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

Executive Summary
Draft
Supplemental
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 (SEIS) 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 Presidential Executive Order (EO) 12114 (Environmental Effects Abroad of Major Federal Actions) and the National Environmental Policy Act of 1969 (NEPA). The Navy currently plans to operate up to four SURTASS LFA sonar systems. At present the Research Vessel (R/V) *Cory Chouest* and the USNS IMPECCABLE (T-AGOS 23) are the only vessels equipped with SURTASS LFA sonar. The additional SURTASS LFA sonar systems would be installed on the USNS VICTORIOUS (T-AGOS 19) Class ocean surveillance vessels. In addition to the No Action Alternative, the SEIS analyze four alternatives. The analysis of these five alternatives is intended to address NEPA deficiencies identified in the Ninth District Court's 26 August 2003 opinion, as well as to fulfill the Navy's responsibilities under NEPA with regard to providing additional information related to the proposed action. The SEIS considers mitigation measures including coastal standoff restrictions of 22 and 46 km (12 and 25 nm) and the designation of additional offshore biologically important areas.

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EXECUTIVE SUMMARY

This Draft Supplemental Environmental Impact Statement (SEIS) evaluates the potential environmental effects of employment of Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) sonar systems. 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 the Final Overseas Environmental Impact Statement/Environmental Impact Statement (FOEIS/EIS) for SURTASS LFA Sonar. Based on current operational requirements, exercises using these sonar systems would occur in the Pacific, 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-decibel (dB) sound pressure level (SPL) or greater within specified 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.

The purpose of the Draft SURTASS LFA Sonar SEIS is to:

- Address deficiencies in the National Environmental Policy Act (NEPA), Endangered Species Act (ESA), and Marine Mammal Protection Act (MMPA)[1] compliance found by the U.S. District Court for the Northern District of California in its 26 August 2003 Opinion and Order;
- Provide information necessary to apply for a new five-year Rule that would provide for incidental takes under the MMPA when the current rule expires in 2007, taking into account legislative changes to the MMPA and the need to employ two additional SURTASS LFA sonar systems;
- Analyze potential impacts for LFA system upgrades; and
- Provide additional information and analyses pertinent to the proposed action.

References to Underwater Sound Levels

1. References to underwater sound pressure level (SPL) in this SEIS 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.
2. References to underwater Sound Exposure Level (SEL) in this SEIS are the measure of sound energy flow per unit area expressed in dB, and are assumed to be standardized at dB re 1 μPa^2-s, unless otherwise stated.

[1] On 2 December 2004, the Court vacated and dismissed the MMPA claims based on the NDAA FY04 amendments to the MMPA.

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, the DASN(E) directed the Navy to prepare a supplemental EIS to address concerns identified by the Court to provide additional information regarding the environment that could potentially be affected by the SURTASS LFA sonar systems and additional information related to mitigation (See APPENDIX A).

The FOEIS/EIS for SURTASS LFA sonar was completed in January 2001 by the Department of the Navy (DON) with the National Marine Fisheries Service (NMFS) as a cooperating agency in accordance with the requirements of NEPA[2] and Presidential Executive Order (EO) 12114 (Environmental Effects Abroad of Major Federal Actions)[3]. The DASN(E) signed the Record of Decision (ROD) on 16 July 2002 (*Federal Register* (FR) (67 FR 48145)), authorizing the operational employment of SURTASS LFA sonar systems contingent upon issuance by NMFS of letters of authorization (LOAs) under the Marine Mammal Protection Act (MMPA) and incidental take statements (ITSs) under ESA for each vessel.

In order to improve readiness, the Department of Defense (DoD) asked Congress to clarify several provisions of environmental laws as they applied to military training and testing activities. This legislative clarification was provided by Congress as part of HR 1588, the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2004 (NDAA FY04), and was signed into law on 24 November 2003. The provisions of this act 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.
- 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.
- Level B "harassment" 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.
- Secretary of Defense may invoke a national security exemption not to exceed two years for any action after conferring with the Secretary of Commerce and the Secretary of Interior, as appropriate.
- NMFS's 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.

[2] The provisions of NEPA apply to major federal actions that occur or have effects in the United States, its territories, and possessions.
[3] The provisions of EO 12114 apply to major federal actions that occur or have effects outside of U.S. territories (the United States, its territories, and possessions).

- Eliminated the "small numbers" and "specified geographic region" requirements from the incidental take permitting process for military readiness activities.

The Draft SEIS focuses on:

- DASN(E) direction to:
  - Provide additional information regarding the environment that could potentially be affected by employment of SURTASS LFA;
  - Provide additional information related to mitigation of the potential impacts of the system;
- Addressing pertinent deficiencies raised by the Court including:
  - Additional mitigation and monitoring;
  - Additional area alternatives analysis;
  - Analysis of the potential impacts of LF sound on fish;
- Providing the information necessary to apply for a new five-year rule that would provide for incidental takes under the MMPA, taking into account the NDAA FY04 amendments to the MMPA for military readiness.

Additional SEIS analyses include:

- Updating literature reviews and determination of data gaps, especially for fish, sea turtles, and marine mammals;
- Marine animal LF sound thresholds/impacts based on Fish Controlled Exposure Experiments (CEE) and updated literature reviews;
- LF sound impact analysis to include:
  - Geographic areas;
  - Marine mammal impacts under NDAA FY04 definition of "harassment;"
  - Fish impacts;
  - Other listed species' impacts, as required;
- Mitigation (need for mitigation will be determined by impact analysis based on new legislation).

The information in the SURTASS LFA sonar FOEIS/EIS remains valid, except as noted or modified in the Draft SEIS. The contents of the FOEIS/EIS are incorporated into the Draft SEIS by reference, except as noted or modified.

ES.1 Purpose and Need

The original stated purpose for SURTASS LFA sonar systems from the FOEIS/EIS was:

> "The purpose of the proposed action is to meet U.S. need for improved capability to detect quieter and harder-to-find foreign submarines at long range. This capability would provide U.S. forces with adequate time to react to, and defend against, potential submarine threats while remaining a safe distance beyond a submarine's effective weapons range."

This statement remains valid, and may be more compelling now than when it was presented in the FOEIS/EIS in January 2001. With the Cold War ending more than a decade ago, the Navy is now faced with a large number of diesel-electric submarines with operations confined to a smaller area[4]. Maritime strategies rely heavily on quiet submarines to patrol the littorals, blockade strategic choke points, and stalk aircraft carrier battle groups[5].

To meet its long-range detection need, the Navy investigated the use of a broad spectrum of acoustic and non-acoustic technologies to enhance antisubmarine warfare (ASW) capabilities. Of those technologies evaluated, low frequency active sonar was the only system capable of providing long-range detection during most weather conditions, day or night. Low frequency active sonar is, therefore, the only available technology capable of meeting the U.S. need to improve detection of quieter and harder-to-find foreign submarines at long range. SURTASS LFA sonar provides a quantifiable improvement in the Navy's capabilities against this threat and markedly improves the survivability of U.S Naval forces in a hostile ASW scenario.

Public Participation

The public participation program for the SURTASS LFA Sonar Draft SEIS began with publication of a Notice of Intent (NOI) to prepare a supplemental analysis in the *Federal Register* on July 28, 2003 (68 FR 44311).

Commencing in early November 2005, copies of the Draft SEIS will be distributed to agencies and officials of federal and state governments, citizen groups and associations, and other interested parties. A Notice of Availability (NOA) will be published in the *Federal Register*. The Draft SEIS will be made available for review at 17 public libraries located in many coastal states including Hawaii. A copy of the Draft SEIS will also be available on the SURTASS LFA Sonar OEIS/EIS Internet website (http://www.surtass-lfa-eis.com).

During the 45-day public comment period on the Draft SEIS, public hearings will be conducted in Washington, DC; San Diego, California; and Honolulu, Hawaii. Notification for the public hearings will be published in the *Federal Register* and in local newspapers. The hearings will be conducted in accordance with NEPA requirements and comments will become part of the record.

ES.2 Description of Proposed Action and Alternatives

SURTASS LFA sonar systems are long-range, all-weather systems operating in the LF band (below 1,000 Hz) within the frequency range of 100 to 500 Hz. These systems are composed of both active and passive components as shown in Figure ES-1.

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

[4] Friedman, N. 2004. The New Challenge—and a New Solution. Sea Technology, 45:11 p. 7.

[5] Goldstein, L., and B. Murray. 2003. China's Subs Lead the Way. Proceedings, U.S.Nav.Inst., Vol 129/3/1,202 pp.58-61.

systems are used for many purposes, ranging from “fish finders” to military ASW systems for detection and classification of submarines. There are two broad 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 basically 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

At present, there are two existing SURTASS LFA sonar systems onboard the R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23). Three additional CLFA systems are planned for the T-AGOS 19, 21, and 22. With the R/V *Cory Chouest* retiring in FY 2008, only two or three systems will be operational through FY 2010. Early in FY 2011 the potential exists for four vessels to be operational. At no point are there expected to be more than four systems in use. Therefore, 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 the FOEIS/EIS for SURTASS LFA Sonar. Based on current operational requirements, exercises using these sonar systems would occur in the Pacific, Atlantic, and Indian oceans, and the Mediterranean Sea.

As future undersea warfare requirements continue to transition to shallow littoral ocean regions, the development and introduction of a compact active system deployable from existing, smaller SURTASS SWATH-P ships is paramount. This smaller system is known as Compact LFA, or CLFA. CLFA consists of smaller, lighter-weight source elements than the current LFA system, and will be compact enough to be installed on the existing SURTASS platforms, VICTORIOUS Class (T-AGOS 19, 21, and 22). The operational characteristics of the compact system are comparable to the existing LFA systems as presented in Subchapter 2.1 of the FOEIS/EIS and the Draft SEIS. Therefore, the potential impacts from CLFA are expected to be similar to the effects from the existing SURTASS LFA sonar systems. Hence, for this analysis, 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.

The active component of the system, LFA, is a set of LF acoustic transmitting source elements (called projectors) suspended by cable from underneath a ship. These projectors produce the active sonar signal or “ping.” A "ping" or transmission can last between 6 and 100 seconds. The time between transmissions is typically from 6 to 15 minutes. The average duty cycle (ratio of sound “on” time to total time) is between 10 and 20 percent. The SURTASS LFA sonar signal is not a continuous tone, but rather a transmission of various waveforms that vary in frequency and duration. The duration of each continuous frequency sound transmission is never longer than 10 seconds. The signals are loud at the source, but levels diminish rapidly over the first kilometer.

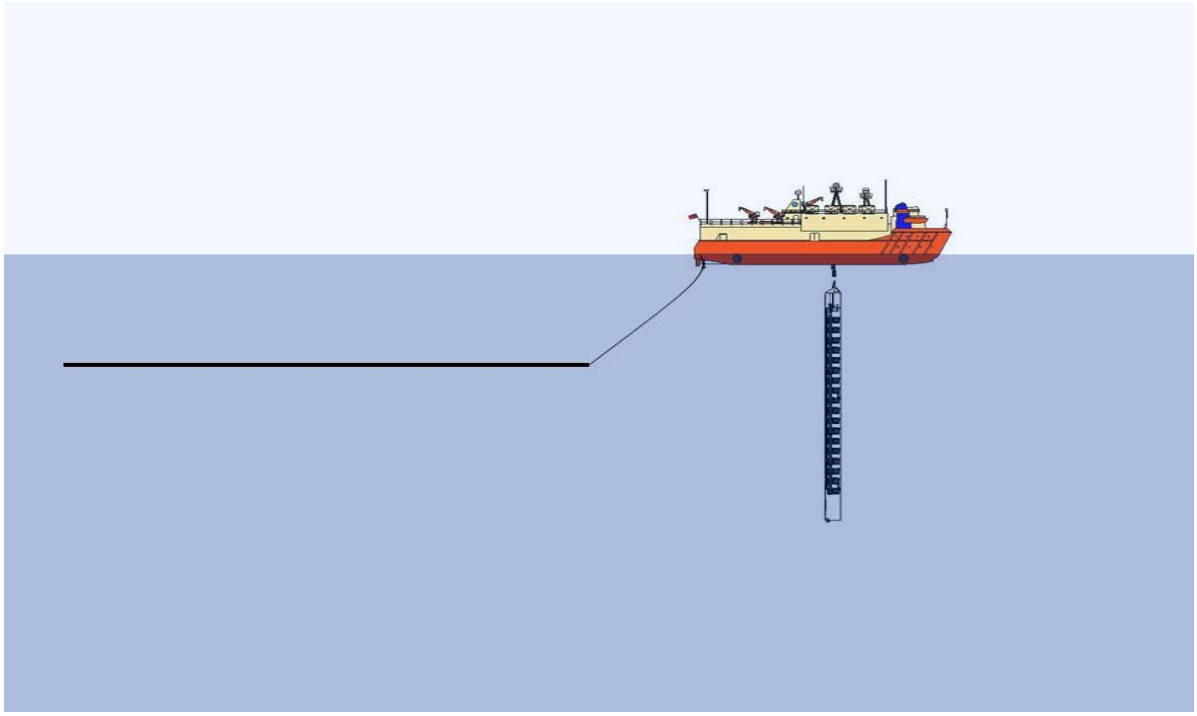

Figure ES-1. SURTASS LFA sonar systems.

The passive, or listening, component of the system is SURTASS, which detects returning echoes from submerged objects, such as threat submarines, through the use of hydrophones on a receiving array that is towed behind the ship. The SURTASS LFA ship maintains a minimum speed of 5.6 kilometers (km) per hour (kph) (3 knots [kt]) through the water to tow the horizontal line hydrophone array.

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). The Draft SEIS provides a description of the proposed alternatives for the employment of SURTASS LFA sonar. In addition to the No Action Alternative, the Draft SEIS addresses four alternatives. The analyses of these five alternatives are intended to address NEPA deficiencies identified in the District Court's 26 August 2003 opinion, as well as to fulfill the Navy's responsibilities under NEPA with regard to changes in the proposed action. Among other things, the SEIS considers mitigation measures including coastal standoff restrictions of 22 and 46 km (12 and 25 nm), seasonal restrictions, the designation of additional offshore biologically important areas (OBIAs), and shutdown procedures for schools of fish. The five alternatives considered in the SEIS are as follows:

- No Action Alternative;
- Alternative 1—Same as the FOEIS/EIS Preferred Alternative;
- Alternative 2 (Preferred Alternative)—Alternative 1 with additional OBIAs;

- Alternative 3—Alternative 1 with extended coastal standoff distance to 46 km (25 nm); and
- Alternative 4—Alternative 1 with additional OBIAs, extended coastal standoff distance to 46 km (25 nm), and shutdown procedures for schools of fish.

ES.3 Affected Environment

The areas of the marine environment that have the potential to be affected by SURTASS LFA sonar employment are:

- Marine Organisms, including fish, sea turtles, and marine mammals; and
- Socioeconomic Conditions, including commercial and recreational fishing, other recreational activities, and research and exploration activities.

ES.3.1 Scientific Screening of Marine Animal Species for Potential Sensitivity to LF Sound

In order for marine species to be affected by the operation of the SURTASS LFA sonar:

- The animal must be in the geographic area of the SURTASS LFA sonar sound field; and
- The animal must be capable of being physically affected by LF sound.

This selection rationale was presented in the FOEIS/EIS and is updated in the Draft SEIS. The selection started with virtually all marine animal species, including both invertebrates and vertebrates. Based on the above criteria, this list was distilled down to five groups of vertebrates, including sharks and rays, bony fish, sea turtles, whales and dolphins, and seals and sea lions. Virtually all invertebrates were eliminated from further consideration because: 1) they do not have delicate organs or tissues whose acoustic impedance is significantly different from water, and 2) there is no evidence of auditory capability in the frequency range used by SURTASS LFA sonar.

ES.3.2 Marine Organisms

A thorough review of available literature of fish, sea turtles, and marine mammals was conducted with emphasis on data developed after the completion of the FOEIS/EIS.

ES.4 Draft SEIS Analytical Process

This section will provide summaries of the recent research and update the analysis of the potential effects of the 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 means fish and sea turtles spend less time in the LFA mitigation zone (180-dB sound field); further, with a ship moving in two dimensions and animals moving in three dimensions, the potential for animals being in the sonar transmit beam during the estimated 7.5 percent of the time the sonar is actually transmitting is very low; and
- Small size of the LFA mitigation zone (180-dB 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 a sound transmission.

ES.4.1 Potential Impacts on Fish

The Court found the FOEIS/EIS lacking because the Navy failed to adequately consider potential impacts to fish. In order to determine the effects of SURTASS LFA sonar on fish, the Navy sponsored independent research with the University of Maryland to examine whether exposure to high-intensity, low frequency sonar, such as the Navy's SURTASS LFA sonar, will affect fish. This study examined the effect of LFA on hearing, the structure of the ear, and select non-auditory systems in the rainbow trout (*Onchorynchus mykiss*) and channel catfish (*Ictalurus punctatus*) and included analysis of fish behavior before, during, and after sound exposure.

Since the SURTASS LFA sonar FOEIS/EIS was completed in 2001, there have been a small number of useful studies on the potential effects of underwater sound on fish, including sharks. However, the University of Maryland study (funded by the Navy to provide data for this SEIS) is directly relevant to potential effects of SURTASS LFA sonar on fish. Thus, while earlier studies examined the effects of sounds using pure tones for much longer duration than the SURTASS LFA sonar signals, this study provides insight into the impact of LF sounds on fish. With the caveat that so far only two species have been examined in this study, the investigations found little or no effect of high intensity sounds, and there was no mortality as a result of sound exposure, even when fish were maintained for days post-exposure.

In addition to being in the same taxonomic genus, rainbow trout are also a good surrogate for listed salmonids because the species have similar, if not identical, ears and hearing sensitivity (Song and Popper, in prep). Hearing tests of hatchery-raised chinook salmon (*Oncorhynchus tshawytscha*) show that hearing sensitivity and range of hearing is very similar to that of rainbow trout. Since the ears and hearing sensitivity are essentially the same for the rainbow trout and another member of the genus *Oncorhynchus*, it is likely that the rainbow trout can serve as the model system in other anthropogenic sound studies, as in the LFA study.

Results of SURTASS LFA sonar study

As of 30 June 2005, there have been four sets of studies (each lasting one week) on rainbow trout and two on channel catfish. There are several significant findings.

(1) No fish died as a result of exposure to the experimental source signals. Fish all appeared healthy and active until they were sacrificed or returned to the fish farm from which they were purchased.
(2) There were no pathological effects from sound exposure. Despite the high level of sound exposure (193 dB RL at the fish), there were no gross effects on fish. Histopathology was done on all major body tissues (brain, swim bladder, heart, liver, gonads, blood, etc.) and no differences were found among sound-exposed fish, controls, or baseline animals.
(3) There were no short- or long-term effects on ear tissue. The sensory cells of the ears of both species were healthy and intact both immediately post exposure and then 96 hours after the end of exposure.
(4) Fish behavior after sound exposure was no different than behavior prior to the tests.
(5) Catfish and some specimens of rainbow trout showed 10-20 dB of hearing loss immediately after exposure to the LFA sound when compared to baseline and control animals, but hearing appeared to return to, or close to, normal within about 24 hours for catfish. Other rainbow trout showed minimal or no hearing loss.
(6) There is potentially interesting variation in the effects of exposure on trout. At some times of the year the trout showed hearing loss, while at other times they did not. All animals received identical treatment, and the only variables between experimental times may have been water temperature and/or how the fish were raised prior to their being obtained for study. The significance here is that not only are there differences in the effects of sound on different species, but there may also be differences within a species, depending on environmental and other variables. However, and most importantly, under no circumstances did exposure to LFA sound result in unrecoverable hearing loss in rainbow trout, and there was no effect on any other organ systems.

Conclusions from SURTASS LFA sonar study

The critical question addressed in the SURTASS LFA sonar study is whether this kind of sound source impairs the survival of fish and, more importantly, whether survival would be impaired in a normal environment when a ship using SURTASS LFA sonar is in the vicinity of a fish. Several factors were taken into consideration.

First, the sound level to which fish were exposed in these experiments was 193 dB RL, a level that is only found within about 100 m (328 ft) of a ship using SURTASS LFA sonar. Thus, the likelihood of exposure to this or a higher sound level is extremely small, considering all the possible places a fish might be relative to the sound source. The volume of the ocean ensonified by a single SURTASS LFA sonar source at 193 dB RL or higher is very small compared to the ocean area ensonified by the LFA source at lower sound levels.

Second, the LFA sound used in the study can be considered to represent a “worst-case” exposure. In effect, the exposures during the experiments were most likely substantially greater than any exposure a fish might encounter in the wild. In the study described here, each fish received three 108-second exposures to high-level LFA sound. However, under normal circumstances the SURTASS LFA sonar source is on a moving ship. A fish in one location can only receive maximum ensonification for a very few seconds (depending on ship speed and whether the fish is moving or not, and its direction of motion and speed). Prior to gaining

proximity to the fish, or after the ship has moved on, the sound level at the fish would be much lower. Since exposure at maximum levels did not cause damage to fish, and only what appears to be a temporary limited hearing loss, it is unlikely that a shorter exposure would result in any measurable hearing loss or non-auditory damage to fish. While it was not possible to present a higher sound level to the fish in this experiment, it is very likely that a shorter exposure than 108 sec to an even higher sound level may not have adversely affected the fish. In effect, it is likely that fish could be even closer than 100 m (328 ft) to the sonar and not be damaged by the sounds.

To quantify the possible effect of SURTASS LFA sonar on fisheries catches, an analysis of nominal SURTASS LFA sonar operations in a region off the Pacific Coast of the U.S. was presented in the FOEIS/EIS Subchapter 4.3.1 for the NMFS Fisheries Resource Region—Pacific Coast, defined here to encompass the area from the Canadian to Mexican border, from the shoreline out to 926 km (500 nm). The results of this analysis–that the percent of fisheries catch potentially affected would be negligible compared to fish harvested commercially and recreationally in the region–remain valid. In fact, because this analysis was based on 180-dB injury level and a 20 percent duty cycle, the results are *highly conservative.*

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 than the SURTASS LFA sonar signals. The Draft SEIS provides summaries of recent research and updates to the analysis of the potential effects of the alternatives based on the SURTASS LFA sonar operational parameters.

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Sea turtles could be affected if they are inside the LFA mitigation zone (180-dB sound field) during a SURTASS LFA sonar transmission. The Draft SEIS updates the FOEIS/EIS analysis, focusing on the potential impacts to individual sea turtles and the issue of potential impact to sea turtle stocks. To quantify the potential impact on sea turtle stocks, the analysis provided in the FOEIS/EIS was updated based on more current information for leatherback sea turtles in the Pacific Ocean. Leatherbacks were chosen for this analysis because they are the largest, most pelagic, and most widely distributed of any sea turtle found between 71N and 47S latitude, inhabit the oceanic zone, and are capable of transoceanic migrations. They are rarely found in coastal waters and are deep, nearly continuous divers with usual dive depths around 250 m (820 ft). Based on a conservative estimate of 20,000 leatherback sea turtles for the Pacific basin, the possible number of times a leatherback could be in the vicinity of a SURTASS LFA sonar vessel during transmissions was estimated to be less than 0.2 animals per year per vessel. Therefore, the potential for SURTASS LFA sonar operations to impact leatherback sea turtle stocks is negligible, even when up to four systems are considered.

In the unlikely event that SURTASS LFA sonar operations coincide with a sea turtle "hot spot," the following factors mitigate any potential impact on the animals to a negligible level: 1) the narrow bandwidth of the SURTASS LFA sonar active signal (approximately 30 Hz bandwidth); 2) the ship is always moving in two dimensions (coupled with low system duty cycle [estimated 7.5 percent], which means sea turtles would have less opportunity to be located in the LFA mitigation zone during a transmission); 3) the sea turtle is often moving in three dimensions; and

4) the monitoring mitigation incorporated into the alternatives (visual and active acoustic [HF] monitoring).

ES.4.3 Potential Impacts on Marine Mammal Stocks

The types of potential effects on marine mammals from SURTASS LFA sonar operations can be broken down into non-auditory injury, permanent loss of hearing, temporary loss of hearing, behavioral change, and masking. The analyses of these potential impacts were presented in the SURTASS LFA sonar FOEIS/EIS. Updated literature reviews and research results indicate that there are no new data that contradict any of the assumptions or conclusions in the FOEIS/EIS; thus, its findings regarding potential impacts on marine mammals remain valid and are incorporated by reference herein.

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 SURTASS LFA sonar signal transmissions is not expected to be severe and would be temporary.

ES.4.4 Risk Assessment Approach for SURTASS LFA Sonar Operations

The FOEIS/EIS provided detailed risk assessments of potential impacts to marine mammals covering the major ocean regions of the world: North and South Pacific Oceans, Indian Ocean, North and South Atlantic Oceans, and the Mediterranean Sea. The 31 acoustic modeling sites in the FOEIS/EIS represented the upper bound of impacts (both in terms of possible acoustic propagation conditions, and in terms of marine mammal population and density) that could be expected from operation of the SURTASS LFA sonar system. The conservative assumptions of the FOEIS/EIS are still valid. Moreover, there are no new data that contradict any of the assumptions or conclusions made in the FOEIS/EIS. Thus, it is not necessary to reanalyze the potential acoustic impacts in the Draft SEIS.

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 areas of operation. The LOA application analytical process utilizes 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 incorporation 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 mission areas. Each stock, for a given species, is then examined. Based on this approach, the highest total annual estimated risk (upper bound) for any marine mammal species' stock is provided in the applications for LOAs.

Information on how the density and stock/abundance estimates are derived for the selected mission sites are provided in the LOA applications. These data are derived from current, available published source documentation, and provide general area information for each mission area with species-specific information on the animals that could potentially occur in that area, including estimates for their stock/abundance and density.

ES.4.4.1 Interim Operational Restrictions and Proposed Modifications to Mitigation

The Draft SEIS evaluates the interim operational restrictions imposed by NMFS during the regulatory process under the MMPA, and questions raised by the Court concerning mitigation.

NMFS interim operational restrictions

In the SURTASS LFA Sonar Final Rule under the MMPA (67 FR 46785), NMFS added interim operational restrictions to preclude the potential for injury to marine mammals by resonance effects, including the establishment of a 1-km (0.54-nm) buffer shutdown zone outside of the 180-dB LFA mitigation zone and limiting the operational frequency of SURTASS LFA sonar to 330 Hz and below.

During the LFA Rule making process (1999 to 2002), the potential for LFA, and sonar in general, to cause resonance-related injury in marine mammals above 330 Hz was an open issue. NMFS, therefore, added an interim operational restriction to the LFA Rule and associated LOAs restricting LFA operations to 330 Hz and below. For the SURTASS LFA sonar systems installed onboard the R/V *Cory Chouest* and USNS IMPECCABLE, this change was feasible. However, the frequency requirements for the Compact LFA (CLFA) to be installed onboard the smaller VICTORIOUS Class (T-AGOS 19 Class) are somewhat higher, but still below 500 Hz. In November 2002, NMFS provided its "Report of the Workshop on Acoustic Resonance as a Source of Tissue Trauma in Cetaceans." The report concluded that the tissue-lined air spaces most susceptible to resonance are too large in marine mammals to have resonance frequencies in the range used by either mid or low frequency sonar. Cudahy and Ellison (2002)[6] reached the same conclusion. In addition, they stated that each of their *in vivo* and theoretical studies relating to tissue damage from underwater sound support a damage threshold on the order of 180 to 190 dB. The 2002 NOAA/NMFS Report and Cudahy and Ellison (2002) provide the empirical and documentary evidence that resonance and/or tissue damage from LFA transmissions are unlikely to occur in marine mammals at levels less than 190 dB for the frequency range 330 to 500 Hz. Therefore, it is concluded in the Draft SEIS that the previous interim operational frequency restriction is not required.

Court's issues

The Court found the FOEIS/EIS lacking because the Navy: 1) should have considered training in areas that present a reduced risk of harm to marine life and the marine environment when practicable; 2) should have further considered extending the shutdown procedures beyond

[6] Cudahy, E. and W.T. Ellison. 2002. A review of the potential for *in vivo* tissue damage by exposure to underwater sound, report for the Department of the Navy. Department of the Navy, Washington, D.C

marine mammals and sea turtles to schools of fish; 3) failed to adequately consider potential impacts to fish; and 4) raised the question concerning the inclusion of requirements for additional monitoring and mitigation through the use of aircraft or small observational craft prior to operating close to shore.

Training in areas of reduced risk

Contrary to common perception, the identification of a SURTASS LFA sonar operating area that is particularly devoid of marine life is not straightforward. The reason that certain areas are believed to have minimal marine mammal activity could very well be because of gaps in animal distribution, abundance and density data there. It usually is more feasible to identify areas of high marine life concentrations and avoid them when practicable. This sensitivity/risk process is the methodology applied to SURTASS LFA sonar operations.

The process starts with the Navy's antisubmarine warfare (ASW) requirements to be met by SURTASS LFA sonar based on mission areas proposed by the CNO and fleet commands. Thereupon, available published data are collected, collated, reduced and analyzed with respect to marine mammal populations and stocks, marine mammal habitat and seasonal activities, and marine mammal behavioral activities. Where data are unavailable, best scientific estimates are made by highly-qualified marine biologists, based on known data for like species and/or geographic areas, and known marine mammal seasonal activity. If marine mammal densities prove to be high and/or sensitive animal activities are expected, the mission areas are changed and/or refined and the process is re-initiated for the modified area. Next, standard acoustic modeling and risk analysis are performed, taking into account spatial, temporal or operational restrictions. Then, standard mitigation is applied and risk estimates for marine mammal stocks in the proposed mission area are calculated. Based on these estimates, a decision is made as to whether the proposed mission area meets the restrictions on marine mammal/animal impacts from SURTASS LFA sonar. If not, the proposed mission area is changed or refined, and the process is re-initiated. If the mission area risk estimates are below the required restrictions, it is considered that the Navy has identified and selected the potential mission area with minimal marine mammal/animal activity consistent with its operational readiness requirements.

Modification of shutdown procedures for schools of fish

Modifying the current SURTASS LFA sonar shutdown protocols to include schools of fish must be weighed against the feasibility and practicality of such a mitigation procedure in the context of military readiness and training. First, based on recent field experimentation, for a fish to suffer injury, it must be extremely close to the source array during transmission (nominally transmitting less than 10 percent of the time). The SURTASS LFA vessel travels at an average speed of 3 knots in two dimensions and fish travel in three dimensions at nominal speeds of 3 knots (e.g., herring, pike, carp) up to 40-50 knots (e.g., tuna, swordfish). Thus, the opportunity for a fish or a school of fish to be exposed to sound pressure levels from SURTASS LFA transmissions that could cause harm must be considered to be negligible. Moreover, the implementation of fish mitigation procedures is impractical. Visual monitoring (daylight only) cannot be relied upon to detect fish schools, passive acoustic detection is infeasible, and active acoustics would give so

many false alarms that the impact on the effectiveness of the military readiness activity (and, hence impact on National Security) would be intolerably high.

Potential injury to fish

The Court also found the FOEIS/EIS lacking because the Navy failed to adequately consider potential impacts to fish. Independent research was sponsored by the Navy to address this issue (as discussed above). 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.

Pre-operational surveys

In order to determine if pre-operational aerial or small boat surveys are feasible and necessary mitigation measures according to the MMPA's treatment of such considerations in a military readiness context, an evaluation considered the feasibility of these surveys based on the following factors: 1) weather conditions, 2) time of day, 3) availability of small craft or small aircraft, 4) proximity to hostile territory, 5) sea state, 6) logistics, 7) overall safety considerations, and 8) National Security. The findings were that small boat and pre-operational aerial surveys for SURTASS LFA operations are not feasible because they are not practicable, not effective, may increase the harassment of marine mammals, and are not safe to the human performers.

ES.4.4.2 Marine Mammal Strandings

Marine mammal strandings are not a rare occurrence. The Cetacean Stranding Database (www.strandings.net) registers that over a hundred strandings occurred worldwide in the year 2004. However, mass strandings, particularly multi-species mass strandings, are relatively rare. Many theories exist as to why noise may be a factor in marine mammal strandings. Several recent stranding events that have been publicly reported and which may, or may not, have been attributed to anthropogenic sound, are discussed in the Draft SEIS.

Although much of the public currently have the impression that military sonar usage is a principal cause of marine mammal strandings, the facts that are available indicate otherwise. The biological mechanisms for these effects must be determined through scientific research, while recognizing that there is an ongoing issue with public perception of the cause that must be dealt with. The important point here is that there is no record of SURTASS LFA sonar ever being implicated in any stranding event since LFA prototype systems were first operated in the late 1980s.

ES.4.5 Socioeconomics

This Draft SEIS 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.

Commercial and recreational fisheries

SURTASS LFA sonar operations are geographically restricted such that LFA received levels are less than 180 dB RL at 22 km (12 nm) from coastlines and at the boundaries of offshore biologically important areas during biologically important seasons. The highest fisheries productivity is generally within these same regions. In addition, based on the low frequency sonar controlled exposure experiments on fish, SURTASS LFA sonar operations will not affect fish populations and, therefore, will not affect commercial and recreational fishing.

Other recreational activities

There are no new data that contradict any of the assumptions or conclusions in the FOEIS/EIS regarding swimming, snorkeling and diving; hence, its contents are incorporated by reference.

Research and exploration activities

It is not believed that SURTASS LFA sonar operations will affect research submersibles, nor seafloor cable-laying. Oceanographic research activities and oil and gas exploration could potentially be affected, as they use equipment such as air guns, hydrophones, and ocean-bottom seismometers. If in the vicinity of a research or exploration activity, SURTASS LFA sonar could possibly interfere with or saturate the hydrophones of these other operations. Research activities and oil and gas exploration, though, could also potentially interfere with SURTASS LFA sonar operations. For these reasons, SURTASS LFA sonar operations are not expected to be close enough to these activities to impact them to any measurable degree.

ES.4.6 Potential Cumulative Impacts

Two areas are evaluated to compare the incremental impacts of SURTASS LFA sonar operations with past, present, and reasonably foreseeable future actions. These include:

- Comparison to anthropogenic oceanic noise levels; and
- Comparison of injury and lethal takes from anthropogenic causes.

The potential for cumulative impacts from the operations of up to four SURTASS LFA sonars is considered to be extremely small and 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, and naturally-occurring sounds (e.g., storms, lightning strikes, subsea earthquakes, underwater volcanoes, whale vocalizations, etc.), the SURTASS LFA sonar systems do not add appreciably to the underwater sounds that fish, sea turtle and marine mammal stocks are exposed to.

In a recently-released report entitled “Ad-Hoc Group on the Impact of Sonar on Cetaceans,” the International Council for the Exploration of the Sea concluded, “It appears that sonar is not a

major current threat to marine mammal populations generally, nor will it ever be likely to form a major part of ocean noise." They went on to state that shipping accounts for more than 75 percent of all human sound in the oceans, that sonar amounts to no more than 10 percent or so and shipping noise is projected to increase, where sonar is not.

Based on extensive evaluation in both this document and the FOEIS/EIS, the operation of SURTASS LFA sonar with monitoring and mitigation will result in no 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. Moreover, there has been no new information or data that contradict the FOEIS/EIS finding that the potential effect from SURTASS LFA sonar operations on any stock of marine mammals from injury (non-auditory or permanent loss of hearing) is considered negligible.

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 those that are practical and feasible from a technical and economic standpoint.

The Draft SEIS provides an analysis of the proposed alternatives for the employment of SURTASS LFA sonar. In addition to the No Action Alternative, four alternatives were analyzed to satisfy the Court's findings and to determine the potential effects of changes to the proposed action. These alternatives incorporate coastline standoff restrictions of 22 and 46 km (12 and 25 nm), seasonal variations, additional offshore biologically important areas (OBIAs), and the possibility of employing shutdown procedures for schools of fish. These alternatives include:

- No Action Alternative
- Alternative 1—Same as the FOEIS/EIS Alternative 1;
- Alternative 2—Alternative 1 with additional OBIAs;
- Alternative 3—Alternative 1 with extended coastal standoff distance to 46 km (25 nm); and
- Alternative 4—Alternative 1 with additional OBIAs, extended coastal standoff distance to 46 km (25 nm), and shutdown procedures for fish schools.

ES.4.7.1 Analysis of Alternatives

The Draft SEIS analyses the additional criteria, which are additional OBIAs, shutdown procedures for fish schools, and increasing the coastal standoff from 22 km (12 nm) to 46 km (25 nm).

Offshore Biologically Important Areas (OBIAs)

The Navy has addressed the Court-defined deficiency regarding additional OBIAs via inclusion in its preferred alternative, Alternative 2. The additional OBIAs reflect a thorough review of

potential areas where SURTASS LFA sonar may be restricted from operating without significantly impacting the Navy's required ASW readiness and training evolutions.

Shutdown procedures for schools of fish

See ES.4.4.1 above.

Generic analytical methodology for coastal standoff range comparison

Analyses in the FOEIS/EIS and this Draft SEIS support the argument that the highest potential for impact from SURTASS LFA sonar operations would be to marine mammals. Hence, a generic analytical methodology is applied to determine the difference in potential impact to marine animals (including fish, sharks, and sea turtles, but particularly for marine mammals) between a 22 km (12 nm) and a 46 km (25 nm) coastal standoff for SURTASS LFA sonar operations. A six-step process was followed for this analysis. Based on the analysis of the risk areas and potential impacts to marine mammals, increasing the coastal standoff range does decrease exposure to higher received levels for concentrations of marine animals closest to shore (shelf species); but does so at the expense of increasing exposure levels for shelf break and pelagic species.

It is important to note that the results of this analysis—that overall there is a greater risk of potential impacts to marine animals with the increase of the coastal standoff distance from 22 km (12 nm) to 46 km (25 nm)—may at first appear counter-intuitive. This greater risk is due to an increase in affected area, with less of the ensonified zone of influence annuluses overlapping land for the 46 km (25 nm) standoff distance than for the 22 km (12 nm) standoff distance.

ES.5 Mitigation and Monitoring

Alternative 2 (the Navy's preferred alternative) incorporates mitigation measures into operation of the SURTASS LFA sonar. The objective of these mitigation measures is to avoid injury to marine mammals and sea turtles near the SURTASS LFA sonar source and to recreational and commercial divers in the coastal environment. This objective would be met by Navy adherence to the following restrictions on SURTASS LFA sonar operations:

- SURTASS LFA sonar-generated sound field would be below 180 dB (RL) within 22 km (12 nm) of any coastlines and in offshore areas outside this zone that have been determined by NMFS and the Navy to be biologically important (see Table 2-4 for the inclusion of additional Offshore Biologically Important Areas);
- When in the vicinity of known recreational or commercial dive sites, SURTASS LFA sonar would be operated such that the sound fields at those sites would not exceed 145 dB (RL); and
- SURTASS LFA sonar operators would estimate SPLs 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 and 145-dB sound field criteria.

In addition, the following monitoring to prevent injury to marine animals would be required 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 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 180-dB sound field (LFA mitigation zone).

ES.7 Conclusion

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

No Action Alternative

In summary, the No Action Alternative would avoid all environmental effects of employment of SURTASS LFA sonar. It does 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 this 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 FOEIS/EIS, the potential impact 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 impacts to marine mammals due to potential impacts 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 impact 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 geographical restrictions would be levied on SURTASS LFA sonar operations through the inclusion of more offshore biologically important areas (OBIAs). The general summary provided in the above paragraph for Alternative 1 would also apply to this alternative. Any change to the above conclusion would be to slightly decrease the potential for impacts to marine animals from SURTASS LFA sonar operations.

Alternative 3

Under Alternative 3, additional geographical restrictions would be levied on SURTASS LFA sonar operations through the increase in the coastal standoff range from 22 km (12 nm) to 46 km (25 nm). The general summary provided in the above paragraph for Alternative 1 would also apply to this alternative. Based on the analysis of the risk areas and the potential impacts to marine animals, increasing the coastal standoff range does decrease exposure to higher received levels for the concentrations of marine animals closest to shore; but does so at the expense of increasing exposure levels for shelf break species and pelagic species.

Alternative 4

Under Alternative 4, the additional geographical restrictions of both Alternative 2 (additional OBIAs) and Alternative 3 (increase in coastal standoff range from 22 km [12 nm] to 46 km [25 nm]), plus shutdown procedures for schools of fish would be combined. The general summary provided for Alternative 1 above also applies here, as do the results from Alternative 2 regarding additional OBIAs and Alternative 3 regarding the increased standoff range. The possibility of implementing additional shutdown procedures for schools of fish is dealt with in ES.4.4.1 above.

Table ES-1 provides a qualitative estimate of the ability of each alternative to meet the Navy's purpose and need. Alternative 2 (additional OBIAs) would be expected to decrease to some extent the littoral areas where SURTASS LFA sonar could operate outside of 22 km (12 nm); thus the detection of threats in the littorals and training in the littorals would remain high but may be slightly degraded compared to Alternative 1. Alternatives 3 and 4, the expansion of the coastal standoff range from 22 km (12 nm) to 46 km (25 nm), and the expansion of the coastal standoff range plus the additional OBIAs would be expected to impose the greatest impact on meeting the Navy's purpose and need, and military readiness, as a much larger portion of the littorals would be restricted from the conduct of SURTASS LFA sonar operations.

Table ES-1. Estimate of ability to meet the Navy's Purpose and Need/Military Readiness/Training for Alternatives 1 through 4.

	Detection of threats in open ocean	Detection of threats in littorals	Training in open ocean	Training in littorals
No Action Alternative	N/A	N/A	N/A	N/A
Alternative 1	H	H	H	H
Alternative 2	H	H	H	H
Alternative 3	H	M/H	H	M/H
Alternative 4	H	M/H	H	M/H

N/A = Does not meet/not applicable
L = Low level
M = Medium level
H = High level

Given the results from the alternatives analysis presented above and Table ES-1, the Navy's preferred alternative is Alternative 2.