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

Department of the Navy
Chief of Naval Operations
January 2007

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OFFICE OF THE CHIEF OF NAVAL OPERATIONS
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WASHINGTON, DC 20350

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From: Branch Head, Undersea Surveillance (N872A)
To: Director, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration

Subj: FINAL COMPREHENSIVE REPORT FOR THE OPERATION OF SURTASS LFA SONAR ONBOARD R/V CORY CHOUEST AND USNS IMPECCABLE (T-AGOS 23) UNDER NMFS FINAL RULE (50 CFR 216 SUBPART Q)

Ref: (a) Final Rule: Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active Sonar 50 CFR 216 Subpart Q (Federal Register Vol. 67 No. 136, 16 July 2002)

Encl: (1) Final Comprehensive Report for the Operations of the Surveillance Towed Array Sensor System Low Frequency Active Sonar (SURTASS LFA) Under the National Marine Fisheries Service Regulations 50 CFR 216 Subpart Q

1. Under reference (a), the Navy is providing enclosure (1), the final comprehensive report analyzing the impacts of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) sonar on marine mammal stocks, to the National Marine Fisheries Service (NMFS).

2. This final report provides an unclassified summary of the classified quarterly reports and unclassified annual reports of SURTASS LFA operations during the first four Letters of Authorization (LOAs) issued to the R/V *Cory Chouest* and USNS IMPECCABLE for the period 16 August 2002 through 15 August 2006.

3. This report concludes that the Navy has met all of the requirements and conditions of the regulations (reference (a)) and the LOAs, as issued. My point of contact on this matter is CDR David Byers, N872A1, (703) 604-6333.

D. S. PRINCE

Final Comprehensive Report

for the

Operation of the Surveillance Towed Array Sensor System

Low Frequency Active (SURTASS LFA) Sonar

Onboard the R/V *Cory Chouest*
and
USNS IMPECCABLE (T-AGOS 23)

Under the National Marine Fisheries Service

Regulations 50 CFR 216 Subpart Q

January 2007

TABLE OF CONTENTS

Section		Page
1.0	INTRODUCTION…..	1
1.1	Purpose of this Report	1
1.2	SURTASS LFA Sonar Description	1
1.3	The Critical Need for SURTASS LFA	2
1.4	The Regulatory Process	3
1.5	Litigation…….	4
1.6	National Defense Authorization Act FY 2004	5
1.7	Supplemental Environmental Impact Statement	6
1.8	Application for Follow-on Incidental Take Authorizations	7
2.0	MITIGATION MEASURES	8
2.1	Mitigation and Monitoring Requirements	8
2.1.1	Geographic Restrictions	9
2.1.1.1	Offshore Biologically Important Areas	10
2.1.1.2	Recreational and Commercial Dive Sites….	11
2.1.1.3	Sound Field Modeling	11
2.1.2	Monitoring to Prevent Injury to Marine Animals	11
2.1.2.1	Visual Monitoring……	12
2.1.2.2	Passive Acoustic Monitoring	12
2.1.2.3	Active Acoustic Monitoring	13
2.1.2.4	Resumption of SURTASS LFA Transmissions	13
2.2	Final Rule and LOA Conditions	13
2.2.1	Interim Operational Restrictions	13
2.2.2	National Marine Sanctuaries Restrictions	14
3.0	PERMANENT INJUNCTION FOR SURTASS LFA OPERATIONS	15
3.1	Preliminary Injunction	15
3.2	Permanent Injunction..	16
4.0	ANALYSES OF SURTASS LFA OPERATIONS	18
4.1	Mitigation Effectiveness	19
4.1.1	LFA Mitigation and Buffer Zones	19
4.1.2	Visual Monitoring……	20
4.1.3	Passive Acoustic Monitoring	20
4.1.4	Active Acoustic Monitoring	20
4.1.5	Delay/Suspension of Operations	22
4.1.6	Monitoring Mitigation Effectiveness	22
4.1.7	Assessment of Interim Operational Restrictions	23
4.1.8	Summary of Mitigation Effectiveness	26
4.2	Estimates of Potential Effects to Marine Mammal Stocks	26
4.2.1	Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected	28
4.2.2	Post-Operational Estimates of Marine Mammal Stocks Potentially Affected	29

TABLE OF CONTENTS

Section		Page
4.3	Incident Monitoring – Marine Mammal Strandings	35
4.4	Assessment of Cumulative Impacts to Marine Mammal Stocks	36
4.4.1	Comparison to Anthropogenic Oceanic Noise levels	37
4.4.2	Operations Concurrent with Other LFA Sources	37
4.4.3	Operations Concurrent with Seismic Air Gun Sources	37
4.4.4	Stress	37
4.4.5	Comparison of Injury and Lethal Takes from Anthropogenic Causes	38
4.4.6	Summary of Potential Cumulative Impacts	39
4.5	Research	39
4.5.1	Research Status	39
4.5.2	Navy-Sponsored Research	39
4.5.3	Research on Fish	43
4.6	Assessment of New Passive Technologies	44
4.6.1	Why Passive Sonar Alone Cannot Meet the Need/Shortcomings of Passive Sonar Technology	44
4.6.2	Summary	47
5.0	CONCLUSIONS	48
6.0	REFERENCES	50

LIST OF FIGURES

No.		Page
1	SURTASS LFA Sonar Operations Areas Permitted under Stipulation Regarding Permanent Injunction as Amended	5
2	HF/M3 Sonar Detection and LFA Mitigation Zones	9
3	Preliminary Injunction Stipulated LFA Operating Area	15
4	Permanent Injunction Western Pacific Operational Areas	16
5	Probability of Detecting (on any given ping) Various Marine Mammals Swimming within the Search Beam of the HF/M3 Sonar System	22

TABLE OF CONTENTS

LIST OF TABLES

No.		Page
1	Summary of Mitigation	10
2	Mission Area Boundary Conditions	17
3	Summary of SURTASS LFA Mitigation	19
4	Summary of SURTASS LFA Sonar Operations	28
5	Post-Operational Estimates of Marine Mammal Stocks Potentially Affected for LOA 1 (with mitigation 120–180 dB)	30
6	Post-Operational Estimates of Marine Mammal Stocks Potentially Affected for LOA 2 (with mitigation 120–180 dB)	31
7	Post-Operational Estimates of Marine Mammal Stocks Potentially Affected for LOA 3 (with mitigation 120–180 dB)	32
8	Post-Operational Estimates of Marine Mammal Stocks Potentially Affected for LOA 4 (with mitigation 120–180 dB)	33
9	Research Status……	41

APPENDICES

A	Stipulation and Order RE: Preliminary Injunction 15 November 2002	A-1
B	Stipulation Regarding Permanent Injunction 14 October 2003	B-1
C	Amendment to the Stipulation Regarding Permanent Injunction 7 July 2005	C-1

ACRONYMS AND ABBREVIATIONS

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

MMPA	Marine Mammal Protection Act
MoD	Ministry of Defence
N	North
NATO	North Atlantic Treaty Organization
NDAA	National Defense Authorization Act
NE	Northeast
NEPA	National Environmental Policy Act of 1969
NGO	Non-Governmental Organization
nm	Nautical mile(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NRC	National Research Council
NW	Northwest
OBIA	Offshore Biologically Important Area(s)
OIC	Officer in Charge
ONR	Office of Naval Research
Pa	Pascal
PTAS	Passive Towed Array Sonar
RL	Received Level
rms	Root Mean Squared
ROD	Record of Decision
R/V	Research Vessel
S	South
SEIS	Supplemental Environmental Impact Statement
SEL	Sound Exposure Level
SERDP	Strategic Environmental Research and Development Program
SL	Source Level
SMRU	Sea Mammal Research Unit
SOC	SURTASS Operations Center
SONAR	SOund Navigation And Ranging
SPL	Sound Pressure Level
SRP	Scientific Research Program
SURTASS	Surveillance Towed Array Sensor System
T-AGOS	Ocean Surveillance Ship
TL	Transmission Loss
TTS	Temporary Threshold Shift
UK	United Kingdom
U.S.	United States
U.S.C.	United States Code
USNS	United States Naval Ship
W	West
VLA	Vertical Line Array
Symbols	
=	Equal to
/	Divided by
+	Plus
≥	Greater than or equal to
>	Greater than
<	Less than
~	Approximately
±	Plus or minus
μ	Micro (10^{-6})
Log	Logarithm

1.0 INTRODUCTION

Under the National Marine Fisheries Service (NMFS) Regulations for the Taking of Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar, 50 CFR 216 Subpart Q (67 *Federal Register* [FR] 46785-89), the Navy is required to provide NMFS and the public with a final comprehensive report analyzing the impacts of SURTASS LFA sonar on marine mammal stocks. This document provides an unclassified summary of the classified quarterly reports and unclassified annual reports of SURTASS LFA operations during the first four LOAs for the period 16 August 2002 through 15 August 2006.

1.1 Purpose of this Report

The primary purpose of this final report is to provide NMFS with unclassified SURTASS LFA sonar operations information to assist them in their evaluation of future Navy LOA applications. This unclassified report includes an analysis of monitoring and research conducted during the 5-year period of these regulations, an estimate of cumulative impacts on marine mammal stocks based on best scientific judgment, and an analysis of the advancement of alternative (passive) technologies as a replacement for LFA sonar.

1.2 SURTASS LFA Sonar Description

SURTASS LFA is a long-range, all-weather, sonar system that operates in the low frequency (LF) band (100-500 Hertz [Hz]). There are presently two SURTASS LFA sonar systems, one each onboard the USNS IMPECCABLE (T-AGOS 23) and R/V *Cory Chouest*, both operating in the northwestern Pacific Ocean. These systems have both passive and active components.

The active system component, LFA, is an adjunct to the passive detection system, SURTASS, and is planned for use when passive system performance proves inadequate. LFA is a set of acoustic transmitting source elements suspended by cable from underneath a ship. These elements, called projectors, are devices that produce the active sound pulse, or ping. The projectors transform electrical energy to mechanical energy that set up vibrations or pressure disturbances within the water to produce a ping.

The characteristics and operating features of LFA are:

- The source is a vertical line array (VLA) of up to 18 source projectors suspended below the vessel. LFA's transmitted sonar beam is omnidirectional (i.e., a full 360 degrees) in the horizontal (nominal depth of the LFA array center is 122 m [400 ft]), with a narrow vertical beamwidth that can be steered above or below the horizontal.
- The source frequency is between 100 and 500 Hz (the LFA system's physical design does not allow for transmissions below 100 Hz). A variety of signal types can be used, including continuous wave (CW) and frequency-modulated (FM) signals. Signal bandwidth is approximately 30 Hz.

- The source level (SL) of an individual source projector is approximately 215 decibels (dB). The sound field of the LFA array can never be higher than the SL of an individual projector.
- The typical LFA transmitted sonar signal is not a constant tone, but a transmission of various waveforms that vary in frequency and duration. A complete sequence of transmissions is referred to as a ping and lasts from 6 to 100 seconds, although the duration of each continuous frequency transmission is never longer than 10 seconds.
- Duty cycles (ratio of sound "on" time to total time) are less than 20 percent—20 percent is the maximum physical limit of the LFA system. Typical duty cycles are approximately 7.5 to 10 percent.
- The time between pings 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 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 signal processing system of the sonar. The SURTASS hydrophones are mounted on a horizontal receive array that is towed behind the vessel. The array length is 1,500 m (4,920 ft) with an operational depth of 152 m (500 ft) to 457 m (1,500 ft). The SURTASS LFA ship must maintain a minimum speed of approximately 5.6 kilometer per hour (kph) (3 knots) through the water in order to tow the hydrophone array in the horizontal plane. The return signals or echoes, which are usually below background or ambient noise level, are then processed and evaluated to identify and classify potential underwater targets.

References to Underwater Sound Levels
1. References to underwater sound pressure levels (SPL) in this document 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 [root mean squared-rms]) for source level (SL) and dB re 1 m (rms) for received level (RL), unless otherwise specified. 2. References to underwater sound exposure level (SEL) in this document refer to the cumulative sum of the squared pressures over a duration of the sound referenced to the standard underwater sound reference level (1 µPa) expressed in dB, and are assumed to be standardized at dB re 1 μPa^2-s, unless otherwise specified.

1.3 The Critical Need for SURTASS LFA

The original stated purpose for the SURTASS LFA sonar from the Final Overseas Environmental Impact Statement/Environmental Impact Statement (OEIS/EIS) for SURTASS LFA Sonar 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." (DON, 2001)

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

faced with a smaller number of diesel-electric submarines, and although their operations are confined to smaller areas (Friedman, 2004), their operational and weapons capabilities have increased measurably (see Subsection 4.6 below). Moreover, today's maritime strategies rely heavily on quiet submarines to patrol the littorals, blockade strategic choke points, and stalk aircraft carrier battle groups (Goldstein and Murray, 2003).

The shift from open ocean areas to shallow, acoustically complex near-shore areas forces drastic changes in the ways in which anti-submarine warfare (ASW) operations can be conducted. The United States and numerous other nations have looked at numerous acoustic and non-acoustic solutions to this problem, including active sonar. According to the Netherlands Organization for Applied Scientific Research – Physics and Electronics Laboratory, "The smaller and quieter coastal diesel-electric and midget submarines can only be detected in the noisy coastal environments by a low frequency active sonar (LFAS) approach" (Ort et al, 2003). Their work and the research of other organizations have shown that LFAS is successful at long-range detection, even in shallow water. Active sonar does not depend on the submarine target to generate noise; therefore, the use of active sonar eliminates any advantage gained by the use of quieting technologies.

The Navy's primary mission is to maintain, train, equip, and operate combat-ready naval forces capable of winning wars, deterring aggression and maintaining freedom of the seas. The Secretary of the Navy and Chief of Naval Operations (CNO) have continually validated that ASW is a critical part of that mission—a mission that requires access to both the high seas and the littorals. In order to be prepared for all potential threats, the Navy must not only continue to test and train in the open ocean, but also in littoral environments[1].

1.4 The Regulatory Process

SURTASS LFA sonar was the first Navy program for an operational system to have completed the National Environmental Policy Act (NEPA) process, a process that began on 18 July 1996, when the Navy published its Notice of Intent (NOI) in the *Federal Register* (67 FR 37452) to prepare an EIS for SURTASS LFA Sonar under NEPA and Presidential Executive Order (EO) 12114. It culminated with the signing of the Record of Decision (ROD) on 16 July 2002 (67 FR 48145).

During the NEPA analysis for the Navy's Final OEIS/EIS for SURTASS LFA sonar operations (DON, 2001), there were scientific data gaps concerning the potential for moderate-to-low exposure levels to affect cetacean hearing ability or modify biologically important behavior. The results of this Low Frequency Sound Scientific Research Program, (LSF SRP) found that these effects would be minimal.

Based on the scientific analyses detailed in the Navy application and further supported by information and data contained in the Navy's Final OEIS/EIS for SURTASS LFA sonar

[1] Littoral Environment—The Navy defines littoral as the region that horizontally encompasses the land/watermass interface from fifty (50) statute miles ashore to two hundred (200) nautical miles at sea; extends vertically from the bottom of the ocean to the top of the atmosphere and from the land surface to the top of the atmosphere (Naval Oceanographic Office, 1999).

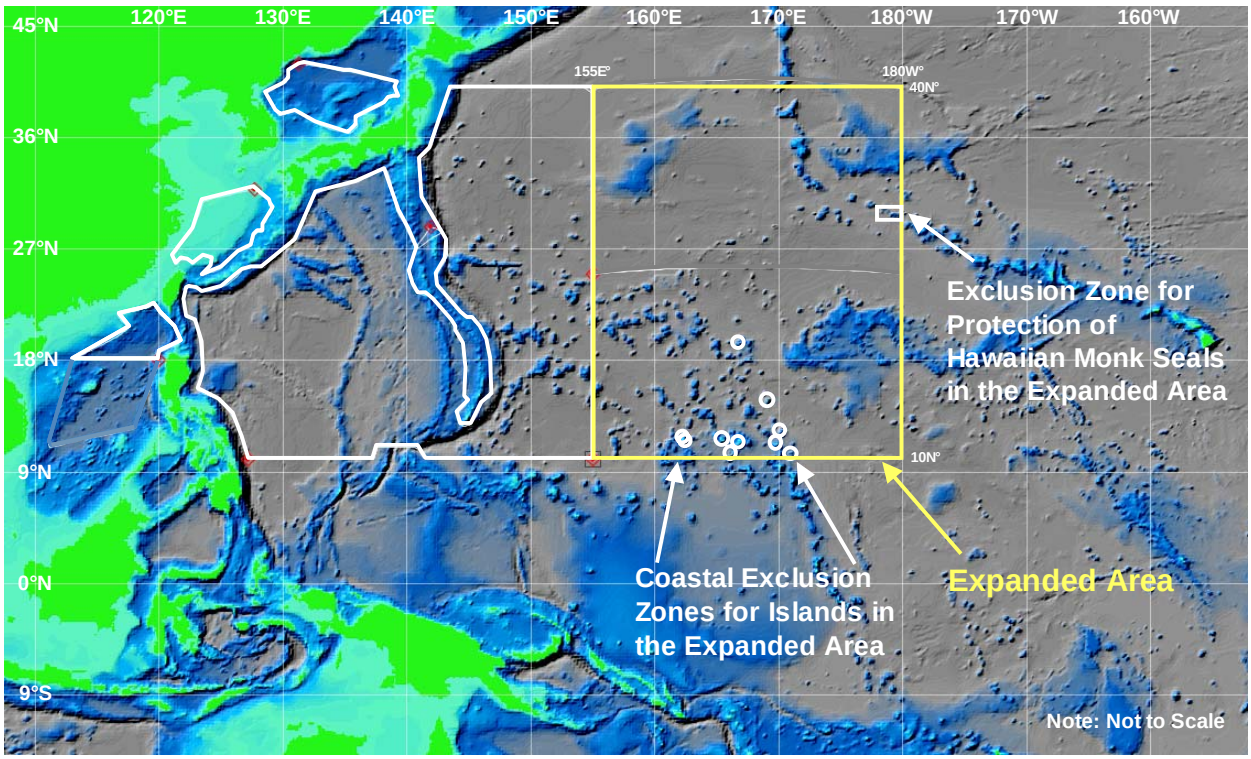
operations, NMFS concurred with the Navy that the operations of SURTASS LFA sonar would result in the incidental harassment of only small numbers of marine mammals, have no more than a negligible impact on the affected marine mammal stocks or habitats, and not have an unmitigable adverse impact on Arctic subsistence uses of marine mammals; and thus issued the initial Letter of Authorization (LOA) (67 FR 55818) under the Marine Mammal Protection Act (MMPA) Final Rule (50 CFR Part 216 Subpart Q) (67 FR 46785) for the operation of SURTASS LFA Sonar on R/V *Cory Chouest*. (67 FR 46783). The Navy's Endangered Species Act (ESA) Section 7 consultation with the NMFS and permitting requirements under the MMPA concluded with NMFS's issuance of the Biological Opinion and Incidental Take Statement (NMFS, 2002a; 2002b). Since the initial LOA was issued in 2002, the Navy has requested annual renewals in accordance with 50 CFR §216.189 for the remaining four years of the current rule for the R/V *Cory Chouest* and USNS IMPECCABLE. NMFS has subsequently issued the LOAs (68 FR 50123, 69 FR 51996, 70 FR 49919, 71 FR 48537).

1.5 Litigation

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

The Court issued a ruling on the parties' motions for summary judgment in the SURTASS LFA litigation on 26 August 2003. The Court found deficiencies in the Navy's and NMFS' compliance under NEPA, ESA, and MMPA. The Court, however, indicated that a total ban of employment of LFA would pose a hardship on the Navy's ability to protect National Security by ensuring military preparedness and the safety of those serving in the military from hostile submarines. Based on mediation, the Court issued a tailored Permanent Injunction on 14 October 2003, allowing SURTASS LFA operations from both R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23) in stipulated areas in the northwest Pacific Ocean/Philippine Sea, Sea of Japan, East China Sea, and South China Sea, with certain year-round and seasonal restrictions (APPENDIX B). On 7 July 2005, the Court amended the injunction to expand the potential areas of operation based on real world contingencies (APPENDIX C). The areas stipulated in the Permanent Injunction, as amended, are shown in Figure 1.

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



Note: For illustrative purposes only. Not to scale.

Figure 1. SURTASS LFA Sonar Operations Areas Permitted under Stipulation Regarding Permanent Injunction as Amended

1.6 National Defense Authorization Act FY 2004

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

Changes to the MMPA set forth in the NDAA FY 04 amended the act in three ways. First, it focused the definition of harassment to biologically significant impacts. Second, it removed references to small numbers and specific geographic regions as applied to incidental take

authorizations. Third, it provided for a national defense exemption. SURTASS LFA sonar is not involved in any national defense exemptions. The Congressional Conference Report specifically notes regarding the new definition of harassment that it will provide greater clarity for the Department of Defense (DoD) and regulatory agencies and properly focus authorizations of military readiness activities on biologically significant impacts to marine mammals, as a science-based approach. As noted by Congress, such changes do not undermine the law's original intent, instead eliminating terms that have proven more valuable as a basis for litigation than forcing legitimate or demonstrative protection to marine mammals.

1.7 Supplemental Environmental Impact Statement

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.

This Draft Supplemental Environmental Impact Statement (DSEIS) was completed in November 2005 (DON, 2005a) (http://www.surtass-lfa-eis.com/). The Draft SEIS proposed action was the U.S. Navy employment of up to four SURTASS LFA sonar systems in the oceanic areas as presented in Figure 1-1 (SURTASS LFA Sonar Systems Potential Areas of Operations) of the Final OEIS/EIS for SURTASS LFA Sonar (DON, 2001). 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) SPL or greater within specific geographic range of land, in offshore biologically important areas (OBIAs) 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 SEIS was to:

- Address deficiencies in NEPA, ESA, and MMPA[2] 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.

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

1.8 Application for Follow-on Incidental Take Authorizations

On 12 May 2006, the Navy submitted an Application to the NMFS for Letters of Authorization (LOAs) under Section 101 (a)(5)(A) of the MMPA for the activities associated with the employment of Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) sonar for a period of five years (16 August 2007 to 15 August 2012) (DON, 2006a).

On 9 June 2006, the Navy submitted a Biological Assessment for the Employment of SURTASS LFA Sonar requesting that NMFS review the document. The Navy further requested Biological Opinion/Incidental Take Statements under Section 7 on the ESA for a period of five years (16 August 2007 to 15 August 2012) (DON, 2006b).

On 28 September 2006, NMFS published a Notice of Receipt of Application and a request of public comments. The public comment period closed on 30 October 2006. Next, NMFS will publish a Proposed Rule and request for comment.

2.0 MITIGATION MEASURES

Under the current rule, NMFS has issued one-year LOAs to the Navy for the USNS IMPECCABLE and R/V *Cory Chouest* for an estimated 12 to 16 active sonar missions for the annual period of each LOA between the two ships (or equivalent shorter missions not to exceed 432 hours of transmit time between the two ships) during the annual period of effectiveness of each of these LOAs. Further, NMFS required that, under these LOAs, the Navy must minimize to the greatest extent practicable any adverse impacts on marine mammals, their habitats, and the availability of marine mammals for subsistence uses.

Mitigation protocols were initially set forth in the Final SURTASS LFA OEIS/EIS, and modified by NMFS in their Final Rule and by the tailored Permanent Injunction issued by the Court in 14 October 2003, as amended on 7 July 2005 (see Section 3.0). Under the conditions of the Final Rule and the LOAs, the mitigation measures discussed below have been implemented. Mitigation protocols set forth in the ROD, NOAA/NMFS Final Rule and LOAs, and Court orders, have been promulgated by the CNO through executive direction messages of 12 August 2002, 31 October 2003, 13 August 2004, 16 August 2005, and 16 August 2006.

The following discussions of mitigation are based on the SURTASS LFA FOEIS/EIS, ROD, and NMFS' final rule/LOAs.

2.1 Mitigation and Monitoring Requirements

The objective of these mitigation measures is to avoid risk of injury to marine mammals, sea turtles, and human divers. This objective is met by:

- Ensuring that coastal waters within 22 km (12 nm) of shore are not exposed to SURTASS LFA sonar signal levels $\geq$ 180 dB RL;
- Ensuring that no OBIAs are exposed to SURTASS LFA sonar signal levels $\geq$ 180 dB RL during critical seasons;
- Minimizing exposure of marine mammals and sea turtles to SURTASS LFA sonar signal levels below 180 dB RL by monitoring for their presence and suspending transmissions when one of these organisms approach the SURTASS LFA 180-dB mitigation (safety) zone as shown in Figure 2; and
- Ensuring that no known recreational or commercial dive sites are subjected to LF sound pressure levels greater than 145 dB RL.

Strict adherence to these measures ensures that there will be no significant impact on marine mammal stocks, sea turtle stocks, and recreational or commercial divers. Table 1 is a summary of the mitigation and monitoring requirements, the criteria for each, and the actions required.

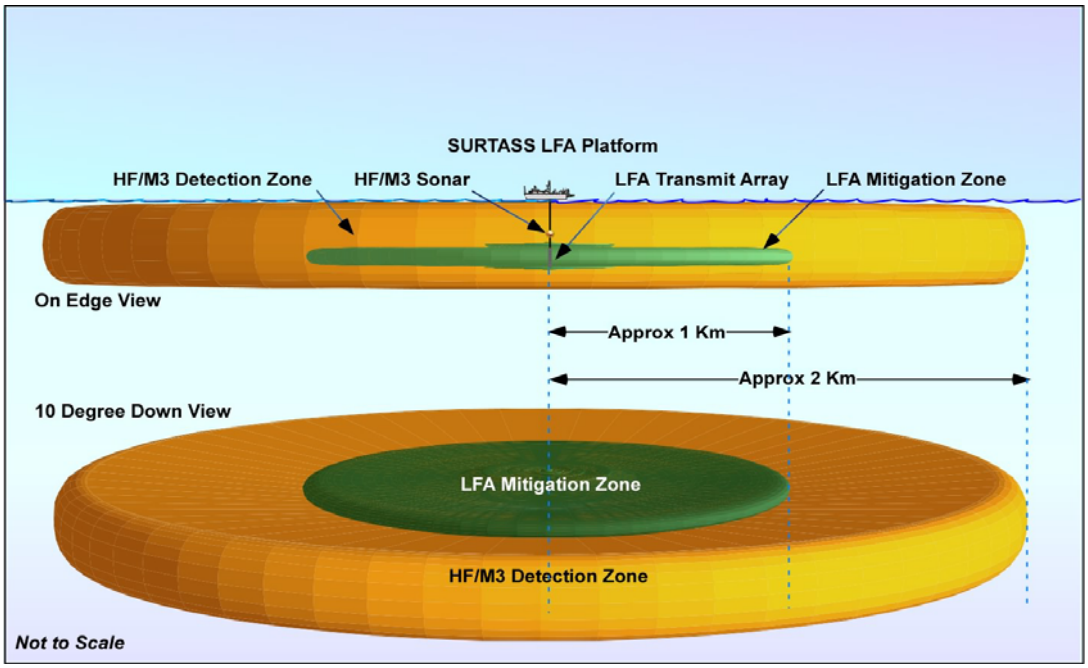


Figure 2. HF/M3 Sonar Detection and LFA Mitigation Zones

2.1.1 Geographic Restrictions

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

- SURTASS LFA sonar-generated sound field will be below 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;
- When in the vicinity of known recreational or commercial dive sites, SURTASS LFA sonar will be operated such that the sound fields at those sites will not exceed 145 dB RL; and
- SURTASS LFA sonar operators will estimate SPL prior to and during operations to provide the information necessary to modify operations, including the delay or suspension of transmissions, in order not to exceed the 180-dB and 145-dB RL sound field criteria cited previously.

Table 1. Summary of Mitigation

Mitigation	Criteria	Actions
Geographic Restrictions		
22 km (12 nm) from coastline and OBIAs during biologically important seasons outside of 22 km (12 nm)	Sound field below 180 dB RL, based on SPL modeling.	Delay/suspend SURTASS LFA sonar operations.
Recreational and commercial dive sites (known)	Sound field not to exceed 145 dB RL, based on SPL modeling.	Delay/suspend SURTASS LFA sonar operations.
Monitoring to Prevent Injury to Marine Mammals and Sea Turtles		
Visual Monitoring	Potentially affected species sighted near the vessel but outside of the LFA mitigation and/or buffer zones.	Notify Officer in Charge (OIC).
	Potentially affected species sighted within the LFA mitigation or buffer zones.	Delay/suspend SURTASS LFA sonar operations.
Passive Acoustic Monitoring	Potentially affected species detected.	Notify OIC.
Active Acoustic Monitoring	Contact detected and determined to have a track that would pass within the LFA mitigation or buffer zones.	Notify OIC.
	Potentially affected species detected inside of the LFA mitigation or buffer zones.	Delay/suspend SURTASS LFA sonar operations.

2.1.1.1 Offshore Biologically Important Areas

OBIAs are areas of the world's oceans outside of 22 km (12 nm) of a coastline where marine animals of concern (those animals listed under the ESA and/or marine mammals) congregate in high densities to carry out biologically important activities. These areas include:

- Migration corridors;
- Breeding and calving grounds; and
- Feeding grounds.

There are four areas designated by the Navy and NMFS as offshore areas of critical biological importance for marine mammals in the Final SURTASS LFA EIS and Final Rule. These are:

- Shoreward of the 200-meter (656-ft) isobath off the North American East Coast, from 28 to 50 degrees North latitude, west of 40 degrees West longitude—year-round.
- Antarctic Convergence Zone, delimited by the following: 1) 30 to 80 degrees East longitude along the 45-degree South latitude; 2) 80 to 150 degrees East longitude along the 55-degree South latitude; 3) 150 degree East to 50 degree West longitude along the 60-degree South latitude; and 4) 50 degree West to 30 degree East longitude along the 50-deg South latitude—October through March (IUCN, 1995).

- Costa Rica Dome, centered at 9 degrees N latitude and 88 degrees W longitude—year round (Longhurst, 1998; Chandler et al., 1999).
- Penguin Bank, Hawaiian Archipelago, centered at 21 degrees North latitude and 157 degrees 30 minutes West longitude—November 1 through May 1.

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

2.1.1.2 Recreational and Commercial Dive Sites

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

2.1.1.3 Sound Field Modeling

SURTASS LFA sonar operators will 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 RL sound field criteria cited above. Sound field limits are estimated using near-real-time environmental data and underwater acoustic performance prediction models. These models are an integral part of the SURTASS LFA sonar processing system. The acoustic models help determine the sound field by predicting the SPLs, or RLs, at various distances from the SURTASS LFA sonar source location. Acoustic model updates are nominally made every 12 hours, or more frequently when meteorological or oceanographic conditions change.

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

2.1.2 Monitoring to Prevent Injury to Marine Animals

The following monitoring to prevent injury to marine animals is required under the conditions of the LOAs, when employing SURTASS LFA sonar:

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

may pass close enough to the SURTASS LFA sonar's transmit array to enter the LFA mitigation and buffer zones.

2.1.2.1 Visual Monitoring

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

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

First, if a potentially affected marine mammal or sea turtle is sighted outside of the LFA mitigation zone, the observer notifies the OIC. The OIC then notifies the HF/M3 sonar operator to determine the range and projected track of the animal. If it is determined that the animal will pass within the LFA mitigation zone, the OIC orders the delay or suspension of SURTASS LFA sonar transmissions when the animal enters the LFA mitigation zone. If the animal is visually observed within 1-km (0.54 nm) buffer zone[3] outside of the LFA mitigation zone, the OIC orders the immediate delay or suspension of SURTASS LFA sonar transmissions. The observer continues visual monitoring/recording until the animal is no longer seen.

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

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

2.1.2.2 Passive Acoustic Monitoring

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

[3] The 1-km (0.54 nm) buffer zone was added by NMFS as an interim operational restriction in the Rule and LOAs, as issued, and is discussed in more detail in Section 2.2.1.

or suspension of SURTASS LFA sonar transmissions when the animal enters the LFA mitigation and buffer zones.

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

2.1.2.3 Active Acoustic Monitoring

HF active acoustic monitoring uses the HF/M3 sonar to detect, locate, and track marine mammals (and possibly sea turtles) that could pass close enough to the SURTASS LFA sonar array to enter the LFA mitigation zone. HF acoustic monitoring begins 30 min before the first SURTASS LFA sonar transmission of a given mission is scheduled to commence and continues until transmissions are terminated. Prior to full-power operations, the HF/M3 sonar power level is ramped up over a period of 5 min from 180 dB SL in 10-dB increments until full power (if required) is attained to ensure that there are no inadvertent exposures of local animals to RLs $\geq$ 180 dB from the HF/M3 sonar. There are two potential scenarios for mitigation via active acoustic monitoring.

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

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

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

2.1.2.4 Resumption of SURTASS LFA Transmissions

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

2.2 Final Rule and LOA Conditions

In its Final Rule and LOAs, as issued, NMFS added additional requirements relating to interim operational retrictions and sound field restrictions in offshore areas of specific National Marine Sanctuaries whose boundaries extend beyond 12 nm (22 km).

2.2.1 Interim Operational Restrictions

In the SURTASS LFA Final Rule under the MMPA (67 FR 46785), NMFS added interim operational restrictions in the Final Rule in response to the possibility of resonance effects on marine mammals. These included: 1) establishment of a 1-km (0.54-nm) radius buffer shutdown

zone outside of the 180-dB LFA mitigation zone; and 2) limiting the operational frequency of SURTASS LFA sonar to 330 Hz and below. The first restriction included a SURTASS LFA sonar system shutdown within a buffer zone that extends 1 km (0.54 nm) from the outer limit of the 180-dB safety zone (SURTASS LFA mitigation zone). This may extend up to 2 km (1.1 nm) from the vessel, depending on oceanographic conditions. At this distance, SPLs are significantly less intense than 180 dB. Second, NMFS imposed an operational restriction on the frequency of the SURTASS LFA sonar sound to 330 Hz and below. These interim operational restrictions would be retained until scientific documentation could be provided which indicated that they could be modified while still providing sufficient protection for marine mammals.

2.2.2 National Marine Sanctuaries Restrictions

The NMFS Final Rule (50 CFR § 216.184(e)(3)) requires that SURTASS LFA sonar will not be operated such that the sound field exceeds 180 dB (RL) within the offshore boundaries that extend beyond 12 nm (22 km) of the following National Marine Sanctuaries:

- Monterey Bay,
- Gulf of the Farallones, and
- Cordell Bank.

Additionally, SURTASS LFA sonar will not be operated such that the sound field exceeds 180 dB (RL) within 23 nm (37.4 km) of the coast during the months of December, January, March, and May of each year in the Olympic Coast National Marine Sanctuary.

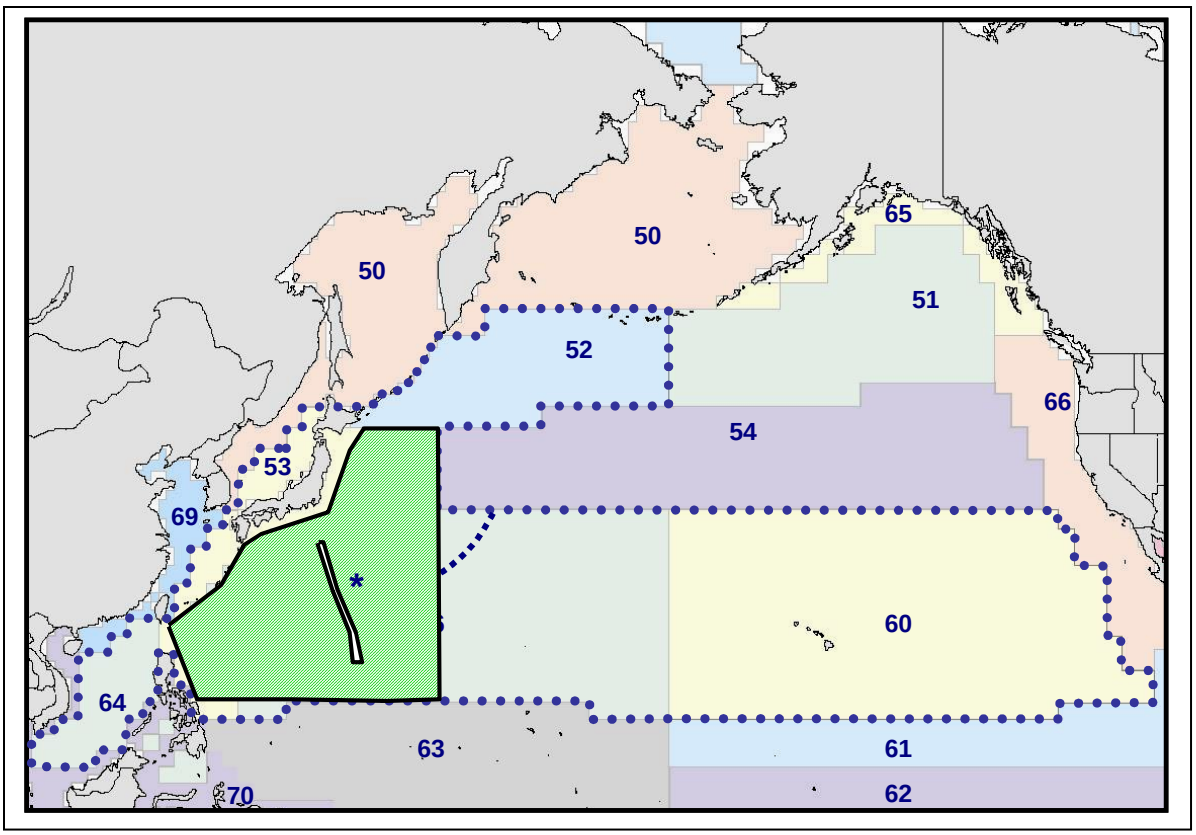
None of these areas were within the authorized operational areas for LFA during the period of this report.

3.0 PERMANENT INJUNCTION FOR SURTASS LFA OPERATIONS

During the period of this report, both SURTASS LFA sonar systems were operated under a tailored Preliminary Injunction from 15 November 2002 until the Court issued its tailored Permanent Injunction issued on 14 October 2003, which was amended on 7 July 2005. Details of the authorized areas of operation are provided in APPENDICES A, B, and C and shown in Figure 1. The associated charts in the appendices reflect the coastal exclusion zones wherein received sound pressure levels will not exceed 180 dB (RL). The stipulations of each are summarized below.

3.1 Preliminary Injunction

Recognizing the Navy's National Security requirements, the Court issued a tailored Preliminary Injunction on 15 November 2002 for operations of LFA in a stipulated area (APPENDIX A). SURTASS LFA testing and training operations with the R/V *Cory Chouest* were restricted to deep-water areas in the northwestern Pacific Ocean for the remainder of the initial LOA, which expired on 15 August 2003. The Court continued the tailored Preliminary Injunction to cover the second year LOAs for the R/V *Cory Chouest* and USNS IMPECCABLE until the subsequent ruling by the Court. The stipulated area is denoted in the green striped area in Figure 3.

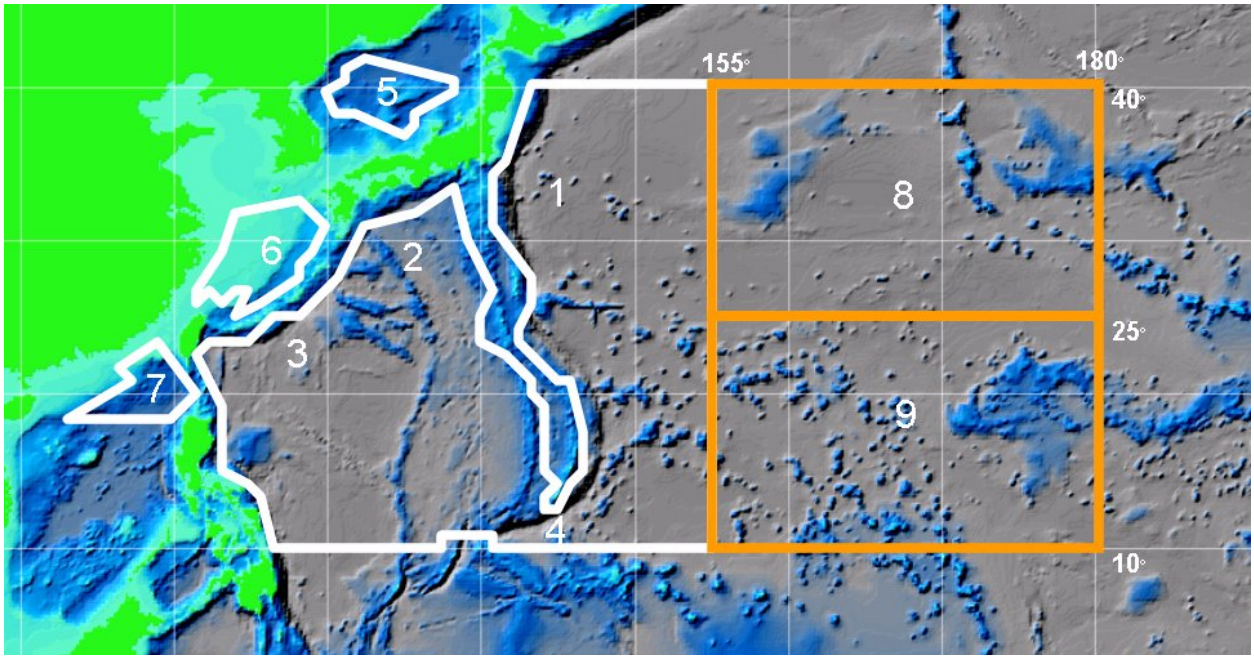


Note: For illustrative purposes only. Not to scale.

Figure 3. Preliminary Injunction Stipulated LFA Operating Area

3.2 Permanent Injunction

The Court issued its Summary Judgment ruling on the SURTASS LFA litigation on 26 August 2003. A tailored Permanent Injunction was issued by the Court on 14 October 2003 (APPENDIX B) allowing SURTASS LFA operations from both R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23) in stipulated areas in the northwest Pacific Ocean/Philippine Sea, Sea of Japan, East China Sea, and South China Sea with certain year-round and seasonal restrictions in accordance with the second years LOAs issued by NMFS. On 7 July 2005, the Court amended the injunction to expand the potential areas of operation based on real world contingencies (APPENDIX C). The operational areas under the tailored Permanent Injunction, as amended are shown in Figure 4. Mission area boundary conditions are summarized in Table 2.



Note: For illustrative purposes only. Not to scale.

Figure 4. Permanent Injunction Western Pacific Operational Areas

Table 2. Mission Area Boundary Conditions

Mission Area	Site	Boundary Conditions
East of Japan	1	Conduct ops at least 30 nm (56 km) offshore. From May through November, for ops north of 34 N, remain in waters deeper than 3000 meters or at least 30 nm (56 km) offshore, whichever is a greater distance offshore, due to presumed beaked whale habitat.
North Philippine Sea	2	Conduct ops at least 60 nm (111 km) offshore or 30 nm (56 km) seaward of the 200-m (656-ft) isobath.
West Philippine Sea	3	From December through April, conduct ops in waters offshore of the 5000 meter (16,405-ft) isobath or 60 nm (111 km) offshore, whichever is a greater distance offshore, due to presumed humpback whale breeding/calving areas in shallow, near-shore waters. During other months, conduct ops at least 60 nm (111 km) offshore or 30 nm (56 km) seaward of the 200-m (656-ft) isobath.
Guam	4	Conduct ops at least 30 nm (56 km) offshore.
Sea of Japan	5	Conduct all ops in waters deeper than 1000 meters or at least 30 nm (56 km) offshore, whichever proves the greatest distance offshore, and avoid the Yamato Rise due to presumed beaked whale habitat. This also addresses presumed gray whale migration activity in shallow, near-shore waters during January, March and December.
East China Sea	6	Conduct all ops at least 30 nm (56 km) offshore, which addresses presumed gray whale migration activity December through March in shallow near-shore waters; and presumed humpback whale breeding/calving activity in shallow, near-shore waters of Okinawa and Miyako Retto Islands December through April. For ops December through March remain southeast of line between 34N/126E and 30N/122E due to presumed gray whale migration activity. Length of ops may have to be shortened in winter due to minke J-stocks.
South China Sea	7	Conduct all ops at least 30 nm (56 km) offshore, which addresses presumed gray whale migration activity in shallow, near-shore waters and presumed gray whale breeding/calving activity in shallow, near-shore waters of Hainan Island; and presumed humpback whale breeding/calving activity in shallow, near-shore waters of Batan and Babuyan Islands in the Luzon Strait.
Offshore Expansion North	8	Conduct ops at least 30 nm (56 km) offshore including an exclusion zone for protection of Hawaiian monk seals in the expanded northwestern pacific ocean area as delineated below: (1) Southern Boundary: 29 degrees 20 minutes N (2) Northern Boundary: 30 degrees 20 minutes N (3) Western Boundary: 178 degrees E (4) Eastern Boundary: 180 degrees E.
Offshore Expansion South	9	Conduct ops at least 30 nm (56 km) offshore including islands of Wake, Sibylla, Bikar, Mejit, Wotho, Enewatak, and Enjebi. The operational standoff distance for Taka/Utrik and Rongelap is 35 nm (65 km). The operational standoff distance for Bikini is 40 nm (74 km).

4.0 ANALYSES OF SURTASS LFA OPERATIONS

Under 50 CFR 216.186(c), this section includes an analysis of monitoring and research conducted during the 5-year period of these regulations, an estimate of cumulative impacts on marine mammal stocks based on best scientific judgment, and an analysis of the advancement of alternative (passive) technologies as a replacement for LFA sonar.

As part of its continuing commitment to protect the environment, the Navy is carrying out a LTM Program to assess and analyze the potential for effects of the employment of SURTASS LFA on the marine environment.

The principal objectives of the LTM Program are to:

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

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

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

- Mission reports (classified) are provided to NMFS on a quarterly basis for each vessel, including all active-mode missions that have been completed 30 days or more prior to the date of the deadline for the report.
- The Navy submits annual reports to NMFS 90 days prior to expiration of the LOAs.
- The Navy will provide a final comprehensive report analyzing any impacts of SURTASS LFA sonar on marine mammal stocks during the 5-year period of the regulations.

4.1 Mitigation Effectiveness

Under LOA Condition 8(b)(i) the following assessment of the effectiveness of the mitigation measures is provided. Table 3 provides a summary of mitigation monitoring and protocols for suspension/delays of LFA transmissions for the first four LOAs, which included 40 missions.

Table 3. Summary of SURTASS LFA Mitigation

	Number of Missions	Visual Detections	Passive Acoustic	Active Acoustic HF/M3	HF/M3 Unavail-able[4]	Mitigation Protocol Suspensions/ delays
LOA 1						
R/V *Cory Chouest*	7	0	0	3	0	3
LOA 2						
R/V *Cory Chouest*	5	0	0	10	0	10
USNS IMPECCABLE	5	0	0	6	2	8
LOA 3						
R/V *Cory Chouest*	3	0	0	1	11	12
USNS IMPECCABLE	2	0	0	1	0	1
LOA 4						
R/V *Cory Chouest*	12	1	0	47	10	58
USNS IMPECCABLE	6	2	0	3	0	5
Totals	**40**	**3**	**0**	**71**	**23**	**97**

4.1.1 LFA Mitigation and Buffer Zones

During the missions, the minimum radial distance to the outer edge of the safety zone from the LFA array was 1 km (0.54 nm). Therefore, the safety and buffer zones comprised a 2-km (1.08-nm) radius.

The 1-km (0.54 nm) buffer zone interim restriction has proven to be practical under the current operations, but analysis has shown that it would not appreciably minimize adverse impacts below 180 dB RL. See Subsection 4.1.7 below for details on the analysis. The monitoring of the 180-dB LFA mitigation zone is to prevent potential injury to marine animals.

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

4.1.2 Visual Monitoring

Visual observers, trained in marine mammal identification, are posted as specified in LOA Condition 7(a)(i) and CNO executive directives (see Section 2.0). The personnel responsible for marine animal visual monitoring were trained in the proper methods, procedures, and protocols required to detect and to identify marine animals in accordance with Condition 7(c) of the LOAs. During the 40 missions, three sightings of marine mammals were noted.

During operations on the USNS IMPECCABLE, there were two visual sightings, one of an unknown whale species and one sighting of two porpoises. During one operation on the R/V *Cory Chouest*, there was one visual sighting of dolphins.

4.1.3 Passive Acoustic Monitoring

The embarked military detachment (MILDET) and system support engineers monitored the SURTASS passive displays for marine mammal vocalizations as specified in LOA Condition 7(a)(ii). There were no LF passive detections during any active LFA transmission events.

4.1.4 Active Acoustic Monitoring

The HF/M3 sonar was operated continuously during the course of the missions in accordance with LOA Conditions 6(c) and 7(a)(iii). The HF/M3 sonar was "ramped-up" prior to operations as required. During the 40 LFA missions, there were 71 HF/M3 alerts that were identified as possible marine mammal or sea turtle detections. No additional correlating data from visual or passive monitoring were available to further verify, identify, or clarify these detections.

The HF/M3 sonar was developed specifically to provide SURTASS LFA operators with a 24-hour, all weather capability to monitor the water column in the vicinity of the transmit array so that marine animals are not exposed to potentially injurious RLs (180 dB or greater) from LFA. This sonar operates with a similar power level (220 dB), signal type and frequency (30 to 40 kHz) as high frequency (HF) "fish finder" type sonars used worldwide by both commercial and recreational fishermen. The HF/M3 sonar is located near the top of the LFA VLA. Its computer terminal for data acquisition, processing and display is located in the SURTASS Operations Center (SOC) onboard the SURTASS LFA vessel. The general characteristics of the HF/M3 sonar are provided in overview in the Final OEIS/EIS (DON, 2001) and in detail in Ellison and Stein (2001) and Stein et al. (2001).

The HF/M3 sonar was designed specifically to track marine mammals and possibly sea turtles. It was not designed to track fish schools. Fish-finder sonars are generally forward and downward looking active sonars for spotting fish schools. HF fish-finder transducers have horizontal beamwidths from 10 to 46 degrees at ranges on the order of 1 km (0.54 nm). The HF/M3 sonar utilizes four ITC 1032 transducers with 8-degree horizontal and 10-degree vertical beamwidths, which sweep a full 360 degrees in the horizontal every 45 to 60 seconds with a maximum range of approximately 2 km (1.1 nm). The HF/M3 sonar was designed to detect, locate, and track marine mammals and possibly sea turtles. Its design was based on HF-commercial type sonar, but its design differs from a fish-finder.

Analysis and testing of the HF/M3 sonar operating capabilities indicate that this system substantially increases the probability of detecting marine mammals that may pass close enough to the SURTASS LFA vessel to enter the 180-dB sound field (LFA mitigation zone) and provides excellent monitoring capability (particularly for medium to large marine mammals) beyond the LFA mitigation zone. The system's ability to detect marine mammals of various sizes has been verified in several sea trials. HF/M3 testing, as documented in the SURTASS LFA Sonar FOEIS/EIS (DON, 2001), has demonstrated a probability of detection above 95 percent within the LFA mitigation zone for most marine mammals (Ellison and Stein, 2001; Stein et al., 2001).

Figure 5 shows the single-ping probabilities of the HF/M3 sonar detecting various marine mammals as a function of range. These curves are based on: 1) the *in situ* measured interference (i.e., backscattering and false targets that cause target-like echoes on the sonar) observed during at-sea testing; 2) the *in situ* measured transmission loss (TL) from at-sea testing; and 3) the best available scientific data on marine mammal target strength (i.e., the expected ability of a marine mammal to "reflect" acoustic energy).

Probabilities of detection for a stationary whale of 20-meter (65.7-ft) length (e.g., a humpback) at various depths and ranges within the LFA mitigation zone are estimated to be from 98 percent (animal at 1-km [0.54-nm] range and 160-meter [525-ft] depth) to 72 percent (animal at 2-km [1.08-nm] range and 160-meter [525-ft] depth). Outside of the LFA mitigation zone, probabilities of detection for the same whale are estimated to be from 95 percent (animal at 1.5-km [0.81-nm] range and 200-meter [656-ft] depth) to 35 percent (animal at 500-meter [1,640-ft] range and 40-meter [131-ft] depth). Thus, an animal of this size approaching the LFA mitigation zone from any direction would have an extremely high likelihood of being detected before entering the zone.

The single-ping probabilities of detection show one facet of the effectiveness of the HF/M3 sonar as a mitigation tool because, in general, any marine mammal that enters the HF/M3 detection zone can be expected to swim within the HF/M3 search beam multiple times—approximately once every 50 seconds.

From Figure 5, it can be seen that for a 2.5-meter (8.2 ft) dolphin, Pd_1 (at 1,000 m/3,281 ft) = 43 percent. Using the formula $Pd_N = 1- (1 - Pd_1)^N$, where N = number of times an animal swims within the search beam and Pd_1 = the single-ping probability of detection, it can be seen that for 2 animal-search beam interactions, $Pd_2 = 1 - (.57)^2 = 1 - 0.32 = 68$ percent. For 4 animal-search beam interactions, probability of detection increases to 90 percent, and for 5 animal-search beam interactions, probability of detection approaches 100 percent.

The probability of detecting marine mammals as shown in Figure 5 is supported by analyses of field data in a sampling of 6 missions between June 2004 and February 2006. Marine animals were initially detected by the HF/M3 sonars onboard the R/V *Cory Chouest* and USNS IMPECCABLE at an average distance of 1,173 m (1,283 yd) from the array and tracked for an average of 21 minutes. The nominal sweep rate for the HF/M3 sonar is 45 to 60 seconds (DON, 2001). Therefore, marine animals would be expected to be within the HF/M3 search beam in

excess of 5 times; thus these field data support the above calculations that even for small odontocetes, the probability of detection with multiple animal-search beam interactions is high.

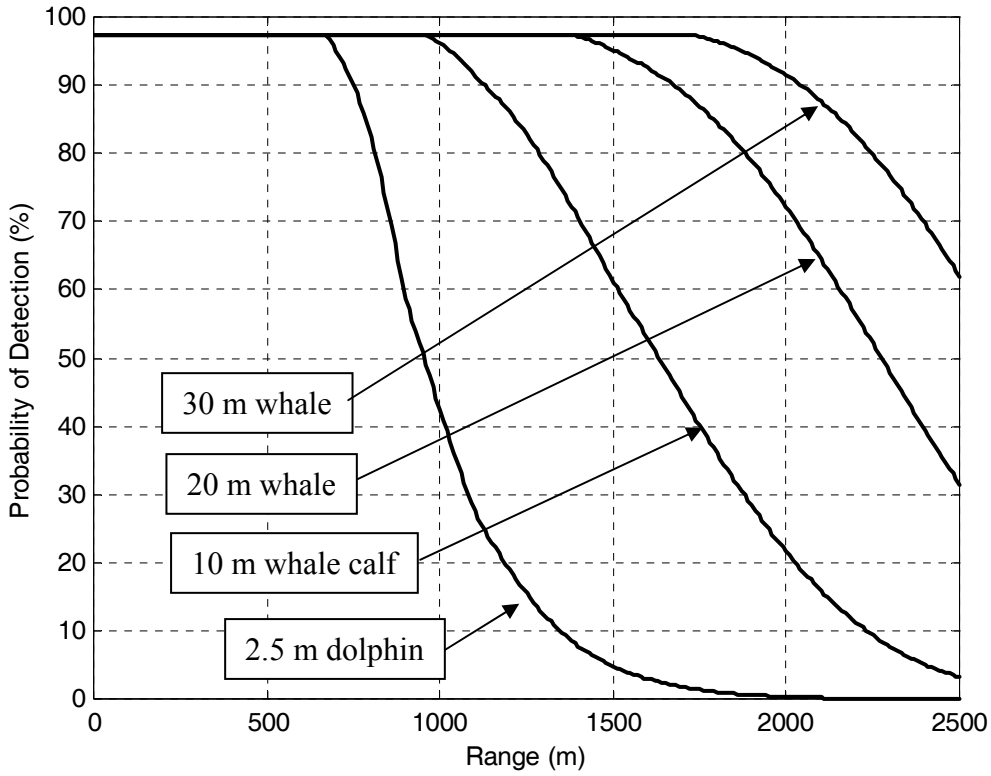


Figure 5. Probability of Detecting (on any given ping) Various Marine Mammals Swimming within the Search Beam of the HF/M3 Sonar System

4.1.5 Delay/Suspension of Operations

SURTASS LFA transmissions were suspended or delayed on 97 separate occasions during the period of the first four LOAs in accordance with the requisite protocols under LOA Condition 6(b). Three were due to visual contacts, and HF/M3 sonar contacts accounted for 71. The remaining 23 delays were due to the unavailability of the HF/M3 sonar due to mechanical or software problems.

4.1.6 Monitoring Mitigation Effectiveness

Based on the methodology from the SURTASS LFA Sonar Final EIS analyses (DON, 2001), the SURTASS LFA sonar mitigation (monitoring) effectiveness (ME) can be represented as follows:

$$ME_{combined} = \text{function } (ME_{passive} + ME_{visual} + ME_{active})$$

Because the SURTASS passive array has limited bandwidth, a conservative value of 0.25 can be used for $ME_{passive}$.

Next, the contribution of visual monitoring was added to the passive acoustic monitoring effectiveness based on the following:

$$ME_{passive+visual} = ME_{passive} + [ME_{visual} \times (1 - ME_{passive})]$$

The mitigation effectiveness for surface visual monitoring ranges from 0.855 for baleen whales and many odontocetes, to 0.24 for the sperm whales, to 0.18 for Cuvier's beaked whales. For the Final EIS analyses, ME_{visual} was estimated from the lowest value (0.18) and then divided in half to account for the possible operation of SURTASS LFA sonar during nighttime, inclement weather, and high sea states. Therefore, ME_{visual} was set at 0.09. The overall combined passive plus visual monitoring mitigation effectiveness was calculated to be:

$$ME_{passive+visual} = 0.32.$$

Utilizing the active acoustic monitoring effectiveness of the HF/M3 sonar of 0.95, an overall, combined monitoring effectiveness is:

$$ME_{combined} = ME_{active} + [ME_{passive+visual} \times (1 - ME_{active})]$$
$$ME_{combined} = 0.98$$

As demonstrated above, the combined mitigation effectiveness for visual and passive acoustic monitoring was estimated to be 0.32 in the FOEIS/EIS analysis (DON, 2001). Utilization of the HF/M3 sonar with an effectiveness value of 0.95 raises that overall mitigation effectiveness to 0.98. This value is supported with field data from actual LFA missions as presented above in Subsection 4.1.4.

4.1.7 Assessment of the Interim Operational Restrictions

In response to the possibility of resonance effects on marine mammals, NMFS amended the mitigation measures to incorporate two interim operational restrictions during the first five-year Rule. The first restriction included a SURTASS LFA sonar system shutdown within a buffer zone that extends 1 km (0.54 nm) from the outer limit of the 180-dB safety zone (SURTASS LFA mitigation zone). This may extend up to 2 km (1.1 nm) from the vessel, depending on oceanographic conditions. At this distance, SPLs will be significantly less intense than 180 dB. Second, NMFS imposed an operational restriction on the frequency of the SURTASS LFA sonar sound to 330 Hz and below. These interim operational restrictions would be retained until scientific documentation could be provided which indicated that they could be modified while still providing sufficient protection for marine mammals.

<u>1-km Buffer Zone</u>

The 1-km (0.54 nm) buffer zone interim operational restriction has proven to be practical under the current operations, but the following analysis demonstrates that it did not appreciably

minimize adverse impacts below 180-dB RL. The monitoring of the 180-dB mitigation zone is to prevent injury to marine animals. The area between the 180-dB radius and the 1-km (0.54 nm) buffer zone (estimated to extend to about the 174 dB isopleth) is an area where marine mammals will experience Level B incidental takes in accordance with the risk continuum (FOEIS/EIS Subchapter 4.2.3). The determination of the percentage of marine mammal stocks potentially affected by LFA operations in the risk assessment case study (DSEIS Subchapter 4.4.2) was determined based on monitoring mitigation in 180-dB injury zone, without accounting for the 1-km (0.54 nm) buffer zone. The area without the buffer zone is 3.14 km² (1.70 nm²) and the area with the buffer zone is 12.6 km² (6.80 nm²), a difference of 9.5 km² (5.1 nm²). The model analysis was rerun using the total 2-km (1.08 nm) mitigation+buffer zone. The differences in the number of animals affected were insignificant. Thus, the removal of this interim operational restriction would not appreciably change the percentage of animals potentially affected.

330-Hz Restriction

The LFA rule-making process under the MMPA commenced in 1999 and ended when the LFA Rule was promulgated in July 2002. During this period, 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 limiting LFA operations to 330 Hz and below. For the SURTASS LFA sonar systems installed onboard the R/V *Cory Chouest* and USNS IMPECCABLE, this interim restriction was feasible. However, the frequency requirements for the Compact LFA (CLFA) to be installed onboard the smaller VICTORIOUS Class (T-AGOS 19 Class) vessels are somewhat higher, but still below 500 Hz.

The 330-Hz frequency interim operational restriction was based on a statement made by Dr. Darlene Ketten, an expert on the functional morphology of marine mammal hearing, in her testimony before the Subcommittee on Fisheries Conservation, Wildlife and Oceans of the House Committee on Resources on October 11, 2001 (Ketten, 2001). Dr. Ketten's statement was "The consensus of data is that virtually all marine mammal species are potentially impacted by sound sources with a frequency of 300 Hz or higher." The topic of Dr. Ketten's testimony was Marine Mammal Auditory Systems: A Summary of Auditory and Anatomical Data and Its Implementations of Underwater Acoustics Impacts. The data presented related predominately to marine mammal hearing and *not resonance*.

In comments received on the SURTASS LFA DSEIS, it was claimed that the two recent workshops, sponsored by NMFS and the Marine Mammal Commission (MMC) respectively, provided data that damage from resonance remains a "reasonably foreseeable" impact that must be considered in the Navy's environmental review and mitigation. In April 2002, NMFS sponsored a Workshop on Acoustic Resonance as a Source of Tissue Trauma in Cetaceans with over 30 scientists (DOC, 2002). In 2004 the Marine Mammal Commission sponsored a workshop on understanding the impacts of anthropogenic sound on beaked whales (Cox et al., 2006).

In November 2002, NMFS provided its "Report of the Workshop on Acoustic Resonance as a Source of Tissue Trauma in Cetaceans" (DOC, 2002). 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. Relating to the requirement for needed research, the report stated that it seemed unlikely that acoustic resonance in air spaces played a primary role in tissue trauma in the Bahamas and other marine mammal stranding events. Nevertheless, they then suggested continued research. The MMC workshop stated that acoustic resonance is highly unlikely in the lungs of beaked whales, but did recommend further studies to fully eliminate this hypothesized mechanism (Cox et al., 2006).

In their review of the potential for *in vivo* tissue damage from underwater sounds regarding tissue effects, Cudahy and Ellison (2002) indicated that the potential for *in vivo* tissue damage to marine mammals from exposure to underwater LF sound (100 to 500 Hz) will occur at a damage threshold on the order of 180 to 190 dB (RL). The paper noted that resonance does not necessarily equal damage, and that damage is not always linked to resonance. Their review included both areas. They concluded the following: (1) transluminal (hydraulic) damage to tissues at intensities on the order of 190 dB or greater; (2) vascular damage thresholds from cavitation at intensities in the 240-dB regime; (3) tissue shear damage at intensities on the order of 190 dB or greater; and (4) tissue damage in air-filled spaces at intensities above 180 dB. The results are primarily based on the Gerth and Thalmann (1999) presentation at the Underwater Sound Conference of January 25, 1999, and summary test data (along with more recent analysis) on animal sound exposure from the SURTASS LFA EIS Technical Report Number 3 (Cudahy et al., 1999). It should be noted that Drs. Cudahy and Ellison were participants in the 2002 NMFS Acoustic Resonance Workshop.

Since the FOEIS/EIS was published in early 2001, research has been published in a peer-reviewed journal that supports the 180-dB criterion for injury. Laurer et al. (2002) from the Department of Neurosurgery, University of Pennsylvania School of Medicine, exposed rats to 5 minutes of continuous high intensity, low frequency (underwater) sound (HI-LFS) either at 180 dB SPL re 1 μPa at 150 Hz or 194 dB SPL re 1 μPa at 250 Hz, and found no overt histological damage in brains of any group. Also blood gases, heart rate, and main arterial blood pressure were not significantly influenced by HI-LFS, suggesting that there was no pulmonary dysfunction due to prolonged exposures at 180 dB and 194 dB. This published paper was based on work performed in support of Technical Report #3 of the SURTASS LFA Sonar FOEIS/EIS.

The MMC workshop listed three possible areas where resonance effects on marine mammals would be useful. The first concerned beaked whale lung resonance, which the MMC workshop concluded was "highly unlikely." The second concerned the potential for other organs and structures to be affected by resonance. Based on the 2002 NMFS workshop report, *if* resonance explained the Bahamas stranding, then sonar operating at a different frequency (like LFA at 100 to 500 Hz) would be unlikely to stimulate resonance in the same structures or species as a mid-frequency (MF) sonar would (DOC, 2002). The third area was tissue shear. Cudahy and Ellison (2002) reported tissue shear damage at intensities on the order of 190 dB (RL) or greater. Therefore, experts in the field of bioacoustics have stated that two of the three MMC proposed research areas are based on impacts that are unlikely and that the third will not occur below an exposure level of 190 dB, which is well within LFA's 180-dB safety zone. Finally, the Ocean Studies Board of the National Research Council (NRC) in its report on Marine Mammal

Populations and Ocean Noise stated that resonance from air spaces is not likely to lead to detrimental physiological effects on marine mammals (NRC, 2005).

Analyses sponsored by the Navy (Cudahy and Ellison, 2002; Laurer et al., 2002), reports on two workshops on acoustic impacts (DOC, 2002; Cox, et al. 2006), and the NRC Ocean Studies Board (NRC, 2005) support the conclusion that resonance from LFA operations is not a "reasonably foreseeable" impact, providing the empirical and documentary evidence that resonance and/or tissue damage from LFA transmissions are unlikely to occur in marine mammals in the frequency range 330 to 500 Hz within or outside the LFA mitigation zone. As a result, the Navy has requested NMFS to lift this interim operational restriction in the new rule making.

4.1.8 Summary of Mitigation Effectiveness

The HF/M3 sonar was developed by the Navy specifically to overcome the low probabilities of detection of both visual and passive acoustic monitoring. As demonstrated in Subsections 4.1.4 and 4.1.6, the combined mitigation effectiveness for visual, passive acoustic and active acoustic monitoring was estimated to be 0.98. This value is supported by analyses of field data in a sampling of 6 missions between June 2004 and February 2006. Marine animals were initially detected by the HF/M3 sonars before they entered the 180-dB sound field at an average distance of 1,173 m (1,283 yd) from the array. They were tracked for an average of 21 minutes. The nominal sweep rate for the HF/M3 sonar is 45 to 60 seconds (DON, 2001); thus, marine animals would be expected to have in excess of 5 animal-search beam interactions. Field data support the original estimates that the probability of detection for the HF/M3 sonar of marine animals at 1000-m (3281-ft) range with multiple animal-search beam interactions is high, even for small odontocetes.

Although the 1-km (0.54 nm) buffer zone interim operational restriction has proven to be practical under current operations, its removal would not appreciable change the percentage of animals potentially affected.

There is scientific evidence that resonance and/or tissue damage from LFA transmissions are unlikely to occur in marine mammals in the frequency range 330 to 500 Hz within and outside the LFA mitigation zone. Analyses sponsored by the Navy (Cudahy and Ellison, 2002; Laurer et al., 2002), reports on two workshops on acoustic impacts (DOC, 2002; Cox, et al. 2006), and the NRC Ocean Studies Board (NRC, 2005) support this conclusion and provide the empirical and documentary evidence required under the Final Rule (67 FR 46783).

4.2 Estimates of Potential Effects to Marine Mammal Stocks

Under the conditions of the Court's Permanent Injunction, two SURTASS LFA sonar systems have been and are currently operating under NMFS regulation (67 FR 46785) and annual LOAs as issued. The purposes of these military readiness activities are to provide fully functional hardware and software, extensive training, job experience, and operational/system monitoring in a variety of LFA mission scenarios and acoustic environments.

The keys to SURTASS LFA success are:

- Assuring LFA Transmit System (LTS) reliability, maintainability, and availability through system maintenance, system shakedown and correction of deficiencies, and LTS training.
- Assuring the system hardware and software (processing, communications, support systems) reliability, maintainability, and availability through system interface testing, system function testing, system operational testing, system load testing, and the correction of deficiencies.
- Training of SURTASS LFA crew through at-sea training in diverse environments and missions.
- Updating the SURTASS LFA Employment Guidelines.
- Testing and certification of the system performance in a variety of missions and environments. The environments should range from familiar acoustic environments during system shakedown to operationally significant environments for crew training.
- Successful system employment in a variety of tactical and strategic scenarios in diverse acoustic environments.
- Operational training with the HF/M3 sonar and compliance with all other applicable mitigation requirements of the LOAs, as issued.

The LFA system onboard R/V *Cory Chouest* commenced reintroduction to the Fleet in January 2003 and is presently operating in the western North Pacific. The second system onboard USNS IMPECCABLE (T-AGOS 23) commenced sea trials in late February 2004 and full Fleet operations in FY 05. Summaries of these operations for the period of the first four LOAs (16 August 2002 to 15 August 2006) are provided in Table 4.

There were 27 training missions from the R/V *Cory Chouest* and 13 training missions for the USNS IMPECCABLE. These missions occurred in the Pacific Ocean (east of Japan), west and north Philippine Sea, the South China Sea, Sea of Japan and near Guam.

Under the conditions of the LOAs, LFA transmissions were not to exceed a total of 432 hours of transmission time between the two ships for the one year period of each LOA. As demonstrated in Table 4, the Navy met these conditions.

Table 4. Summary of SURTASS LFA Sonar Operations

	Number of Mission	Sites[1]	Length of Mission (days)	Active Transmission Time (hours)	Mitigation Protocol Suspensions/ delays
LOA 1					
R/V *Cory Chouest*	7	2, 4	34.2	82.2	3
LOA 1 Total			**34.2**	**82.2**	**3**
LOA 2					
R/V *Cory Chouest*	5	3	46.2	110.7	10
USNS IMPECCABLE	5	1, 2, 3	26.3	63.0	8
LOA 2 Total			**72.5**	**173.7**	**18**
LOA 3					
R/V *Cory Chouest*	3	2, 3, 4	13.1	19.2	12
USNS IMPECCABLE	2	2	9.4	22.7	1
LOA 3 Total			**22.5**	**41.9**	**13**
LOA 4					
R/V *Cory Chouest*	12	2, 3, 5	73.1	133.8	58
USNS IMPECCABLE	6	2, 4, 7	22.5	39.4	5
LOA 4 Total			**95.6**	**173.2**	**63**

[1]See Figure 4

4.2.1 Pre-Operational Estimates of Marine Mammal Stocks Potentially Affected

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

Information on how the density and stock/abundance estimates were derived for the operational areas shown in Figure 4. These data were derived from best available published source

documentation, and provided general area information for mission areas, with species-specific information on the animals that could potentially occur in those areas, including estimates for their stock/abundance and density. Animal demographics (stocks and densities) are based on the current literature reviews of the western North Pacific Ocean as provided in the fifth year LOA application (DON, 2006a).

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

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

Locations are shown in Figure 4 and boundary conditions are provided in Table 2.

4.2.2 Post-Operational Estimates of Marine Mammal Stocks Potentially Affected

In the annual reports, the Navy provided post-operational assessments of whether incidental harassment occurred within the LFA mitigation and buffer zones and estimates of the percentages of marine mammal stocks possibly harassed incidentally using predictive modeling based on dates/times/location of operations, system characteristics, oceanographic/environmental conditions, and animal demographics. The basis for the methodology used for the acoustic modeling to analyze risk and produce the incidental harassment estimates was essentially the scientific analysis process used in the SURTASS LFA Final EIS (DON, 2001) and detailed in the Navy's second year application to NMFS for LOAs (DON, 2003a).

Operations occurred in the vicinity of sites 1, 2, 3, 4, 5, and 7 (as shown in Figure 4). Tables 5 through 8 provide post-operational risk estimates for marine mammal stocks in these operating areas for the first four LOAs (16 August 2002 through 15 August 2006) as documented in the Navy's Annual Reports (DON, 2003b; 2004a; 2005b; 2006c). These values support the conclusion that all risk estimates for marine mammal stocks were below—for most cases, well below—the criteria delineated by NMFS in the Final Rule (67 FR 46785-89). Upon completion of the missions under the requested authorization, these estimates were refined and submitted to NMFS under the reporting requirements of the Final Rule and the conditions of the LOAs, as issued. They are summarized below.

Table 5. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected for LOA 1 (with mitigation 120-180 dB)

Animal	Stock Name	% Risk (with mitigation 120-180 dB)		
		Site 2	Site 4	Annual Total
Blue whale	N Pacific	--	0.64	0.64
Fin whale	N Pacific	--	1.35	1.35
Minke whale	Western N Pacific	0.67	0.11	0.78
Bryde's whale	Western N Pacific	0.13	0.21	0.34
Humpback whale (winter only)	Central N Pacific	0.00	0.00	0.00
Sperm whale	N Pacific	0.04	0.29	0.33
Kogia	N Pacific	0.14	0.38	0.52
Spinner dolphin	Western N Pacific	--	0.86	0.86
Ginkgo-toothed beaked whale	N Pacific	0.37	--	0.37
Cuvier's beaked whale	N Pacific	0.55	1.37	1.92
Blainville's beaked whale	N Pacific	0.37	0.92	1.29
Killer whale	Western N Pacific	0.06	--	0.06
Pygmy killer whale	Western N Pacific	0.03	--	0.03
False killer whale	Western N Pacific	0.86	0.71	1.57
Melon-headed whale	Western N Pacific	--	0.77	0.77
Short-finned pilot whale	Western N Pacific	1.41	2.46	3.87
Bottlenose dolphin	Western N Pacific	0.51	0.92	1.43
Rough-toothed dolphin	Western N Pacific	--	0.32	0.23
Risso's dolphin	Western N Pacific	0.76	0.01	0.77
Pantropical spotted dolphin	Western N Pacific	0.17	0.62	0.79
Striped dolphin	Western N Pacific	0.30	0.02	0.32

Table 6. Post-Operational Estimates of Marine Mammal Stocks Potentially Affected for LOA 2 (with mitigation 120-180 dB)

Animal	Stock Name	% Risk (with mitigation 120-180 dB)			
		Site 1	Site 2	Site 3	Annual Total
Blue whale	N Pacific	0.17	--	--	0.17
Fin whale	N Pacific	0.17	--	0.80	0.97
Sei whale	N Pacific	0.13	--	--	0.13
Bryde's whale	Western N Pacific	0.22	0.17	1.01	1.40
Minke whale	Western N Pacific	1.22	0.91	2.66	4.79
Sperm whale	N Pacific	0.07	0.06	0.29	0.42
Humpback whale (winter only)	Western N Pacific	--	--	0.0	0.0
Kogia	N Pacific	0.25	0.20	0.97	0.42
Ginkgo-toothed beaked whale	N Pacific	0.60	0.51	2.49	3.60
Cuvier's beaked whale	N Pacific	0.90	0.76	3.73	5.39
Baird’s beaked whale	N Pacific	2.71	--	--	2.71
Hubbs’ beaked whale	N Pacific	0.60	--	--	0.60
Blainville's beaked whale	N Pacific	--	0.51	2.49	3.00
Killer whale	Western N Pacific	--	0.08	--	0.08
False killer whale	Western N Pacific	2.04	1.18	6.43	9.65
Pygmy killer whale	Western N Pacific	0.06	0.05	0.25	0.36
Melon-headed whale	Western N Pacific	0.12	--	5.17	5.29
Short-finned pilot whale	Western N Pacific	2.14	1.93	5.24	9.31
Spinner dolphin	Western N Pacific	0.62	--	1.29	1.91
Fraser's dolphin	Western N Pacific	0.07	--	2.55	2.42
Common dolphin	Western N Pacific	1.21	--	5.20	6.41
Bottlenose dolphin	Western N Pacific	1.11	0.70	3.70	5.51
Pantropical spotted dolphin	Western N Pacific	0.62	0.23	1.28	2.13
Rough-toothed dolphin	Western N Pacific	0.12	--	0.48	0.60
Striped dolphin	Western N Pacific	0.20	0.42	1.18	1.80
Risso's dolphin	Western N Pacific	1.28	1.03	5.44	7.75
Pacific white-sided dolphin	Western N Pacific	1.22	--	5.20	6.42

Table 7. Post Operational Estimates of Marine Mammal Stocks Potentially Affected for LOA 3 (with mitigation 120-180 dB)

Animal	Stock Name	% Risk (with mitigation 120-180 dB)			
		Site 2	Site 3	Site 4	Annual Total
Blue whale	N Pacific	--	--	0.13	0.13
Fin whale	N Pacific	--	0.04	0.29	0.33
Bryde's whale	Western N Pacific	0.14	0.05	0.46	0.65
Minke whale	Western N Pacific	0.76	0.13	0.02	0.91
N. Pacific right whale	Western N Pacific	0.00	--	--	0.00
Sperm whale	N Pacific	0.05	0.01	0.06	0.12
Humpback whale (winter only)	Western N Pacific	--	0.00	0.00	0.00
Kogia	N Pacific	0.09	0.01	0.03	0.13
Ginkgo-toothed beaked whale	N Pacific	0.12	0.03	--	0.15
Cuvier's beaked whale	N Pacific	0.32	0.00	0.15	0.47
Blainville's beaked whale	N Pacific	0.33	0.09	0.40	0.82
Killer whale	Western N Pacific	0.19	--	--	0.19
False killer whale	Western N Pacific	0.99	0.31	0.22	1.52
Pygmy killer whale	Western N Pacific	0.39	0.12	--	0.51
Melon-headed whale	Western N Pacific	--	0.69	0.92	1.61
Short-finned pilot whale	Western N Pacific	1.62	0.25	0.08	1.95
Spinner dolphin	Western N Pacific	--	0.00	0.04	0.04
Fraser's dolphin	Western N Pacific	--	0.04	--	0.04
Common dolphin	Western N Pacific	--	0.03	--	0.03
Bottlenose dolphin	Western N Pacific	0.59	0.18	0.04	0.81
Pantropical spotted dolphin	Western N Pacific	0.19	0.06	0.21	0.46
Rough-toothed dolphin	Western N Pacific	--	0.31	0.17	0.48
Striped dolphin	Western N Pacific	0.35	0.06	0.14	0.55
Risso's dolphin	Western N Pacific	0.87	0.26	0.02	1.15
Pacific white-sided dolphin	Western N Pacific	--	0.48	--	0.48

Table 8. Post Operational Estimates of Marine Mammal Stocks Potentially Affected for LOA 4 (with mitigation 120-180 dB)

Animal	Stock Name	% Risk (with mitigation 120-180 dB)					
		Site 2	Site 3	Site 4	Site 5	Site 7	Annual Total
Blue whale	N Pacific	--	--	0.04	--	--	0.04
Fin whale	N Pacific	--	0.50	0.04	0.37	0.13	1.04
Bryde's whale	Western N Pacific	0.20	0.61	0.09	0.02	0.16	1.08
Minke whale	Western N Pacific	1.05	1062	0.02	0.06	0.10	2.85
Minke whale	J stock	--	--	--	0.68	--	0.68
Gray whale (winter only)	Western N Pacific	--	--	--	0.38	0.00	0.38
N. Pacific right whale (spr, fall, win)	Western N Pacific	0.07	--	--	0.00	--	0.07
Humpback whale (winter only)	Western N Pacific	--	0.00	0.00	--	--	0.00
Sperm whale	N Pacific	0.07	0.17	0.02	0.03	0.04	0.33
Kogia	N Pacific	0.06	0.09	0.01	--	0.02	0.18
Cuvier's beaked whale	N Pacific	0.44	0.06	0.11	0.16	0.02	0.79
Blainville's beaked whale	N Pacific	0.45	1.18	0.29	--	0.31	2.23
Ginkgo-toothed beaked whale	N Pacific	0.16	0.41	--	0.07	0.11	0.75
Killer whale	N Pacific	0.26	--	--	--	--	0.26
False killer whale	Western N Pacific	1.36	3.92	0.33	--	--	5.61
False killer whale	Inshore archipelago	--	--	--	1.23	1.19	2.42
Pygmy killer whale	Western N Pacific	0.54	1.56	--	--	0.45	2.55
Melon-headed whale	Western N Pacific	0.25	8.73	0.67	0.00	1.53	11.18
Short-finned pilot whale	Western N Pacific	2.23	3.18	0.10	0.12	0.92	6.43
Risso's dolphin	Western N Pacific	1.19	3.31	0.03	0.45	1.08	6.06
Common dolphin	Western N Pacific	0.14	0.42	--	0.12	0.11	0.79
Bottlenose dolphin	Western N Pacific	0.81	`2.25	0.05	--	--	3.11
Bottlenose dolphin	Inshore archipelago	--	--	--	0.04	1.18	1.22
Spinner dolphin	Western N Pacific	0.00	0.01	0.03	0.00	0.01	0.05
Pantropical spotted dolphin	Western N Pacific	0.26	0.78	0.75	0.29	0.48	2.56
Striped dolphin	Western N Pacific	0.48	0.71	0.33	--	0.22	1.74
Rough-toothed dolphin	Western N Pacific	0.34	1.00	0.12	--	0.21	1.67
Fraser's dolphin	Western N Pacific	0.15	0.45	--	--	0.14	0.74

Animal	Stock Name	% Risk (with mitigation 120-180 dB)					
		Site 2	Site 3	Site 4	Site 5	Site 7	Annual Total
Pacific white-sided dolphin	Western N Pacific	1.47	8.97	--	0.21	--	10.65
Baird's beaked whale	Western N Pacific	--	--	--	0.13	--	0.13
Stejneger's beaked whale	N Pacific	--	--	--	0.59	--	0.59
Dall's porpoise	Sea of Japan	--	--	--	3.18	--	3.18

Exposure within the 180-dB LFA Migration Zone

As reported in the annual reports (DON, 2003b; 2004a; 2005b; 2006c), post-operational incidental harassment assessments demonstrate that there were no marine mammal exposures to RLs at or above 180 dB.

These findings are supported by the results from the visual, passive acoustic and active acoustic monitoring efforts discussed in Subsection 4.1. In addition, a review of recent stranding data from the National Science Museum of Tokyo, Japan and Internet sources did not indicate any stranding events associated with the times and locations of LFA operations.

Exposure between 120 and 180 dB

The percentage of marine mammal stocks estimated to be exposed to LFA transmissions between 120 and 180 dB (RL) for post-operational estimates are shown in Tables 5 through 8. These tables confirm that the post-operational estimates are below 12 percent for any marine mammal stock, the maximum percentage authorized in LOA Condition 6 (g).

4.3 Incident Monitoring—Marine Mammal Strandings

The Navy monitored and reviewed data on marine mammal strandings from federal, state, and international organizations involved in marine mammal and sea turtle stranding incident monitoring. In addition, a review of recent stranding data from the National Science Museum of Tokyo, Japan; the Cetacean Stranding Database (www.strandings.net); other Internet sources; and international reports, did not indicate any stranding events associated with the times and locations of LFA operations in the northwestern Pacific Ocean.

In April 2004, the MMC convened a workshop on understanding the impacts of anthropogenic sound on beaked whales (Cox et al., 2006). In examining the theory that naval sonar activity in Greece (1996), Bahamas (2000), Madeira (2000), and Canaries (2002) caused marine mammal strandings, Cox et al. provided a summary of common features shared by these strandings events. These included deep water close to land (such as offshore canyons), presence of an acoustic waveguide (surface duct conditions), and periodic sequences of transient pulses (i.e., rapid onset and decay times) generated at depths less than 10 m (33 ft) by sound sources moving at speeds of 2.6 m/s (5.1 knots) or more during sonar operations (D'Spain et al., 2006). Three of these features do not relate to LFA operations. First, the SURTASS LFA vessel operates with a horizontal line array (SURTASS) of 1,500 m (4921 ft) length at depths below 150 m (492 ft) and a VLA (LFA source) at depths greater than 100 m (328 ft). Second, operations are limited by mitigation protocols to at least 22 km (12 nm) offshore. Therefore, for these reasons SURTASS LFA sonar cannot be operated in deep water that is close to land. Finally, the LFA signal is transmitted at depths well below 10 m (33 ft). Because of the extensive vertical and horizontal arrays, the SURTASS LFA vessels speed of advance is only 1.5 m/s (3 knots).

While it is true that there was a low-frequency component to the sonar employed in the Greece stranding in 1996, only MF sonar components were involved with the marine mammal strandings in the Bahamas in 2000, Madeira 2000, and Canaries in 2002. This supports the logical conclusion that the LF sonar component in the Greek stranding was not causative (ICES, 2005; Cox et al., 2006). In its discussion of the Bahamas stranding, Cox et al. (2006) stated, "The event raised the question of whether the MF component of the sonar in Greece in 1996 was implicated in the stranding, rather than the low-frequency component proposed by Frantzis (1998)." The International Council for the Exploration of the Sea (ICES) in its "Report of the Ad-Hoc Group on the Impacts of Sonar on Cetaceans and Fish" raise the same issue as Cox et al. (2006), stating that the consistent association of MF sonar in the Bahamas, Madeira, and Canary Island strandings suggest that it was the MF component, not the LF component, in the North Atlantic Treaty Organization (NATO) sonar that triggered the Greece stranding of 1996 (ICES, 2005). The ICES Report further stated, "No stranding, injury, or major behavioural change has yet been associated with the exclusive use of LF sonar."

Also, most odontocetes have relatively sharply deceasing hearing sensitivity below 2 kHz. If a cetacean cannot hear a sound or hears it poorly, it is unlikely to have a significant impact (Ketten, 2001). Therefore, it is unlikely that LF transmissions from LFA would induce behavioral reactions from animals that have poor LF hearing.

LFA has not been implicated in any known strandings based on current operations in a relatively limited area of the Northwestern Pacific Ocean and adjacent seas (Sea of Japan, East China Sea and South China Sea). This is supported by both national and international reports cited above (ICES, 2005; Cox et al., 2006). However, the Navy and NMFS do not dismiss the possibility that behavioral reactions to sound can produce Level A harassment in certain species of odontocetes. Therefore, the Navy and NMFS are presently planning 2007-2008 field research for deep-diving odontocetes behavioral response studies (BRS) to address this issue. This BRS is discussed in more detail in Subsection 4.5 2.

4.4 Assessment of Cumulative Impacts to Marine Mammal Stocks

Two areas were evaluated to assess the potential cumulative impacts of the operations of SURTASS LFA sonars. These included:

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

Specifically for LFA, existing scientific evidence indicates that whales may respond to LFA over short temporal periods and over small spatial areas (DON, 2001). As indicated by the LFS SRP, minor changes in behavior only can occur to marine mammals relatively close to the LFA source and are addressed by the risk continuum approach of the FOEIS/EIS (DON, 2001). For those areas which are outside of the area covered by the risk continuum, the received LFA signals are small and incremental. Even though LFA signals are long range, LFA sonar cannot be considered to be pervasive because of the nominal 7.5 to 10 percent duty cycle—meaning that during any given mission LFA is not transmitting 90 to 92.5 percent of the time. Thus, the signals do not add appreciably to the ambient noise levels, and therefore do not accumulate, or collect, to greater effects. The conclusion reached in the FOEIS/EIS that even when considered in combination with other underwater sounds, SURTASS LFA sonar does not add appreciably to the underwater sounds to which marine mammal stocks are regularly exposed, remains valid. There is no evidence of LFA impact on individual animal survivorship or reproductive success.

The potential for cumulative impacts from the operations of SURTASS LFA sonars is considered to be small and has been addressed by limitations proposed for employment of the system (i.e., geographical restrictions and monitoring mitigation). The geographic restriction imposed by the 145-dB RL exposure criterion for known commercial and recreational dive sites further limits (in addition to the 180-dB RL geographic restriction) the accumulation of anthropogenic sound in coastal areas. Even if considered in combination with other underwater sounds, such as commercial shipping, other military activities (at sea exercises), 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 to which marine mammal stocks are routinely exposed.

4.4.1 Comparison to Anthropogenic Oceanic Noise Levels

For SURTASS LFA's contribution to anthropogenic noise, comparisons were made to oceanic noise level changes, commercial shipping, vessel noise sources, oil and gas industry, and military and commercial sonars. In a recent analysis for the Policy on Sound and Marine Mammals: An International Workshop sponsored by the Marine Mammal Commission (U.S.) and the Joint Nature Conservation Committee (UK) in 2004, Dr. John Hildebrand provided a comparison of anthropogenic underwater sound sources by their annual energy output (Hildebrand, 2004). This analysis included SURTASS LFA sonar, in which he estimated that on an annual basis four SURTASS LFA systems would have a total energy output two orders of magnitude less than seismic air gun arrays and one order of magnitude less than mid-frequency active (MFA) sonar and super tankers.

4.4.2 Operations Concurrent with Other LFA Sources

The FOEIS/EIS addressed the potential effects on marine mammals stocks for the operations of two LFA sources in proximity to each other (DON, 2001). The findings were that there is minimum potential for cumulative impact if the sources were approximately 100 nautical miles (185 km) apart. Beyond this range, the potential for cumulative impacts are negligible.

4.4.3 Operations Concurrent with Seismic Air Gun Sources

There are significant differences between the LFA coherent signals and seismic air gun impulsive "shots." Air guns are impulsive, broadband sources, typically producing sound repetitively every 9-14 seconds over a span of days to weeks, with only occasional interruptions. Broadband source levels can be from 248 to 255 dB (peak-to-peak pressure) with most energy emitted between 5 and 20 Hz. This differs substantially from LFA transmissions, which are coherent, narrow bandwidth signals of 6 to 100 seconds in length followed by a quiet period of 6 to 15 minutes. The SURTASS LFA sonar bandwidth is limited (approximately 30 Hz) with a constant frequency for 10 seconds and an average duty cycle of 7.5 percent (thus the system is off over 90 percent of the time). This situation would present itself only rarely, as LFA testing and training operations have not been, and are not expected to be, conducted in proximity to any seismic survey activity.

4.4.4 Stress

The NRC (2003) discusses acoustically-induced stress in marine mammals. The NRC stated that sounds resulting from one-time exposure are less likely to have population-level effects than sounds that animals are exposed to repeatedly over extended periods of time. Stress can be defined as a threat to homeostasis (Fair and Becker, 2000) and is frequently measured with changes in blood chemistry

Thomas et al. (1990) exposed captive belugas to recorded industrial noise for 30 minutes at a time, with a total exposure of 4.5 hours over 13 days with a source level of 153 dB. Catecholamine blood levels were checked both before and after noise exposure; however, no significant differences in blood chemistry were observed. The RLs at the belugas in this

experiment were relatively low. Another experiment that varied the sound level is described in Romano et al. (2004). In this experiment, one animal was exposed to varying levels of an impulsive signal produced by a water gun. The levels of three stress-related blood hormones (norepinephrine, epinephrine and dopamine) were measured after control, low-level sound (171-181 dB SEL) exposure and high-level (184–187 dB SEL) sound exposure. There were no significant differences between low-level sound exposure and control, while the high-level sound exposure did produce elevated levels for all three hormones. Furthermore, regression analysis demonstrated a linear trend for increased hormone level with sound level.

In a related study on fish, Smith et al. (2004) exposed goldfish (a hearing-specialist fish) to continuous background noise of 160-170 dB RL. There was a "transient spike" in blood cortisol levels within 10 minutes of the onset of noise that was loud enough to cause temporary threshold shift (TTS). However, this cortisol spike did not persist and there was no long-term physiological stress reaction in the animals

These data support a linear dose-response function for sound exposure and the onset of stress, with only high levels of sound potentially leading to a stress reaction. The extrapolation of the response thresholds from the Romano et al. (2004) experiment to the LFA situation is tenuous because of the differences in the signals, but the relationship between sound level and stress is supported by several studies, which suggest that, while stress in marine animals could possibly be caused by operation of the LFA source, it is likely to be constrained to an area much smaller than the zone of audibility, more similar in size to the LFA mitigation zone around the vessel.

The NRC (2003) stated that although techniques are being developed to identify indicators of stress in natural populations, determining the contribution of noise exposure to those stress indicators will be very difficult, but important, to pursue in the future when the techniques are fully refined. There are scientific data gaps regarding the potential for LFA to cause stress in marine animals. Even though an animal's exposure to LFA may be more than one time, the intermittent nature of the LFA signal, its low duty cycle, and the fact that both the vessel and animal are moving, provide a very small chance that LFA exposure for individual animals and stocks would be repeated over extended periods of time, such as those caused by shipping noise.

4.4.5 Comparison of Injury and Lethal Takes from Anthropogenic Causes

Analyses sponsored by the Navy (Cudahy and Ellison, 2002; Laurer et al., 2002), reports on two workshops on acoustic impacts (DOC, 2002; Cox, et al. 2006), and the NRC Ocean Studies Board (NRC, 2005) support the conclusion that resonance and/or tissue damage from LFA transmissions are unlikely to occur in marine mammals within and outside the LFA mitigation zone as discussed in Subsection 4.1.7 of this report.

LFA has not been implicated in any known strandings based on current operations in a relatively limited area of the northwestern Pacific Ocean and adjacent seas (Sea of Japan, East China Sea and South China Sea). This is supported by both national and international reports cited above (ICES, 2005; Cox et al., 2006).

Based on mitigation measures implemented by the Navy (see Section 2.0 and Subsection 4.1), the Navy and NMFS do not believe that SURTASS LFA sonar operations will cause injuries or mortalities to marine mammals, and thus will not contribute to cumulative effects from such takes from other underwater anthropogenic causes. This determination is also supported by the ICES (2005) report that stated, "No strandings, injury, or major behavioural change has yet been associated with the exclusive use of LF sonar."

4.4.6 Summary of Potential Cumulative Impacts

Even though an animal's exposure to LFA signals may be more than one time, the intermittent nature of the LFA signal, its low duty cycle, and the fact that both the vessel and animal are moving, provide a very small chance that LFA exposure for individual animals and stocks would be repeated over extended periods of time, such as those caused by shipping noise. The intermittent nature of LFA transmissions are demonstrated by actual operational data provided in this document. As shown in Table 3, there are on average about 10 SURTASS LFA missions per year. The maximum annual transmission time was 173.7 hours for the 2nd year, which is less than 2 percent per annum.

SURTASS LFA transmissions will not contribute significantly to overall anthropogenic oceanic noise levels, will not cause injury or mortality, and not cause effects from stress. Therefore, cumulative effects from the intermittent LFA transmissions are not a reasonable foreseeable significant adverse impact.

4.5 Research

NMFS's original LOA (67 FR 55818) and Final Rule (67 FR 46785) included the conduct of additional research involving the topics listed in Table 9 below. The research activities listed would help to increase the knowledge of marine mammal species and the determination of levels of impacts from potential takes.

4.5.1 Research Status

Table 9 below provides the status of research that has been conducted, is underway or is being planned to address NMFS's research topics based on the eight recommended research topics provided in the preamble to the Final Rule (67 FR 46782).

4.5.2 Navy-Sponsored Research

The Office of Naval Research (ONR) sponsors significant research to study the potential effects of its activities on marine mammals. The Navy spends on average $10M annually on marine mammal research at universities, research institutions, federal laboratories, and private companies. In 2004 and 2005, Navy-funded research produced approximately 65 peer-reviewed articles in professional journals. Publication in open professional literature thorough peer review is the benchmark for the quality of the research. This ongoing marine mammal research include hearing and hearing sensitivity, auditory effects, dive and behavioral response models, noise impacts, beaked whale global distribution, modeling of beaked whale hearing and response, tagging of free ranging marine animals at-sea, and radar-based detection of marine mammals

from ships. These studies, though not specifically related to LFA operations, are crucial to the overall knowledge base on marine mammals and the potential effects from underwater anthropogenic noise.

In addition, ONR and the Strategic Environmental Research and Development Program (SERDP) have funded the development and fieldwork for sound-and-orientation recording tags (DTAGs), which have been successfully attached with suction cups to beaked whales and sperm whales (Tyack et al., 2006). In particular, these data are providing tremendous amounts of information on the movement and diving behavior of beaked whales, both of which are important to know in order to understand the acoustic exposure to which the animals may be subjected.

Under the NMFS Final Rule, the Navy is required to conduct research in accordance with 50 CFR § 216.185(e) and the LOAs, as issued. As demonstrated in Table 9, the Navy has and is continuing to meet these recommended research requirements (67 FR 46782). The SURTASS LFA Sonar LTM Program has been budgeted by the Navy at a level of approximately $1M per year for five years, starting with the issuance of the first LOA. Planning has commenced for a 2007-2008 deep-diving odontocetes BRS to determine the potential effects of LFA, MFA, and seismic sources on beaked whales and other deep diving odontocetes at an estimated cost of $3M per year.

Table 9. Research Status

NMFS Research Topics	Status
Systematically observe SURTASS LFA sonar training exercises for injured or disabled marine animals	As reported in the annual reports (DON, 2003b; 2004a; 2005b; 2006c), post-operational incidental harassment assessments demonstrate that there were no known marine mammal exposures to RLs at or above 180 dB (Subsection 4.2). These findings are supported by the results from the visual, passive acoustic and active acoustic monitoring efforts discussed in Subsection 4.1. In addition, a review of recent stranding data from the National Science Museum of Tokyo, Japan and Internet sources did not indicate any stranding events associated with the times and locations of LFA operations (Subsection 4.3)
Compare the effectiveness of the three forms of mitigation (visual, passive acoustic, HF/M3 sonar)	A summary of mitigation effectiveness is provided in Subsection 4.1.8.
Behavioral reactions of whales to sound levels that were not tested during the research phase, specifically between 155 and 180 dB.	Preliminary assessment of the feasibility of conducting such research indicates that a Scientific Research Permit (SRP) under the MMPA, backed up with a National Environmental Protection Act environmental assessment would be required. The potential for acquiring authorization to intentionally expose marine mammals to RLs up to 180 dB would be expected to be extremely low. Moreover, it should be noted that for the Low Frequency Sound SRP conducted in 1997-98, where the goal was to expose blue, fin, gray and humpback whales to RLs up to 160 dB, even with total control of placement of the LFA source in relation to known animal locations and movements, it was rare to achieve RLs at the animals greater than 150 dB. Intentions are to hold discussions with NMFS on the practicability of future research of this nature.
Responses of sperm and beaked whales to LF sonar signals.	• Expert marine biologist and bio-acousticians agree that the conduct of controlled exposure experiments (CEE) with sperm and/or beaked whales will prove to be extremely complicated and expensive. Nevertheless, the Navy and NMFS are going forward with the planning for beaked whale BRSs, using controlled exposures of LF, MF and seismic sources, with execution during the summer/fall of 2007 and 2008. • An April 2004 Beaked Whale Workshop organized by the Marine Mammal Commission in Baltimore, MD where there was unanimous support for CEEs as a top research priority to be used to gather critical information on beaked whale responses to sound. A Summary report of this workshop is available at: http://www.mmc.gov/sound/ and also in Cox et al. (2006). • A November 2004 Beaked Whale Research Planning Workshop at St. Andrews University, UK, jointly funded by the University's Sea Mammal Research Unit (SMRU) and the UK Ministry of Defence (MoD); where SMRU provided a strawman proposal for conducting CEEs with beaked whales. • A second SMRU/MoD meeting in October 2005 of leading scientists in the fields of marine bio-acoustics and whale research, in Oxford UK, produced a draft research strategy on The Effects of Anthropogenic Sound on Marine Mammals, which focuses on a risk assessment framework of 5 steps: 1) Hazard identification; 2) Animal exposure assessment; 3) Animal dose-response assessment; 4) Risk characterization; and 5) Risk management. Navy funding supported this research effort. • The Navy is funding SMRU and QinetiQ (UK) to help provide the framework for future national and international research on the responses of beaked whales to LF sonar signals. • The Navy and NMFS met the 2006 goal to develop an agreed-upon experimental plan for follow-on field research (e.g., BRSs) with beaked whales in 2007/2008. The Navy convened an *ad hoc* scientific working group meeting in April 2006 to

NMFS Research Topics	Status
	concentrate on the details of a 2007 beaked whale BRS; independent scientists from Cornell University, Woods Hole Oceanographic Institution, and St. Andrews University attended, which developed a plan of action with milestones for the 2007/2008 experiments. Navy and industry funding is supporting this research effort. • The Deep-Diving Odontocetes BRS Planning Meeting was held in Oct 2006 with participants from Cornell University, Woods Hole Oceanographic Institution, St. Andrews University, NMFS, Navy, and the seismic exploration industry. The primary objectives were to agree upon a plan for the BRS 2007 Scientific Research Permit (SRP) Application under the MMPA, and set the BRS organization.
Habitat preferences of beaked whales.	The ONR has funded the following research that has been published: MacLeod, C. D., and G. Mitchell. 2006. Key areas for beaked whales worldwide. J. Cetacean Res. Manage. 7(3):309-322. MacLeod, C. D., W. F. Perrin, R. Pitman, J. Barlow, L. Balance, A. D'Amico, T. Gerrodette, G. Joyce, K. D. Mullin, D. L. Palka, and G. T. Waring. 2006. Known and inferred distributions of beaked whale species (Cetacea: Ziphiidae). J. Cetacean Res. Manage. 7(3):271-286. The U.S. Navy/ONR and SERDP have funded the following research on predicting the distribution of marine mammal species, including beaked whales: Redfern, J. V., M. C. Ferguson, E. A. Becker, K. D. Hyrenbach, C. Good, J. Barlow, K. Kaschner, M. F. Baumgartner, K. A. Forney, L. T. Ballance, P. Fauchald, P. Halpin, T. Hamazaki, A. J. Pershing, S. S. Qian, A. Read, S. B. Reilly, L. Torres, and F. Werner. 2006. Techniques for cetacean–habitat modeling. MEPS 310:271-295. Ferguson, M. C., J. Barlow, B., S. B. Reilly, and T. Gerrodette. 2006. Predicting Cuvier's (*Ziphius cavirostris*) and *Mesoplodon* beaked whale population density from habitat characteristics in the Eastern Tropical Pacific Ocean. JCRM 7(3):287-299. As part of the BRS planning, a Navy-funded draft document from SMRU has identified three “top-tier,” three “second-tier” and eight “third-tier” sites (i.e., habitat preferences of beaked whales), including discussion for each on: 1) scientific impact; 2) logistics and cost; 3) team qualifications; and 4) permits and politics. • Top Tier: Bahamas, Azores, Canaries. • Second Tier: Bay of Biscay, Hawaii, Ligurian Sea (Genoa Canyon). • Third Tier: Alboran Sea, Baja California, Western Greece, New Zealand, Tazmania, Japan (Yokosuka Bay), Washington State (Quinalt Canyon), Caribbean Sea (esp. eastern Puerto Rico and Virgin Islands). These data will be further examined and beaked whale experts consulted in determining the oceanic area and specific sites for the conduct of the proposed BRS field research effort. Navy funding supports this research effort.
Passive acoustic monitoring for the possible silencing of calls of large whales using bottom-mounted hydrophones.	Four research efforts in the North Atlantic (NORLANT, 2004, 2005, 2006-01, 2006-02) have addressed this topic. The research reports for these tasks are classified; unclassified summary reports have been produced. Navy funding has supported and continues to support these research efforts.

NMFS Research Topics	Status
Continued research with the HF/M3 Sonar	Based on system component maintenance history and training experience with the HF/M3 sonars installed onboard the R/V *Cory Chouest* and the USNS IMPECCABLE, the HF/M3 sonar is being upgraded for integration into the installations of CLFA on the T-AGOS 19 Class vessels.
Long-term, cumulative effects on a stock of marine mammals that is expected to be regularly exposed to LFA and monitor it for population changes throughout the five-year period.	The overall topic of cumulative impacts to marine mammal stocks from LFA operations is addressed in Subsection 4.4. Detecting and scientifically validating a change in a marine mammal population (e.g, trend, demographics) is extremely difficult. It is unrealistic to expect that a single factor would explain population changes. Also, for LFA, research results indicate that some whales will respond to LFA over relatively short temporal periods and over small spatial areas, and it is recognized that this research was only capable of testing for responses over short time periods and spatial scales. There is no evidence that LFA could have an effect on individual survivorship or reproductive success, or population trends or demographics. However, research on the appropriate temporal and spatial scales has not been conducted to address this level of potential impact, so questions concerning the level of impact at such scales remain unanswered.

4.5.3 Research on Fish

Although not directly related to the LFA regulatory process, the Navy has funded independent research to determine the potential for SURTASS LFA signals to affect fish, a prey species for marine mammals. Dr. Arthur Popper (University of Maryland), an internationally recognized fish acoustics expert, investigated the effects of exposure to LFA sonar on rainbow trout (a hearing non-specialist related to several endangered salmonids) and channel catfish (a hearing specialist) using an element of the standard SURTASS LFA source array (Popper et al., 2005; Halvorsen et al., 2006). Hearing sensitivity was measured using auditory brainstem response (ABR), effects on inner ear structure were examined using scanning electron microscopy, effects on non-auditory tissues were analyzed using general pathology and histopathology, and behavioral effects were observed with video monitoring. Exposure to 193 dB re 1 µPa rms RL in the LFA frequency band for 324 seconds resulted in a TTS of 20 dB at 400 Hz in rainbow trout, with less TTS at 100 and 200 Hz. TTS in catfish ranged from 6 to 12 dB at frequencies from 200 to 1000 Hz. Both species recovered from hearing loss in several days. Inner ear sensory tissues appeared unaffected by acoustic exposure. Gross pathology indicated no damage to non-auditory tissues, including the swim bladder. There was no fish death attributable to sound exposure, even up to four days post-exposure. Both species showed initial movement responses at sound onsets and changed position relative to the sound source during exposures. The sound levels (up to 193 dB RL) used in these experiments approached those that fish would encounter very close to an active LFA source array (within approximately 200 m [656 ft]). However, the exposure during experiments was very likely more substantial than any a fish would encounter in that the fish were exposed to multiple replicates of very intense sounds, whereas any fishes in the wild would encounter sounds from a moving source, and successive emissions from the source would decrease intensity as the ship moved away from exposed fish. Therefore, based on recent field research results, the potential for a fish or schools of fish to be harmed (thus impacting fish

stocks) by exposure to LFA signals above 193 dB RL (within approximately 200 m (656 ft) of the SURTASS LFA operational array) is negligible.

4.6 Assessment of New Passive Technologies

In the preamble to the Final Rule, the Navy was required to provide in this comprehensive report an analysis on the advancements of alternative (passive) technologies as a replacement for LFA sonar. Traditionally, passive sonars have been the dominant means used by U.S. Naval forces to conduct long-range surveillance of and initial classification of enemy sonar threats. These systems were developed to counter an open ocean threat presented during the Cold War by the former Soviet Union. Passive systems have the benefit of stealth, emitting no noise that may be detected by enemy forces. They were a particularly effective tool against relatively noisy Soviet submarines and allowed effective, accurate tracking at significant distance (Tyler, 1992).

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

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

The U.S. military anticipates that future naval conflicts are most likely to occur within littoral or coastal areas. This is a further complication to the Naval ASW mission and a distinct change from the Cold War era, where conflicts were most likely to occur in mid-ocean areas. Littoral areas have highly variable and frequently high underwater background noise; largely, this is a result of commercial shipping, and difficult underwater acoustic propagation conditions (Farrell, 2003).

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

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

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

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

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

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

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

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

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

The table below shows the hypothetical allowable TLs for a 1960 and 2006 diesel submarine. This table includes the following reasonable assumptions: 1) the maximum value in a nominal 200-300 Hz frequency band is utilized for all SL and NL values, 2) the 1960 submarine had source levels similar to the World War II diesel submarines cited in Urick (1983), 3) the source level for the quieted diesel was conservatively reduced by 40 dB, 4) ambient noise is from the Wenz curves for moderate shipping and 11-16 knot wind speed (see Urick, 1983), and for a

conservative estimate, no increase is applied for the 2006 value, 5) array DI has improved by 5 dB accounting for improved hydrophones and array design, and 6) DT has improved by 10 dB based on improved signal processing and displays.

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

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

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

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

Some of the problems faced by PTAS are being addressed by Twinline, the shallow water variant of the basic SURTASS towed array. The system has a "Y" shaped array with two apertures, these are approximately 1/5 the length of a standard SURTASS array. Twinline is designed to provide vertical directivity, resolve right-left ambiguity, and provide higher tow speeds and increased functionality. In testing it proved its value in littoral waters by rejecting back-lobe interference in high surface-clutter areas. Twinline is planned for use with the SURTASS LFA sonar systems.

Another technology, passive synthetic-aperture sonar, artificially extends the length of the array by making use of the motion of the sensor. This method improves bearing resolution and has been able to detect lower frequencies than previous systems.

Matched-field localization, another emerging technology, seeks to match actual received signals to modeled signals in the hope of determining depth and range. This technology is currently beyond naval capabilities. Among other difficulties, it would be necessary to obtain detailed oceanic environmental data over a large area to generate accurately modeled signals. Many hope that satellites will be able to fulfill this need by providing oceanographic measurements throughout the oceans' depths, but that technology is not yet available. Were both these technologies able to work in combination they may be able to provide a three-dimensional underwater picture; range, bearing, and depth data (Ort, 2003) out to ranges greater than currently possible. However, even if they increase submarine detection ranges by an order of magnitude (i.e., out to approximately 5 nm or so), the passive sonar ship would still be within the weapons delivery range of the threat submarine and therefore extremely vulnerable.

4.6.2 Summary

There are no new passive technology advancements that meet the purpose and need as stated in the SURTASS LFA FOEIS/EIS (DON, 2001) and the Draft SEIS (2005a). Based on the continued advancements in submarine quieting techniques and the increase in oceanic ambient noise levels, the present state of passive sonar technology alone cannot meet this threat.

5.0 CONCLUSIONS

During the first four LOAs under the Final Rule for the Taking of Marine Mammals Incidental to the Navy Operations of SURTASS LFA Sonar, the Navy considers that it has met all of the requirements under Part 216 Subpart Q of the regulations and the LOAs, as issued. These include all mitigation and monitoring requirements, required reporting, and timely renewal applications for annual LOAs. In addition, this final comprehensive report is required to provide an analysis of all monitoring and research conducted during the period of these regulations, an estimate of cumulative impacts on marine mammal stocks, and an analysis on the advancement of alternative (passive) technologies as a replacement for LFA sonar. This report provides an unclassified analysis of SURTASS LFA sonar operations from the R/V *Cory Chouest* and the USNS IMPECCABLE for the first four LOAs (16 August 2002 through 15 August 2006).

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

Empirical and documentary evidence that resonance and/or tissue damage from LFA transmissions are unlikely to occur in marine mammals in the frequency range 330 to 500 Hz within and outside of the LFA mitigation zone was presented. Based on these facts, there is no scientific justification for retaining the 330-Hz upper limit interim operational restriction.

As reported in the annual reports (DON, 2003b, 2004a; 2005b, 2006c), post-operational incidental harassment assessments demonstrated that there were no known marine mammal exposures to RLs at or above 180 dB.

LFA has not been implicated in any strandings based on current operations in a relatively limited area of the northwestern Pacific Ocean and adjacent seas (Sea of Japan, East China Sea, and South China Sea). The Navy monitored and reviewed data on marine mammal strandings from federal, state, and international organizations that are involved in marine mammal and sea turtle stranding incident monitoring. A review of recent stranding data from the National Science Museum of Tokyo, Japan; the Cetacean Stranding Database; other Internet sources; and international reports did not indicate any stranding events associated with the times and locations of LFA operations in the northwestern Pacific Ocean. This is supported by both national and international reports (ICES, 2005; Cox et al., 2006).

The post-operational estimates of the percentage of marine mammal stocks exposed to LFA transmissions between 120 and 180 dB were below, in most cases well below, the maximum 12 percentage authorized in LOA Condition 6 (g) for any marine mammal stock.

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

Navy-sponsored research has been accomplished in accordance with the requirements of NMFS's Letters of Authorization and Final Rule as summarized in Table 9.

An assessment of new passive technologies demonstrates that the purpose and need as stated in the SURTASS LFA FOEIS/EIS (DON, 2001) and the Draft SEIS (2005a) remain valid. Passive sonar alone cannot meet the need in a threat environment where submarines are becoming quieter and ambient oceanic noise levels are increasing. Presently, there are no advancements in passive technologies that even approach the level of detection provided by LFA.

In conclusion, the operations of the SURTASS LFA systems, with appropriate mitigation measures, have caused no measurable environmental effects in the northwestern Pacific Ocean area. Therefore, in accordance with the requirements of the Final Supplemental Environmental Impact Statement (FSEIS) and ROD, as issued, the Navy believes that the continuation of LFA operations under new rule making is warranted.

6.0 REFERENCES

Burgess, R.R. 2005. *Awfully Slow Warfare*. Seapower 28(4): 12 – 14.

Chandler, T.E., J. Calambokidis, and K. Rasmussen. 1999. Population identity of blue whales on the Costa Rica Dome. 13th Biennial Conference on the Biology of Marine Mammals. Wailea, Hawaii.

Cox, T.M., T.J. Ragen, A.J. Read, E. Vox, R.W. Baird, K. Balcomb, J. Barlow, J. Caldwell, T. Cranford, L. Crum, A. D'Amico, G. D'Spain, A. Fernandez, J. Finneran, R. Gentry, W. Gerth, F. Gulland, J. Hildebrand, D. Houser, Y. Hullar, P.D. Jepson, D. Ketten, C.D. MacLeod, P. Miller, S. Moore, D.C Mountain, D. Palka, P. Ponganis, S. Rommel, T. Rowles, B. Taylor, P. Tyack, D. Wartzok, R. Gisiner, J. Mead, and L. Benner. 2006. Understand the impacts of anthropogenic sound on beaked whales. J. Cetacean Res. Manage. 7(3):177-187.

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.

Cudahy, E., Hanson, E. and Fothergill, D. 1999. "Summary report on the bioeffects of low frequency waterborne sound," LFA EIS, Technical Report 3, March, 1999.

Department of Commerce (DOC). 2002. Report on the workshop on acoustic resonance as a source of tissue trauma in cetaceans. April 24 and 25, 2002. Silver Spring, Maryland. National Marine Fisheries Service, Silver Spring, Maryland.

Department of the Navy (DON). 2001. Final Overseas Environmental Impact Statement and Environmental Impact Statement for Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar. Chief of Naval Operations. Washington DC. January, 2001.

Department of the Navy (DON). 2003a. Application for Letters of Authorization for the Taking of Marine Mammals Incidental to the Operation of SURTASS LFA Sonar Onboard R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23) Under NMFS Final Rule (50 CFR 216 Subpart Q. Chief of Naval Operations (N774). Washington DC. 26 June 2003.

Department of the Navy (DON). 2003b. Annual Report No. 1: Operation of the Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar Onboard the R/V *Cory Chouest* Under the National Marine Fisheries Services Letter of Authorization of 16 August 2002. May 2003.

Department of the Navy (DON). 2004a. Annual Report No. 2: Operation of the Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar Onboard the R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23) Under the National Marine Fisheries Services Letter of Authorization of 16 August 2003. May 2004.

Department of the Navy (DON). 2005a. Draft Supplemental Environmental Impact Statement for Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar. Chief of Naval Operations. Washington, D.C. November, 2005.

Department of the Navy (DON). 2005b. Annual Report No. 3: Operation of the Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar Onboard the R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23) Under the National Marine Fisheries Services Letter of Authorization of 16 August 2004. May 2005.

Department of the Navy (DON). 2006a. Application for Letters of Authorization Under Section 101(a)(5)(A) of the Marine Mammal Protection Act for Activities Associated with the Employment of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar. Chief of Naval Operations (N872A). Washington DC. 12 May 2006.

Department of the Navy (DON). 2006b. Biological Assessment for the Employment of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar. Chief of Naval Operations (N872A). Washington DC. 9 June 2006.

Department of the Navy (DON). 2006c. Annual Report No. 4: Operation of the Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar Onboard the R/V *Cory Chouest* and USNS IMPECCABLE (T-AGOS 23) Under the National Marine Fisheries Service Letters of Authorization of 12 August 2005. Chief of Naval Operations. Wash DC.

D'Spain, G.L., A. D'Amico, and D.A. Fromm. 2006. Properties of the underwater sound fields during some well documented beaked whale mass stranding events. J. Cetacean Res. Manage. 7:223-23.

Ellison, W.T., and P.J. Stein. 2001. SURTASS LFA High Frequency Marine Mammal Monitoring (HF/M3) Sonar: System Description and Test & Evaluation. Marine Acoustics Inc. and Scientific Solutions Inc.

Fair, P.A., P.R. Becker. 2000. Review of stress in marine mammals. Journal of Aquatic Ecosystem Stress and Recovery 7:335-354.

Farrell, R.E. 2003. Revitalize ASW. Proceedings, U.S.Nav.Inst., Vol 129/12/1,210 pp.40-43.

Frantzis, A. 1998. Does acoustic testing strand whales? Nature 392:29.

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

Friedmann, Normann. 2004. *Sonar Technology: Where We Are, Where We Are Likely to Be Going*. Naval Forces 25(5): 76 – 84.

Gerth, W.A., and E.D. Thalmann. 1999. "Vascular effects of underwater low frequency sound in immersed individuals." Underwater Sound Conference of January 25, 1999.

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.

Halvorsen, M. B., Wysocki, L. E., and Popper, A. N. 2006. Effects of high-intensity sonar on fish. J. Acoust. Soc. Am. 119:3283.

Hildebrand, John. 2004. Sources of Anthropogenic Sound in the Marine Environment. Report to the Policy on Sound and Marine Mammals: An International Workshop. U.S. Marine Mammal Commission and Joint Nature Conservation Committee, UK. London, England.

ICES, 2005. Report of the Ad-Hoc Group on the Impacts of Sonar on Cetaceans and Fish (AGISC) (2nd edition). International Council for the Exploration of the Sea (ICES). ICES CM 2005/ACE:06.

IUCN (The World Conservation Union). 1995. A global representative system of marine protected areas. Vol. 1, Antarctic, Arctic, Mediterranean, Northwest Atlantic, Northeast Atlantic and Baltic. The International Bank for Reconstruction and Development/The World Bank, 818 H. Street, N.W., Washington, DC.

Ketten, D. 2001. Congressional Testimony House Resources Committee, Subcommittee on Fisheries Conservation, Wildlife and Oceans Hearing: Marine Mammal Protection Act/Low Frequency Sonar. October 11, 2001.

Laurer, H.L., A.N. Ritting, A.B. Russ, F.M. Bareyre, R. Raghupathi, and K.E. Saatman. 2002. Effects of underwater sound exposure on neurological function and brain histology. Ultrasound in Med. &. Biol., Vol. 28, No. 7, pp. 965-973.

Longhurst, A. 1998. Ecological geography of the sea. Academic Press, San Diego, CA.

Naval Oceanographic Office (NAVOCEANO). 1999. Fleet Oceanographic and Acoustic Reference Manual. RP 33. Stennis Space Center, MS. April 1999.

National Marine Fisheries Service (NMFS). 2002a. Supplemental Biological Opinion: Proposed letter of authorization to authorize Navy to take marine mammals incidental to its employment of Surveillance Towed Array Sensor System Low Frequency Active Sonar for the period August 16, 2002, through August 15, 2003. U.S. Dept. of Comm., NOAA, NMFS. Silver Spring, MD. 16 August 2002.

National Marine Fisheries Service (NMFS). 2002b. Biological Opinion: Proposed regulations to authorize the Navy to take marine mammals incidental to its employment of Surveillance

Towed Array Sensor System Low Frequency Active Sonar. U.S. Dept. of Comm., NOAA, NMFS. Silver Spring, MD. 30 May 2002.

National Research Council (NRC). 2003. Ocean Noise and Marine Mammals. National Academy Press. Washington, D.C.

National Research Council (NRC). 2005. Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects. The National Academies Press. Wash DC.

Naval Doctrine Command. 1997. Littoral Anti-submarine Warfare Draft Concept - Draft 3 for the Littoral ASW Concept Development Team. Department of the Navy, Naval Doctrine Command, 24 March 1997.

Ort, Coenraad, Peter Beerens, and Pascal de Theije. 2003. *From Low Frequency Active Sonar to Netcentric Underwater Warfare: Remedy for 'Silent Subs'?* Naval Forces 24(5): 41 – 48.

Popper, A.N., M.B. Halvorsen, D. Miller, M.E. Smith, J. Song, L.E. Wysocki, M.C. Hastings, A.S. Kane, and P.Stein. 2005. Effects of surveillance towed array sensor system (SURTASS) low frequency active sonar on fish. J. Acoust. Soc. Am. 117, 2440 (2005).

Romano TA, Keogh MJ, Kelly C, Feng P, Berk L, Schlundt CE, Carder DA, Finneran JJ (2004) Anthropogenic sound and marine mammal health: measures of the nervous and immune systems before and after intense sound exposure. Canadian Journal of Fisheries and Aquatic Sciences 61:1124-1134.

Smith ,M.E., A. S. Kane, and A. N. Popper. 2004. "Noise-induced stress response and hearing loss in goldfish (*Carassius auratus*), J. Exp. Biol. 207, 427-435.

Stein, P., J. Rudzinsky, m. Birmann, W. Ellison, and J. Johnson. 2001. High Frequency Marine Mammal Mitigation Active Sonar System. 1002. MTS 0-933957-28-9.

Thomas J, Kastelein R, Aubrey F (1990) Behavior and blood catecholamines of captive belugas during playbacks on noise from an oil drilling platform. Zoo Biology 9:393-402.

Tyack, P.L., M. Johnson, N.A. Soto, A. Sturlese, and P.T. Madsen. 2006. Extreme diving of beaked whales. The Journal of Experimental Biology 209: 4238-4253.

Tyler, G.D., Jr. 1992. The emergence of low-frequency active acoustics as a critical antisubmarine warfare technology. Johns Hopkins APL Technical Digest 13(1):145-159.

Urick, R.J. 1983. Principles of Underwater Sound, 3rd Edition. McGraw-Hill, Inc. Los Altos, CA.

Watts, A.J. (Editor). 2003. Jane's Underwater Systems Fifteenth Edition 2003-2004. Jane's Information Group Limited, Surrey, UK.

APPENDIX A

Stipulation and Order RE: Preliminary Injunction
15 November 2002

FILED

NOV 15 2002

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SAN FRANCISCO DIVISION

NATURAL RESOURCES DEFENSE COUNCIL, INC. et al.,

Plaintiffs,

v.

DONALD L. EVANS, et al.,

Defendants.

Civ. No. 02-3805-EDL
STIPULATION AND ORDER RE: PRELIMINARY INJUNCTION

Pursuant to the Court's October 31,2002, Opinion and Order (Opinion and Order) in this matter, and after the meet and confer process directed by that Opinion and Order, the parties have arrived at the following stipulation:

i. Neither party waives any right of appeal from the Opinion and Order or from the Order entering this stipulation by entering into the meet and confer process or by submitting this agreed upon stipulation;

ii. This stipulation will remain in effect until the expiration of the August 16, 2002, Letter of Authorization (LOA) issued by the National Marine Fisheries Service for operation of SURTASS LFA sonar or until a final judgment on the merits by the district court, whichever occurs first;

iii. The parties agree that all discussions leading up to this stipulation are confidential;

iv. The parties agree that tho attached maps (Tabs 1 and 2) and associated text (Tab 3) will govern operation of SURTASS LFA sonar under the LOA. The green-striped area on the attached "Stipulated LFA Operating *Areas* for LOA 1" map (Tab *1)* shows the area where SURTASS LFA will operate and the yellow area on

the attached "Detail for Area A" map (Tab 2) shows where SURTASS LFA sonar will not be operated within the green-striped area. The yellow area on the attached "Detail for Area A" map (Tab 2) is the same as the "exclusion zone within the stipulated LFA operating area" defined in Tab 3. A detailed map including precise coordinates will be generated no later than November 22, 2002;

v. The coastal buffer zone defined in 50 C.F.R. 216.184(e)(1) shall be extended to 40 kilometers for purposes of this stipulation;

vi. Operation of SURTASS LFA pursuant to this stipulation shall remain subject to the LOA to the extent consistent with this stipulation;

vii. This stipulation shall not be deemed a waiver by either party of the right to claim or oppose attorneys fees;

viii. The stipulation is not to be construed as a concession by either party as to (a) the potential impacts on marine mammals or other animals of operating SURTASS LFA sonar, (b) the absence or presence of marine mammals or other animals in any areas depicted on the attached map, or (c) the validity of any other fact or legal position concerning the claims or defenses in this action; and

ix. The parties agree that the entry of this Order constitutes preliminary injunctive relief under 28 U.S.C. §1292(a), for which the time for appeal runs from the date of entry of this Order.

SO STIPULATED.

Respectfully submitted this 15th day of November 2002,

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Attorneys for Defendants

SO ORDERED,

Nov. 15, 2002

Elizabeth D. Laporte

Magistrate Judge Elizabeth Laporte

Stipulated LFA Operating *Area*

(November 15,2002)

1. The stipulated area of LFA Operations for LOA 1 is defined as follows: a zone between latitude 12N and 40N and between the east and west lines shown on tho attached *map.* Boundaries of this *area an?* defined as follows:

   The Northern Boundary is at 40N latitude.

   The Eastern Boundary is at 155 E longitude

   The Southern Boundary is at 12 N latitude.

   The Western Boundary is defined as follows'Beginning at 40 degrees N latitude, running south along a line *at* 100 km seaward of the 3000m isobath to the south-east tip of Taiwan, and thence running *along* a direct line to 12N128E.

2. Exclusion Zone within the Stipulated LFA Operating Area is defined as follows:

   The zone extends from 29N south to 15N along the Bonin Island chain, including Ogasawara, extending south through the northern Marianas south to Saipan (15N).

   The zone is defined, along the above island chain, as 100 km from the 200 meter depth contour. In addition, where there are gaps of lees than 200km, (between the 200m depth contours), the zone is extended along a line connecting the outer edged of the 200m depth contour. Where there are gaps between the 200m contours in excess of 200km *the* zone is defined as a 50 km buffer *on* either side of a line connecting the center points of the 200m contour (still staying 100km away from any area of less

Stipulated LFA Operating *Area*
(November 15,2002)

1. **The stipulated area of LFA operations for LOA 1 is defined as follows: a zone between latitude 12N and 40N and between the east and west lines shown on the attached *map.* Boundaries of this area are defined as follows:**

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   The zone extends from 29N south to 15N along the Bonin Island chain, including Ogasawara, extending south through the northern Marianas south to Saipan (15N)

   The zone is defined, dong the above island chain, as 100 km from the 200 meter depth contour. In addition. where there are gaps of less than 200km, (between the 200m depth contours), the zone is extended along a line connecting the outer edges of the 200m depth contour. Where there are gaps between the 200m contours in excess of 200km *the* zone is defined *as* a 50 km buffer on either side of a line connecting the center points of the 200m contour (still staying 100km away from any area of less than 200m water depth).

TAB 3

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SAN FRANCISCO DIVISION

NATURAL RESOURCES DEFENSE COUNCIL, INC. et al.,

Plaintiffs,

v.

DONALD L. EVANS, et al.,

Defendants.

Civ. No. 02-3805-EDL

CERTIFICATE OF SERVICE

I hereby certify that on November 15, 2002, I caused a true and correct copy of the attached Stipulation Re: Preliminary Injunction and attachments to be sent by facsimile and by Federal Express to the following attorneys of record:

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UNITED STATES DISTRICT COURT

FOR THE

NORTHERN DISTRICT OF CALIFORNIA

Natural Resources Defense Council, et al.,

Plaintiffs,

v.

Donald L. Evans, et al.,

Defendants.

Case Number: C-02-3805 EDL

CERTIFICATE OF SERVICE

I, the undersigned, hereby certify that I am an employee in the Office of the Clerk, U.S. District Court, Northern District of California.

That on November 15, 2002, I SERVED a true and correct copy(ies) of the attached, by placing said copy(ies) in a postage paid envelope addressed to the person(s) hereinafter listed, by depositing said envelope in the U.S. Mail, or by placing said copy(ies) into an inter-office delivery receptacle located in the Clerk's office.

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Dated: November 15, 2002

Richard W. Wieking, Clerk

By: Welinda Hewlin Kelly
Deputy Clerk

APPENDIX B

Stipulation Regarding Permanent Injunction
14 October 2003

ORIGINAL

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v.

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Defendants.

Civ. No. 02-3805-EDL

STIPULATION REGARDING PERMANENT INJUNCTION

Pursuant to the Court's August 26, 2003, Opinion and Order on Cross Motions for Summary Judgment (Opinion and Order) in this matter, and after the meet and confer process directed by that Opinion and Order, the parties have arrived at the following Stipulation:

1. Neither party waives any right of appeal from the Opinion and Order or from the Order entering this Stipulation by entering into the meet and confer process or by submitting this agreed upon Stipulation.

2. The parties agree that all negotiations leading up to this Stipulation are confidential.

3. The parties agree that this Stipulation shall remain in effect unless modified by the Court until the earlier of: (a) the expiration of the Final Rule, 50 C.F.R. Part 216, Subpart Q (Taking of Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar) (Final Rule); (b) the determination by this Court, pursuant to a noticed motion or stipulation by the parties, that the Opinion and Order and this Stipulation are superseded by subsequent relevant events or authority, including but not limited to the outcome of any appeal; or (c) the issuance of a mandate by a higher court which overturns this Court's Opinion and Order and vacates the injunction.

4. The parties agree that if the Navy wishes to seek an alteration to the stipulated operational areas (described in paragraph 5 below) for the final two years of the Final Rule, the parties shall engage in a meet and confer process with the assistance of a court-designated mediator. This meet and confer process shall be subject to the Opinion and Order and any subsequent relevant opinions, orders, or other applicable authority. No later than April 1, 2005, the parties agree to submit a joint status report to the Court stating whether there is a need for a further meet and confer process. The parties agree to complete this meet and confer process no later than August 1, 2005. If the meet and confer process does not yield an agreement, any party may apply to the Court for resolution of the dispute.

5. The parties agree that the attached maps and associated text describing coordinates and seasonal restrictions (Tabs 1, 2, 3, 4) will govern operations of SURTASS LFA sonar under the current Letters of Authorization ("LOAs") or any future LOAs issued during the pendency of the Stipulation until one of the events described in paragraphs 3 and 4 above occurs. The associated map text reflects the following coastal exclusion zones wherein received sound pressure levels shall not exceed 180 dB: (a) for the Stipulated Area within the Philippine Sea, a coastal exclusion zone of at least 60 nautical miles or 30 nautical miles seaward of the 200 meter isobath, whichever is greater, except for waters adjacent to Taiwan, which shall be subject to "(b)" below; and (b) for all other areas, a coastal exclusion zone of at least 30 nautical miles. In the event of a discrepancy between the maps in Tabs 1 through 4 and the associated map text, the associated text controls. Likewise, in the event of a discrepancy between this paragraph's description of the associated map text ((5)(a) and (b) above) and the map text itself, the map text controls. The parties agree that the Navy shall also observe a coastal exclusion zone of 30 nautical miles around any islands occurring within the stipulated areas of operation.

6. The Navy agrees that if SURTASS LFA sonar transmissions are delayed or suspended as a result of the detection by the HF/M3 sonar, passive sonar, or visual observation within the 180 dB plus the one-kilometer buffer zone, as set forth in 50 C.F.R. § 216.184(b), of a marine mammal, sea turtle, or other marine species, transmissions will not resume until 15 minutes after there are no further detections by the HF/M3 sonar or by visual observations of the marine mammal, sea turtle, or other marine species within the 180 dB plus the one-kilometer buffer zone.

7. The parties agree that the Navy is not required to conduct "pre-operation surveys," as described in the Opinion and Order, for the duration of this Stipulation.

8. Operation of SURTASS LFA pursuant to this Stipulation shall remain subject to the applicable Letters of Authorization issued by the National Marine Fisheries Service. In the event of a conflict between this Stipulation and any Letter of Authorization, the more restrictive condition, provision, or requirement will apply.

9. This Stipulation shall not be deemed a waiver by either party of the right to claim or oppose attorney's fees.

10. This Stipulation is not to be construed as a concession by either party as to (a) the potential impacts on marine mammals or other animals of operating SURTASS LFA sonar, (b) the absence or presence of marine mammals or other animals in any areas depicted on the attached maps, or (c) the validity of any other fact or legal position concerning the claims or defenses in this action.

11. Nothing in this Stipulation shall prevent any party from returning to the Court at any time to seek relief from its terms.

SO STIPULATED.

Respectfully stipulated to and submitted this 8th day of October 2003,

THOMAS L. SANSONETTI
Assistant Attorney General
Environment and Natural Resources Division

JEAN WILLIAMS, Chief
Wildlife and Marine Resources Section

KRISTEN L. GUSTAFSON, Trial Attorney
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SO STIPULATED.

Respectfully stipulated to and submitted this 8th day of October 2003,

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Assistant Attorney General
Environment and Natural Resources Division

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Wildlife and Marine Resources Section

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(323) 934-1210 (fax)

Attorneys for Plaintiffs

The terms of the above Stipulation are hereby approved and so ORDERED.

Dated: October 14, 2003

Magistrate Judge Elizabeth D. LaPorte

PROOF OF SERVICE

I declare that I am employed with the law firm of Morrison & Foerster LLP, whose address is 425 Market Street, San Francisco, California 94105. I am not a party to the within cause and am over the age of eighteen years.

On October 8, 2003, I caused to be served a true copy of the within:

STIPULATION REGARDING PERMANENT INJUNCTION

☒ BY FACSIMILE AND UPS OVERNIGHT DELIVERY

addressed to the following persons:

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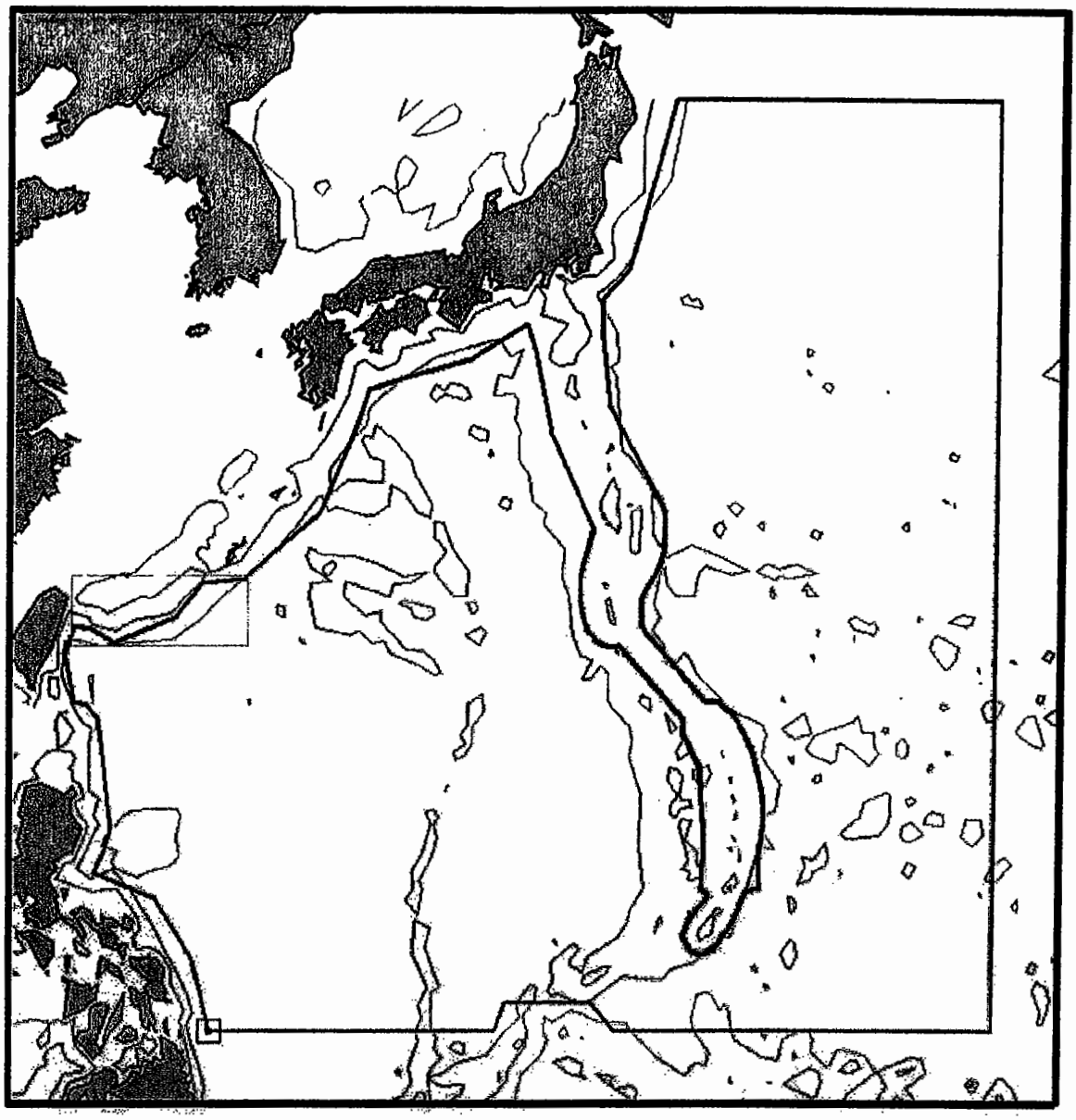
I declare under penalty of perjury under the laws of the State of California that the above is true and correct.

Executed at San Francisco, California, this 8th day of October 2003.

Millie Calvo
(typed)

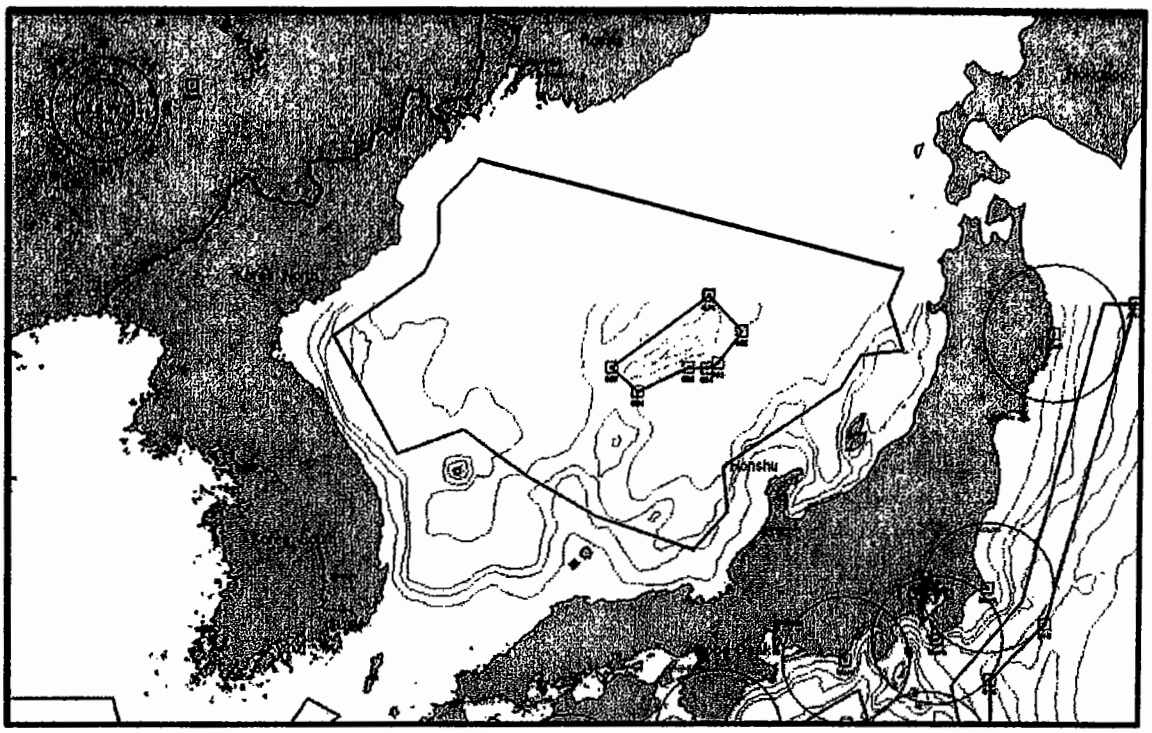
Millie Calvo
(signature)

Philippine Sea Area



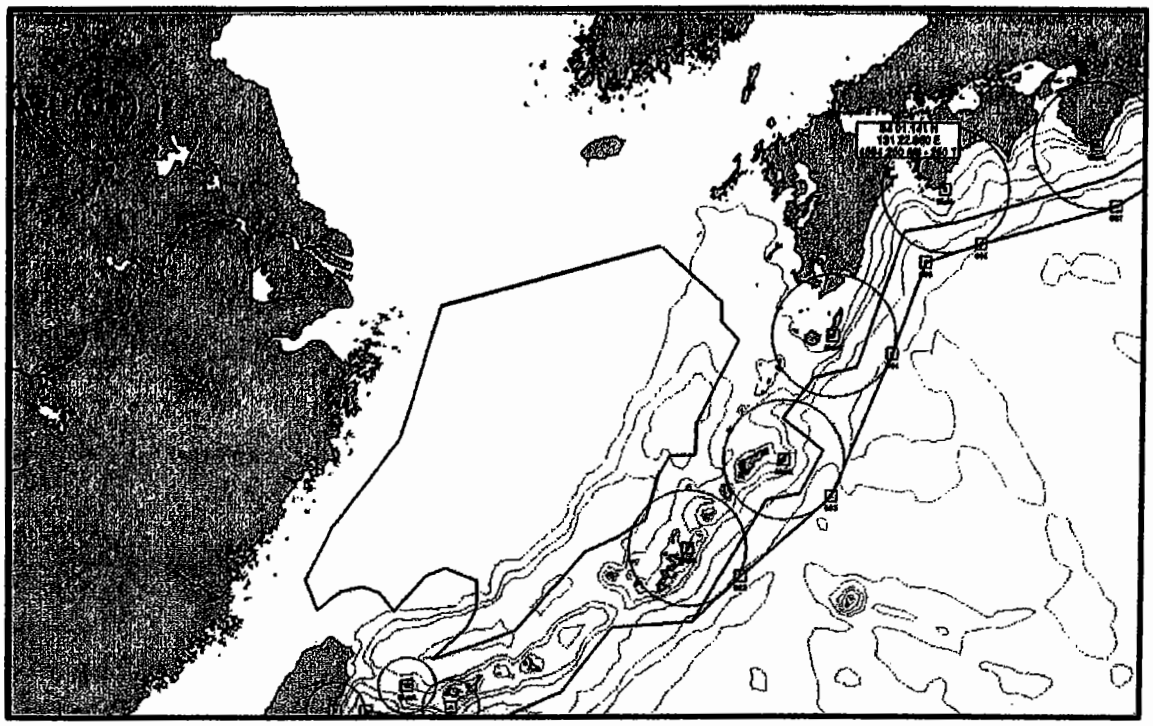
Posit #	Latitude	Longitude	Posit #	Latitude	Longitude
Philippine Sea Year-Round					
1	10 00.0 N	127 09.5 E	19	31 34.6 N	132 38.6 E
2	10 00.0 N	137 16.0 E	20	30 05.1 N	132 02.4 E
3	11 00.0 N	137 37.0 E	21	27 41.6 N	130 54.9 E
4	11 00.0 N	140 44.6 E	22	25 33.5 N	128 19.4 E
5	10 00.0 N	141 31.9 E	23	25 26.9 N	126 48.3 E
6	10 00.0 N	155 00.0 E	24	24 19.4 N	125 50.8 E
7	40 00.0 N	155 00.0 E	25	23 26.6 N	123 42.3 E
8	40 00.0 N	143 32.7 E	26	23 53.4 N	122 53.3 E
9	35 09.6 N	141 55.4 E	27	24 01.3 N	122 15.8 E
10	34 17.2 N	140 55.2 E	28	23 02.2 N	121 56.4 E
11	33 06.7 N	140 58.4 E	29	21 29.7 N	122 13.8 E
12	31 02.2 N	141 17.3 E	30	21 22.6 N	122 39.9 E
13	28 24.4 N	142 52.1 E	31	20 55.4 N	123 04.8 E
14	27 01.8 N	140 47.1 E	32	17 03.5 N	123 35.4 E
15	30 10.7 N	139 10.3 E	33	15 33.5 N	123 01.2 E
16	32 45.7 N	138 35.4 E	34	14 41.2 N	125 07.0 E
17	33 34.3 N	138 14.5 E	35	12 31.1 N	126 28.9 E
18	32 29.3 N	136 12.3 E			
Philippine Sea Exclusion Zone Restricted					
1	28 49.9 N	141 53.9 E	20	12 40.5 N	144 35.8 E
2	28 24.0 N	142 52.8 E	21	12 52.2 N	144 14.9 E
3	27 39.4 N	143 15.9 E	22	13 19.9 N	144 01.1 E
4	26 33.3 N	143 16.6 E	23	13 57.6 N	144 15.4 E
5	25 51.3 N	142 57.4 E	24	14 45.4 N	145 01.0 E
6	24 54.2 N	142 22.7 E	25	15 00.0 N	144 37.4 E
7	24 22.9 N	142 26 2 E	26	16 44.9 N	144 46.6 E
8	23 57.5 N	142 24.2 E	27	19 17.6 N	144 31.1 E
9	21 26.0 N	144 44.6 E	28	20 15.0 N	144 00.7 E
10	21 24.5 N	145 13.5 E	29	20 32.5 N	143 56.1 E
11	21 01.1 N	145 43.5 E	30	20 50.2 N	143 59.3 E
12	19 55.5 N	146 21.7 E	31	23 20.0 N	141 41.6 E
13	18 14.8 N	146 46.6 E	32	23 19.3 N	141 18.8 E
14	17 33.4 N	146 49.8 E	33	23 31.0 N	140 50.2 E
15	16 30.0 N	146 42.4 E	34	23 55.9 N	140 31.0 E
16	15 00.0 N	146 43.0 E	35	24 51.7 N	140 15.3 E
17	14 51.2 N	146 13.5 E	36	25 39.0 N	140 18.3 E
18	13 47.4 N	145 44.3 E	37	27 10.0 N	140 44.8 E
19	12 50.1 N	145 04.4 E	38	28 50.0 N	141 53.9 E

Sea of Japan Area



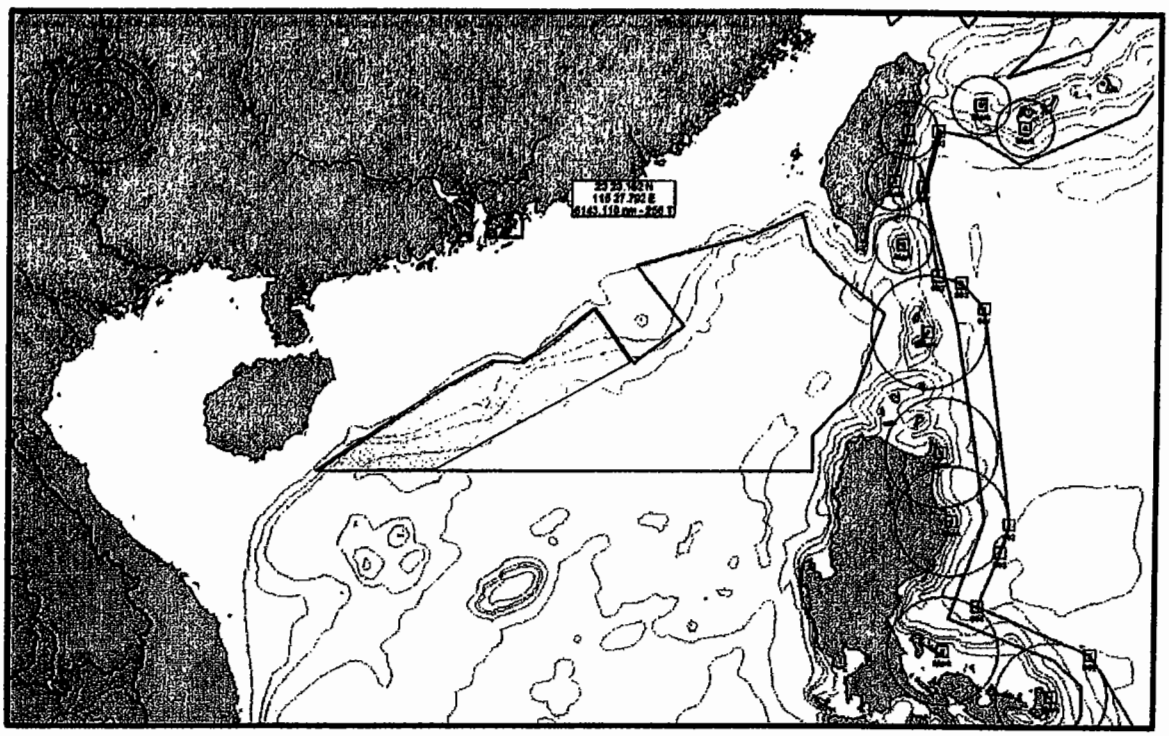
Posit #	Latitude	Longitude	Posit #	Latitude	Longitude
Sea of Japan Restricted May thru July			Yamato Rise Restricted		
1	42 00.0 N	131 14.9 E	1	40 05.9 N	135 31.3 E
2	40 28.7 N	139 10.7 E	2	39 34.0 N	136 12.0 E
3	39 58.3 N	138 57.5 E	3	39 06.0 N	135 45.4 E
4	39 18.1 N	139 13.9 E	4	39 01.9 N	135 32.9 E
5	39 13.4 N	138 27.5 E	5	39 02.4 N	135 11.6 E
6	38 43.6 N	138 03.1 E	6	38 41.8 N	134 15.0 E
7	37 33.6 N	135 51.5 E	7	39 01.9 N	133 42.9 E
8	36 53.0 N	135 57.6 E			
9	36 18.2 N	135 19.2 E			
10	36 48.9 N	133 27.8 E			
11	37 24.1 N	132 13.0 E			
12	38 07.6 N	130 57.8 E			
13	37 45.7 N	129 43.1 E			
14	39 31.2 N	128 33.2 E			
15	40 25.3 N	130 12.2 E			
16	40 51.4 N	130 28.4 E			
17	41 24.1 N	130 28.9 E			

East China Sea Area



Posit #	Latitude	Longitude	Posit #	Latitude	Longitude
East China Sea Year-Round					
1	31 49.2 N	127 40.3 E	15	25 27.9 N	124 05.0 E
2	30 55.6 N	128 50.1 E	16	25 48.9 N	124 15.8 E
3	30 36.6 N	128 49.5 E	17	26 16.2 N	124 14.7 E
4	30 18.0 N	129 09.4 E	18	26 29.1 N	123 39.5 E
5	28 56.1 N	128 22.3 E	19	26 20.4 N	123 17.6 E
6	28 23.6 N	128 20.8 E	20	25 44.5 N	122 42.6 E
7	28 23.2 N	127 52.5 E	21	26 03.9 N	122 25.3 E
8	28 03.7 N	127 38.8 E	22	26 10.2 N	122 06.9 E
9	27 18.5 N	127 25.9 E	23	26 04.6 N	121 42.8 E
10	27 00.5 N	126 53.1 E	24	25 46.3 N	121 17.3 E
11	26 45.7 N	126 17.0 E	25	26 16.9 N	121 03.3 E
12	25 24.0 N	124 59.3 E	26	27 11.8 N	121 33.8 E
13	25 08.7 N	124 14.0 E	27	28 41.6 N	122 47.9 E
14	24 54.1 N	123 25.7 E	28	30 54.3 N	123 33.5 E

South China Sea Area

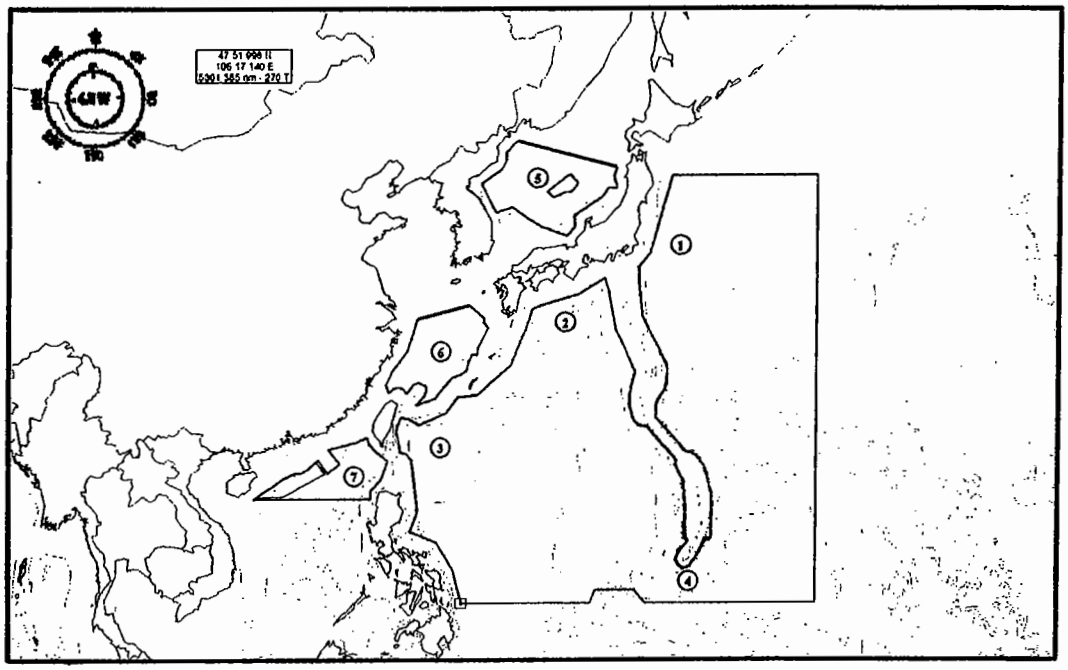


Posit #	Latitude	Longitude
South China Sea Year-Round		
1	18 00.0 N	119 56.4 E
2A	18 00.0 N	112 58.9 E
8	19 55.9 N	116 35.5 E
9	20 35.8 N	117 32.2 E
10	21 40.2 N	116 38 4 E
11	22 10.8 N	118 46.4 E
12	22 34.1 N	119 41.6 E
13	22 23.4 N	119 44.7 E
14	22 00.9 N	119 51.6 E
15	21 32.9 N	120 17.7 E
16	20 49.5 N	121 15.1 E
17	19 24.2 N	120 42.2 E
18	18 39.4 N	119 57.2 E

Posit #	Latitude	Longitude
South China Sea Restricted Nov thru Apr		
2A	18 00.0 N	112 58.9 E
2	18 00.0 N	110 43.5 E
3	19 30.2 N	113 06.3 E
4	19 58.1 N	114 03.7 E
5	19 56.0 N	114 32.1 E
6	20 14.3 N	115 02.9 E
7	20 54.1 N	115 53.2 E
8	19 55.9 N	116 35.5 E

Enclosure (2)
North Pacific Ocean Mission Areas and Boundary Conditions – R/V *Cory Chouest* and USNS IMPECCABLE Combined Planned Mission Areas for 3rd Year LOAs

Mission Areas and Sites



Mission Area Boundary Conditions

Mission Area	Site	Boundary Conditions
Stipulated East of Japan	1	Conduct ops at least 30 nm offshore. From May through November, for ops north of 34 N, remain in waters deeper than 3000 meters or at least 30 nm offshore, whichever is a greater distance offshore, due to presumed beaked whale habitat.
Stipulated North Philippine Sea	2	Conduct ops at least 60 nm offshore or 30 nm seaward of the 200-m isobath.
Stipulated West Philippine Sea	3	From December through April, conduct ops in waters offshore of the 5000 meter isobath or 60 nm offshore, whichever is a greater distance offshore, due to presumed humpback whale breeding/calving areas in shallow, near-shore waters. During other months, conduct ops at least 60 nm offshore or 30 nm seaward of the 200-m isobath.
Stipulated Guam	4	Conduct ops at least 30 nm offshore.
Sea of Japan	5	Conduct all ops in waters deeper than 1000 meters or at least 30 nm offshore, whichever proves the greatest distance offshore, and avoid the Yamato Rise due to presumed beaked whale habitat. This also addresses presumed gray whale migration activity in shallow, near-shore waters during January, March and December.
East China Sea	6	Conduct all ops at least 30 nm offshore, which addresses presumed gray whale migration activity December through March in shallow near-shore waters; and presumed humpback whale breeding/calving activity in shallow, near-shore waters of Okinawa and Miyako Retto Islands December through April. For ops December through March remain southeast of line between 34N/126E and 30N/122E due to presumed gray whale migration activity.
South China Sea	7	Conduct all ops at least 30 nm offshore, which addresses presumed gray whale migration activity in shallow, near-shore waters and presumed gray whale breeding/calving activity in shallow, near-shore waters of Hainan Island; and presumed humpback whale breeding/calving activity in shallow, near-shore waters of Batan and Babuyan Islands in the Luzon Strait.

APPENDIX C

Amendment to the Stipulation Regarding Permanent Injunction 7 July 2005

RECEIVED
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CLERK, U.S. DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA

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UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

NATURAL RESOURCES DEFENSE COUNCIL, INC., et al.,

Plaintiffs,

v.

CARLOS M. GUTIERREZ, et al.,

Defendants.

Civ. No. 02-3805-EDL

AMENDMENT TO THE STIPULATION REGARDING PERMANENT INJUNCTION

JUL 13 2005
90-8-6-05418

On October 8, 2003, the parties executed and filed a Stipulation Regarding Permanent Injunction, which the Court entered as an order on October 14, 2003 ("Stipulation"). Paragraph 5 of the Stipulation and Tabs 1-4 describe coordinates and seasonal restrictions governing the United States Department of the Navy's ("Navy") operation of the SURTASS LFA sonar system under Letters of Authorization ("LOAs") issued by the National Marine Fisheries Service ("NMFS") during the pendency of the Stipulation until one of the events described in paragraph 3 of the Stipulation occurs. In the event that the Navy needs to alter the operational areas described in paragraph 5 for the final two years of the Final Rule, 50 C.F.R. Part 216, Subpart Q (Taking of Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar) ("Final Rule"), paragraph 4 of the Stipulation establishes a procedure for the parties to meet and confer with the assistance of a court-designated mediator.

In accordance with the procedure outlined in paragraph 4, counsel for Defendants contacted Plaintiffs and the Court regarding amending the stipulated operating areas for the final two years of the Final Rule. The Navy seeks to amend the operational areas described in paragraph 5 of the Stipulation based on its conclusion that updated national security requirements dictate a need to operate the SURTASS LFA sonar system in an expanded area of the Northwestern Pacific Ocean.

Pursuant to the Court's Order of April 12, 2005, on May 18, 2005, the parties engaged in mediation assisted by Magistrate Judge Joseph C. Spero to discuss the Navy's request for an expansion of the authorized operating areas. Through mediation the parties agreed to the following Amendment to the Stipulation Regarding Permanent Injunction ("Amendment"):

1. Except as amended herein, the parties agree that all terms of the Stipulation remain in full force and effect.

2. The parties agree that all negotiations leading up to this Amendment are confidential.

3. The parties agree that the Stipulation, as amended herein, shall remain in effect unless modified by the Court until the earlier of: (a) the expiration of the Final Rule, 50 C.F.R. Part 216, Subpart Q (Taking of Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar); (b) the determination by this Court, pursuant to a noticed motion or stipulation by the parties, that the Court's Opinion and Order and the Stipulation, as amended herein, are superseded by subsequent relevant events or authority, including but not limited to the outcome of any appeal; or (c) the issuance of a mandate by a higher court which overturns this Court's Opinion and Order and vacates the injunction.

4. The parties agree that paragraph 5 of the Stipulation is amended as follows: (a) The eastern boundary of the northwestern Pacific Ocean area in which the Navy is currently authorized to operate SURTASS LFA sonar under LOAs is enlarged from 10 degrees N/ 150 degrees E and 40 degrees N/ 150 degrees E to 10 degrees N/ 180 degrees E and 40 degrees N/ 180 degrees E ("Expanded Northwestern Pacific Ocean Area") with certain exclusion zones described below in subsections (b) and (c); (b) a coastal exclusion zone of at least 30nm wherein received sound pressure levels shall not exceed 180 dB will apply within the Expanded Northwestern Pacific Ocean Area, including the islands indicated on the map and associated text attached hereto at Tab 1, except for waters adjacent to the islands of Taka/Utrik, Rongelap, and Bikini, where a greater exclusion zone will apply, as indicated; (c) the map and associated text attached hereto at Tab 2 identify an exclusion zone for the protection of the Hawaiian monk seal, wherein received sound pressure levels shall not exceed 180 dB. In the event of a discrepancy between the maps at Tabs 1 and 2 and the associated map text, the associated text controls. Likewise, in the event of a discrepancy between this paragraph's description of the associated map text and the map text itself, the map text controls.

5. This Amendment is not to be construed as a concession by either party as to (a) the potential impacts on marine mammals or other animals of operating SURTASS LFA sonar, (b) the absence or presence of marine mammals or other animals in any areas depicted on the attached maps, or (c) the validity of any other fact or legal position concerning the claims or defenses in this action.

6. Nothing in this Amendment shall prevent any party from returning to the Court at any time to seek relief from the terms of the Stipulation, as amended.

SO STIPULATED.

Respectfully stipulated to and submitted this 30th day of June 2005,

KELLY A. JOHNSON
Acting Assistant Attorney General
Environment and Natural Resources Division

JEAN E. WILLIAMS, Chief
Wildlife and Marine Resources Section

Kristen L. Gustafson

KRISTEN L. GUSTAFSON, Trial Attorney
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ANN D. NAVARO, Senior Attorney
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Attorneys for Federal Defendants

Respectfully stipulated to and submitted this 30th day of June 2005,

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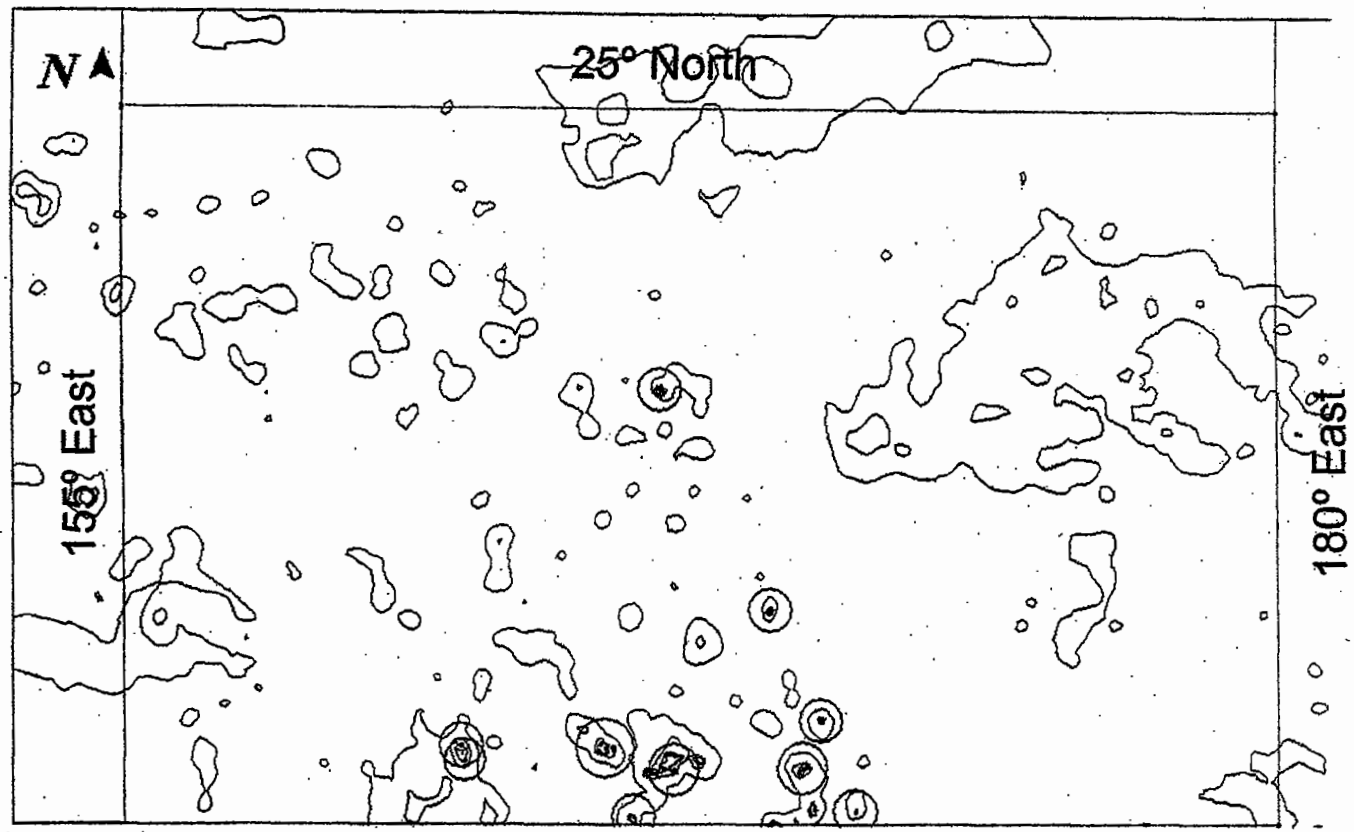
Attorneys for Plaintiffs

The terms of the above Amendment to the Stipulation Regarding Permanent Injunction are hereby approved and so ORDERED.

DATED: July 7, 2005

ELIZABETH D. LAPORTE
United States Magistrate Judge

Tab 1: Coastal exclusion zones for islands in the expanded northwestern Pacific Ocean area

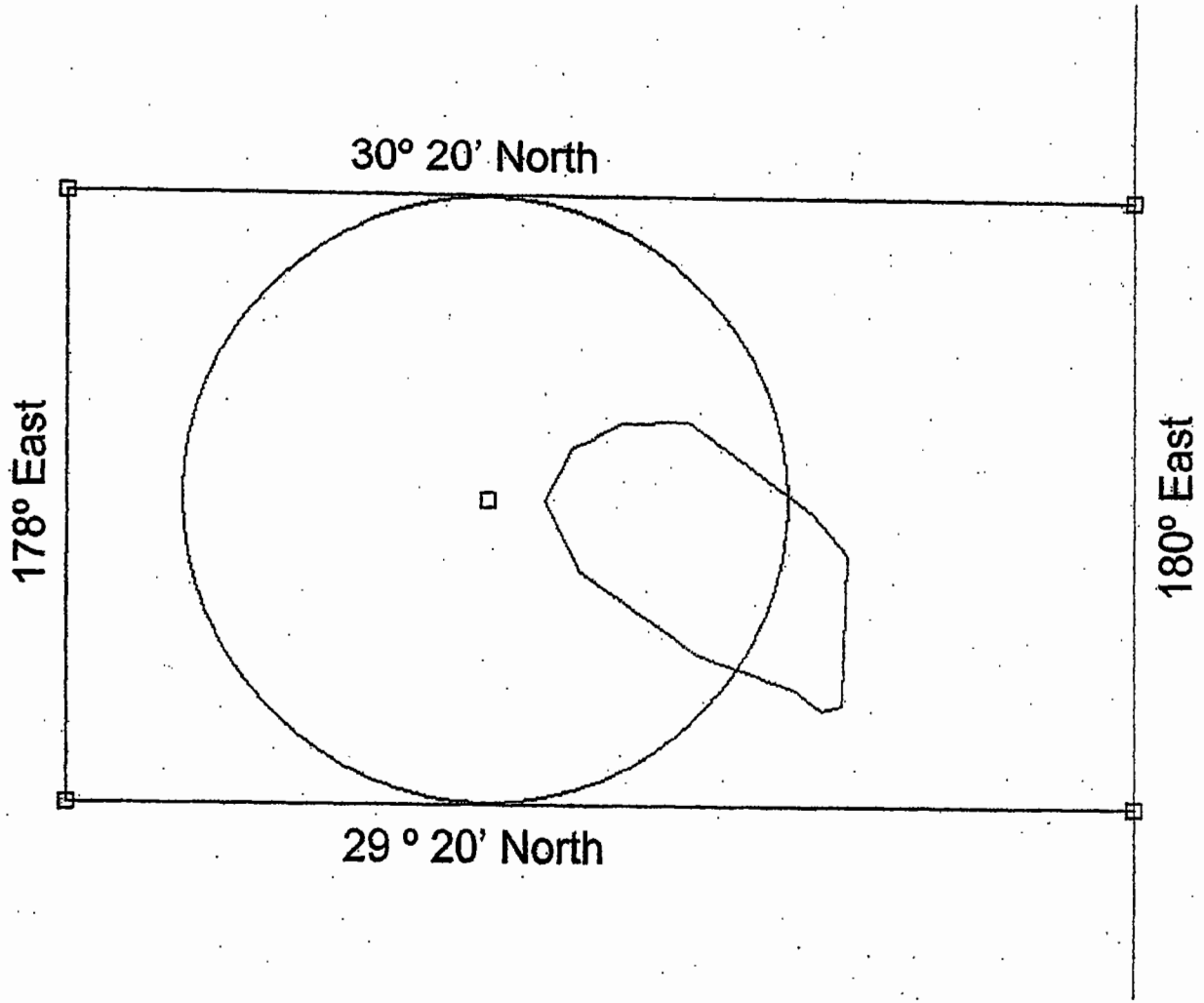


TAB 1: COASTAL EXCLUSION ZONES FOR ISLANDS IN THE EXPANDED NORTHWESTERN PACIFIC OCEAN AREA

Location	Lat (N)	Lon (E)	Radius (nm)
Wake	19 17.978	166 37.113	30
Sibylla	14 36.072	169 0.399	30
Bikar	12 11.703	170 6.769	30
Taka/Utrik	11 11.141	169 43.444	*35
Mejit	10 16.993	170 53.053	30
Wotho	10 10.639	166 1.002	30
Rongelap	11 9.158	166 53.636	*35
Bikini	11 36.512	165 23.887	*40
Enewatak	11 20.015	162 19.518	30
Enjebi	11 39.878	162 14.245	30

*Note: These coastal exclusion zones exceed the 30nm radius specified in the Stipulation because the island group consists of more than one land mass, and the exclusion zones around these land masses were combined for simplicity in a manner that ensures the presence of at least a 30nm exclusion zone surrounding all land masses in the island group.

Tab 2: Exclusion zone for protection of Hawaiian monk seals in the expanded northwestern Pacific Ocean area



TAB 2: EXCLUSION ZONE FOR PROTECTION OF HAWAIIAN MONK SEALS IN THE EXPANDED NORTHWESTERN PACIFIC OCEAN AREA

(1) Southern Boundary: 29 degrees 20 minutes N
(2) Northern Boundary: 30 degrees 20 minutes N
(3) Western Boundary: 178 degrees E
(4) Eastern Boundary: 180 degrees E

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

NATURAL RESOURCES DEFENSE COUNCIL, et al., Plaintiff, v. DONALD L. EVANS, Secretary of the United States Department of Commerce, et al. Defendants.	Case No. C-02-3805 EDL CERTIFICATE OF SERVICE

I hereby certify that true copies of the Defendants' Amendment to the Stipulation Regarding Permanent Injunction were sent by Federal Express, on this 6th day of July 2005, to the following counsel of record:

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Kristen L. Gustafson
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UNITED STATES DISTRICT COURT

FOR THE

NORTHERN DISTRICT OF CALIFORNIA

Natural Resources Defense Council, et al.,

Plaintiffs,

v.

Donald L. Evans, et al.,

Defendants.

Case Number: C-02-3805 EDL

CERTIFICATE OF SERVICE

I, the undersigned, hereby certify that I am an employee in the Office of the Clerk, U.S. District Court, Northern District of California.

That on July 8, 2005, I SERVED a true and correct copy(ies) of the attached, by placing said copy(ies) in a postage paid envelope addressed to the person(s) hereinafter listed, by depositing said envelope in the U.S. Mail, or by placing said copy(ies) into an inter-office delivery receptacle located in the Clerk's office.

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BY: _____
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