational activities, and research and exploration activities that could result from implementation of the alternatives under consideration.

ES.4.5.1 COMMERCIAL AND RECREATIONAL FISHERIES

SURTASS LFA sonar operations are geographically restricted such that SURTASS LFA sonar RLs are less than 180 dB dB re 1 µPa (rms) SPL within 22 km (12 nmi) from coastlines and within OBIAs during biologically important seasons, where fisheries productivity is generally high. SURTASS LFA sonar operations occur in proximity to fish stocks, and members of some fish species could potentially be affected by LF sounds. Even then, the impact on fish is likely to be minimal to negligible since only an inconsequential portion of any fish stock would be present within the 180-dB SPL sound field at any given time. Moreover, recent results from direct studies of the effects of LFA sounds on fish (Popper et al., 2005a, 2007; Halvorsen et al., 2006; Kane et al., 2010) provide evidence that SURTASS LFA sonar sounds at relatively high received levels (up to 193 dB dB re 1 µPa [rms] SPL) have minimal impact on at least the species of fish that were studied. Nevertheless, the 180-dB SPL criterion has been maintained for the analyses presented in this DSEIS/SOEIS, with emphasis that this value is *highly conservative* and protective of fish. Therefore, SURTASS LFA sonar operations are not likely to affect fish populations and, thus, are not likely to affect commercial and recreational fisheries.

ES.4.5.2 OTHER RECREATIONAL ACTIVITIES

There are no new data that contradict any of the assumptions or conclusions in Subchapter 4.3.2 (Other Recreational Activities) in the FOEIS/EIS and Subchapter 4.5.2 in the FSEIS regarding recreational swimming, snorkeling, and diving. Hence, the contents of the FOEIS/EIS and FEIS subchapters are incorporated herein by reference. Whale watching typically takes place during times of year and in geographic locations where the probability of observing cetaceans are greatest. The probability of occurrence is higher because cetaceans have aggregated in specific areas to participate in some biologically important activity, such as feeding or migrating. Due to the water depth and accessibility, the vast majority of recreational swimming, snorkeling, and diving occurs within 22 km (12 nmi) of shore. Since SURTASS LFA sonar operations are restricted from transmitting ≥180 dB dB re 1 µPa (rms) SPL RL within 22 km (12 nmi) from shore, more than 145 dB dB re 1 µPa (rms) SPL RL near known recreational[10] and commercial dive sites, and in OBIAs during biologically important seasons, there is no reasonably foreseeable likelihood that operation of the sonar will affect recreational diving, swimming, snorkeling, or whale watching.

[10] Recreational dive sites are generally defined as coastal areas from the shoreline or island(s) 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.

ES.4.5.3 RESEARCH AND EXPLORATION ACTIVITIES

There are no new data that contradict any of the assumptions or conclusions in Subchapter 4.3.3 in the FOEIS/EIS and Subchapter 4.5.3 in the FSEIS regarding research and exploration activities; hence, their contents are incorporated herein by reference. SURTASS LFA sonar operations are highly unlikely to affect oceanographic research that utilize submersibles (remotely operated vehicles [ROVs], autonomous undersea vehicles [AUVs], or manned submersibles) but could potentially affect other types of oceanographic research or oil and gas exploration activities that employ underwater acoustic equipment or instruments such as airguns, hydrophones, and ocean-bottom seismometers. If transmitted near oceanographic or exploration activities using underwater acoustic instrumentation, SURTASS LFA sonar could possibly interfere with the acoustic instruments or saturate the hydrophones. Conversely, research and exploration activities using underwater acoustic instruments or sources could interfere with SURTASS LFA sonar operations. For these reasons, SURTASS LFA sonar will not operate in the vicinity of known oceanographic or oil and gas exploratory operations and, thus, will not have an effect on these activities.

ES.4.6 POTENTIAL CUMULATIVE EFFECTS

The operations of up to four SURTASS LFA sonars are evaluated in this DSEIS/SOEIS 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 DSEIS/SOEIS, 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 injury or lethal takes of marine mammals or other marine animals. SURTASS LFA sonar operations are not likely to affect commercial and recreational fisheries, or research and exploration activities; and there is no reasonably foreseeable likelihood of affecting recreational diving, swimming, snorkeling, or whale watching. Analysis of the potential impacts from concurrent LFA and MFA sonar operations demonstrates that the overall risks of Level A and Level B impacts are no greater than the risks obtained by simply adding the risks from the individual LFA and MFA sources. 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.

ES.4.7 EVALUATION OF ALTERNATIVES

NEPA requires federal agencies to prepare an EIS that discusses the environmental effects of a reasonable range of alternatives (including the No Action Alternative). Reasonable alternatives are those that will accomplish the purpose and meet the need of the proposed action, and are practical and feasible from a technical and economic standpoint.

This DSEIS/SOEIS is the third environmental impact statement for SURTASS LFA sonar prepared under NEPA and Executive Order 12114. Previous to this document a final environmental impact statement (under NEPA) and final overseas environmental impact statement (under Executive Order 12114) were prepared in 2001 (DoN, 2001) and supplemented in 2007 (DoN, 2007). In these documents, numerous potential alternatives have been analyzed including: acoustic and non-acoustic detection methods such as radar, laser, magnetic, infrared, electronic, electric, hydrodynamic, biological technologies, passive sonar and high- or mid-frequency active sonar; unrestricted SURTASS LFA sonar operations; monitoring and mitigation for fish; the use of small boats and aircraft for pre-operational surveys; and an extended coastal standoff range of 46 km (25 nmi) vice 22 km (12 nmi). It has been concluded in the FOEIS/EIS and the FSEIS that none of these potential alternatives met the purpose and need of the proposed action to provide U.S. Naval forces with reliable long-range underwater threat detection and, thus, did not provide adequate reaction time to counter potential threats. Furthermore, they were not considered practical and/or feasible for technical and economic reasons.

The following alternatives were considered in this DSEIS/SOEIS, and are compared in Table ES-2:

- No Action;
- Alternative 1—Same as the 2007 FSEIS Preferred Alternative; and
- Alternative 2—Alternative 1 with new OBIA list (total 21) (the Preferred Alternative).

Table ES-2. Alternatives considered in this document for SURTASS LFA sonar operations.

PROPOSED RESTRICTIONS/MONITORING	NO ACTION	ALTERNATIVE 1	ALTERNATIVE 2
Dive Sites	NA	RL not exceed 145 dB SPL	RL not exceed 145 dB SPL
Coastline Restrictions	NA	RL <180 dB SPL within 12 nmi of coast	RL <180 dB SPL within 12 nmi of coast
FSEIS (2007) OBIAs (total 9)	NA	Yes	No
New OBIA list (total 21)	NA	No	Yes
Visual Monitoring	NA	Yes	Yes
Passive Acoustic Monitoring	NA	Yes	Yes
Active Acoustic Monitoring	NA	Yes	Yes
Reporting	NA	Yes	Yes

ES.5 MITIGATION MEASURES

Mitigation, as defined by the Council on Environmental Quality (CEQ), includes measures to minimize impacts by limiting the degree or magnitude of a proposed action and its implementation. In this document, three alternatives for the operation of SURTASS LFA sonar are presented, two of which will meet, to varying degrees, the Navy's purpose and need and reduce potential impacts through the mitigation measures discussed in this document. The mitigation and monitoring measures presented for SURTASS LFA sonar are similar to those in the FSEIS.

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 RLs ≥180 dB re 1 µPa (rms) SPL;
- Ensuring that no OBIAs 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 zone; 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 will minimize impacts on marine mammal stocks and species, as well as on sea turtle stocks, and recreational/commercial divers.

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 SURTASS LFA sonar (Table ES-3).

Table ES-3. 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	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

Table ES-3. Summary of mitigation measures for operation of SURTASS LFA sonar.

MITIGATION MEASURE	CRITERIA	ACTIONS
Monitoring to Prevent Injury to Marine Mammals and Sea Turtles		
Visual Monitoring	Potentially affected species near the vessel but outside of the LFA mitigation zone	Notify Military Detachment Officer in Charge (MILDET OIC)
	Potentially affected species sighted within 2 km (1.1 nmi) and 45 degrees either side of the bow or inside the LFA mitigation zone	Delay/suspend SURTASS LFA sonar operations
Passive Acoustic Monitoring	Potentially affected species' vocalizations detected	Notify MILDET OIC
Active Acoustic Monitoring	Contact detected and determined to have a track that would pass within the LFA mitigation zone	Notify MILDET OIC
	Potentially affected species detected inside the LFA mitigation zone	Delay/suspend SURTASS LFA sonar operations

ES.6 CONCLUSIONS

The following conclusions in this DSEIS/SOEIS are supported by the analyses addressing the operations of up to four SURTASS LFA sonar systems in the FOEIS/EIS and the supplementary analyses undertaken in the FSEIS, which are both incorporated herein by reference; and the supplementary analyses undertaken in this DSEIS/SOEIS, which also encompass the at-sea operations of up to four systems.

No Action

In summary, the No Action Alternative would avoid all environmental effects of employment of SURTASS LFA sonar. It would not, however, support the Navy's stated priority ASW need for long-range underwater threat detection. The implementation of this alternative would allow potentially hostile submarines to clandestinely threaten U.S. Fleet units and land-based targets. Without SURTASS LFA sonar long-range surveillance capability, the reaction times to enemy submarines would be greatly reduced and the effectiveness of close-in, tactical systems to neutralize threats would be seriously, if not fatally, compromised.

Alternative 1

Under Alternative 1, as was concluded in the FSEIS, the potential effects on any stock of marine mammals from injury is considered to be negligible, and the effect on the stock of any marine mammal from significant change in a biologically important behavior is considered to be minimal. Any momentary

behavioral responses and possible indirect effects on marine mammals due to potential effects on prey species are considered not to be biologically significant effects. Any auditory masking in mysticetes, odontocetes, or pinnipeds is not expected to be severe and would be temporary. Further, the potential effects on any stock of fish, sharks or sea turtles from injury is also considered to be negligible, and the effect on the stock of any fish, sharks, or sea turtles from significant change in a biologically important behavior is considered to be negligible to minimal. Any auditory masking in fish, sharks or sea turtles is expected to be of minimal significance and, if occurring, would be temporary.

Alternative 2 (The Preferred Alternative)

Under Alternative 2, additional geographic restrictions would be levied on SURTASS LFA sonar operations through the inclusion of more marine mammal OBIAs (Table ES-1). The general summary provided in the above paragraph regarding the potential for injury on any stock of marine mammals, fish, sharks, or sea turtles, or significant change in a biologically important behavior of marine mammals, fish, sharks, or sea turtles from the operation of SURTASS LFA sonar would also apply to this alternative. Potential effects to marine animals from SURTASS LFA sonar operations under this alternative would be expected to be slightly decreased when compared to Alternative 1 conclusions.

Summary

Table ES-4 provides a qualitative estimate of the ability of each alternative to meet the Navy's purpose and need. Alternative 2 (additional marine mammal OBIAs) would be expected to decrease to some extent the littoral areas where SURTASS LFA sonar operations could occur outside of 22 km (12 nmi). Thus, the long-range detection of threats in the littorals and Fleet training in the littorals would remain high, but may be slightly reduced compared to Alternative 1.

Table ES-4. Estimate of ability of the proposed alternatives to meet the Navy's purpose and need.

	DETECTION OF THREATS IN OPEN OCEAN	DETECTION OF THREATS IN LITTORALS	FLEET TRAINING IN OPEN OCEAN	FLEET TRAINING IN LITTORALS
No Action	N/A[11]	N/A	N/A	N/A
Alternative 1	H[12]	H	H	H
Alternative 2	H	H(1)[13]	H	H(1)

Based on the results of the analyses in this document and the two previous NEPA EISs, operation of SURTASS LFA sonars, when employed in accordance with the mitigation measures (geographic restrictions and monitoring/reporting) detailed in Chapter 5.0 of this document, support a negative impact determination.

[11] N/A= not applicable/does not meet.

[12] H=high level

[13] H(1) = High level but may be slightly reduced compared to Alternative 1.

These include:

- Potential effects on most if not all individual marine mammals are expected to be limited to Level B harassment. The Navy does not expect those effects to impact rates of recruitment or survival on the associated marine mammal species and stocks. Thus, effects on recruitment or survival are expected to be negligible.
- Navy's impact analysis does not anticipate any mortality nor any injury of marine mammals to occur as a result of SURTASS LFA sonar operations, and the potential to cause strandings of marine mammals is negligible
- Potential for injury to sea turtles and fish is negligible.
- Potential for non-injurious effects (TTS, masking, modification of biologically important behavior) is minimal to negligible.

Cumulative effects are not a reasonably foreseeable adverse impact.Since the initial LOA was issued for the operation of SURTASS LFA sonar systems in 2002, the percent of Level B incidental takes of marine mammals has consistently been below the amounts authorized in the LOAs. There have been no reported strandings and no Level A takes incidental to SURTASS LFA sonar operations.

Therefore, this document supports the Navy application under the MMPA for take authorizations incidental to the operation of SURTASS LFA sonar by providing the means of effecting the least practicable adverse impact on the species or stock and its habitat and on the availability of the species or stock for "subsistence" uses. These results will also support the interagency consultations, or Section 7 consultations, under the ESA to ensure the operations of SURTASS LFA sonar do not jeopardize the continued existence of a species or destroy or adversely modify critical habitat.

ES.7 PUBLIC PARTICIPATION

Public involvement in the review of draft SEISs is stipulated in 40 CFR Part 1503.1 of the CEQ regulations implementing NEPA and in OPNAVINST 5090.1C. These regulations and guidance provide for active solicitation of public comment via public comment periods and public hearings/meetings. Chapter 7 of this DSEIS/SOEIS has been prepared to document the public involvement process in preparation of this document and also present the response to questions and comments raised by individual commenters during the public comment period on the DSEIS/SOEIS.

On January 21, 2009, the Navy, with NMFS as a cooperating agency, published a Notice of Intent (NOI) to prepare a SEIS/SOEIS for the employment of SURTASS LFA sonar in the *Federal Register* (DoN, 2009a). The NOI described the decision of DASN(E) to further the purposes of NEPA, support the issuance of a new Final Rule under the MMPA for the taking of marine mammals incidental to operation of SURTASS LFA sonar systems, and to continue the Navy's commitment to environmental stewardship by preparing an additional supplemental analysis for operation of SURTASS LFA sonar. DASN(E) called for the additional supplemental analysis to focus on potential OBIAs in regions of the world's oceans where SURTASS LFA sonar might be used for routine training, testing, and military operations, as well as the potential for cumulative effects associated with the use of SURTASS LFA sonar with other active sonar systems, and the potential for a greater coastal standoff range, where operationally practicable. In the NOI, the Navy and NMFS solicited scoping comments on the above topics, to include OBIAs, greater coastal standoff ranges, and cumulative effects. At the end of the 45-day public scoping period, no comments had been received (DoN, 2009a).

Commencing with the filing of the DSEIS/SOEIS with the U.S. EPA, copies of the SURTASS LFA Sonar DSEIS/SOEIS have been distributed to agencies and officials of the federal, state, and local governments, citizens groups and associations, and other interested parties.

A 60-day public review and comment period on the Draft SEIS/SOEIS commences when the Notice of Availability (NOA) is published in the *Federal Register*.