DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 216

[Docket No. 0080724897–8900–01]

RIN 0648–AW90

Taking and Importing Marine Mammals; U.S. Navy's Atlantic Fleet Active Sonar Training (AFAST)

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Proposed rule; request for comments.

SUMMARY: NMFS has received a request from the U.S. Navy (Navy) for authorization to take marine mammals incidental to training activities conducted off the U.S. Atlantic Coast and in the Gulf of Mexico for the period of January 2009 through January 2014. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is proposing regulations to govern that take and requesting information, suggestions, and comments on these proposed regulations.

DATES: Comments and information must be received no later than November 13, 2008.

ADDRESSES: You may submit comments, identified by 0648–AW90, by any one of the following methods:

- Electronic Submissions: Submit all electronic public comments via the Federal eRulemaking Portal *http://www.regulations.gov.*
- Hand delivery or mailing of paper, disk, or CD–ROM comments should be addressed to Michael Payne, Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225.

Instructions: All comments received are a part of the public record and will generally be posted to *http://www.regulations.gov* without change. All Personal Identifying Information (for example, name, address, etc.) voluntarily submitted by the commenter may be publicly accessible. Do not submit Confidential Business Information or otherwise sensitive or protected information.

NMFS will accept anonymous comments Enter N/A in the required fields, if you wish to remain anonymous). Attachments to electronic comments will be accepted in Microsoft Word, Excel, WordPerfect, or Adobe PDF file formats only.

FOR FURTHER INFORMATION CONTACT: Jolie Harrison, Office of Protected Resources, NMFS, (301) 713–2289, ext. 166.

SUPPLEMENTARY INFORMATION:

Availability

A copy of the Navy's application may be obtained by writing to the address specified above (See **ADDRESSES**), telephoning the contact listed above (see **FOR FURTHER INFORMATION CONTACT**), or visiting the Internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.* The Navy's Draft Environmental Impact Statement (DEIS) for AFAST was published on February 15, 2008, and may be viewed at *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.* NMFS is participating in the development of the Navy's EIS as a cooperating agency under NEPA.

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional taking of marine mammals by U.S. citizens, who engage in a specified activity (other than commercial fishing) during periods of not more than five consecutive years each if certain findings are made and regulations are issued or, if the taking is limited to harassment, notice of a proposed authorization is provided to the public for review.

Authorization shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such taking are set forth. NMFS has defined ''negligible impact'' in 50 CFR 216.103 as:

> ''an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.''

The National Defense Authorization Act of 2004 (NDAA) (Pub. L. 108–136) removed the ''small numbers'' and ''specified geographical region'' limitations and amended the definition of ''harassment'' as it applies to a ''military readiness activity'' to read as follows (Section 3(18)(B) of the MMPA):

> (i) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or
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> (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment].

Summary of Request

On February 4, 2008, NMFS received an application from the Navy requesting authorization for the take of individuals of 40 species of marine mammals incidental to upcoming Navy training activities, maintenance, and research, development, testing, and evaluation (RDT&E) activities to be conducted within the AFAST Study Area, which extends east from the Atlantic Coast of the U.S. to 45° W. long. and south from the Atlantic and Gulf of Mexico Coasts to approximately 23° N. lat., but not encompassing the Bahamas (see Figure 1–1 in the Navy's Application), over the course of 5 years. These training activities are classified as military readiness activities. The Navy states, and NMFS concurs, that these training activities may incidentally take marine mammals present within the AFAST Study Area by exposing them to sound from mid-frequency or high frequency active sonar (MFAS/HFAS) or to employment of the improved extended echo ranging (IEER) system. The IEER consists of an explosive source sonobuoy (AN/SSQ–110A) and an air deployable active receiver (ADAR) sonobuoy (AN/SSQ–101). The Navy requests authorization to take individuals of 40 species of marine mammals by Level B Harassment. Further, though they do not anticipate it to occur, the Navy requests authorization to take, by injury or mortality, up to 10 beaked whales over the course of the 5-yr regulations.

Background of Navy Request

The purpose of the Navy's proposed action is to provide mid- and high-frequency active sonar and IEER system training for U.S. Navy Atlantic Fleet ship, submarine, and aircraft crews, as well as to conduct RDT&E activities to support the requirements of the Fleet Readiness Training Plan (FRTP) and stay proficient in anti-submarine warfare (ASW) and mine warfare (MIW) skills. The FRTP is the Navy's training cycle that requires naval forces to build up in preparation for operational deployment and to maintain a high level of proficiency and readiness while deployed. All phases of the FRTP training cycle are needed to meet Title 10 requirements.

The Navy's need for training and RDT&E is found in Title 10 of the United States Code (U.S.C.), Section 5062 (10 U.S.C. 5062). Title 10 U.S.C. 5062 requires the Navy to be ''organized, trained, and equipped primarily for prompt and sustained combat incident to operations at sea.'' The current and emerging training and RDT&E activities addressed in the AFAST Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) are conducted in fulfillment of this legal requirement.

The RDT&E activities addressed in the AFAST EIS/OEIS are those RDT&E activities that are substantially similar to training, involving existing systems or systems with similar operating parameters.

Description of Specified Activities

Anti-Submarine Warfare (ASW) Training

The Navy explains that potential adversary nations are investing heavily in submarine technology, including designs for nuclear attack submarines, strategic ballistic missile submarines, and modern diesel electric submarines. In addition, the modern diesel electric submarine is the most cost-effective platform for the delivery of several types of weapons, including torpedoes, long-range antiship cruise missiles, land attack missiles, and a variety of antiship mines. Since submarines are inherently covert and can operate independently of escort vessels, submarines can be used to conduct intrusive operations in sensitive areas and can be inserted early in the mission without being detected. The inability to detect a hostile submarine before it can launch a missile or a torpedo is a critical vulnerability that puts U.S. forces and merchant mariners at risk and, ultimately, threatens U.S. national security.

Because Navy personnel ultimately fight as trained, a training environment that matches the conditions of actual combat is necessary. Sailors must also train using the combat tools (e.g., active sonar) that would be used during a conflict. A complicating factor facing the Navy today is the nature of the littoral waters where submarines can operate. These littoral regions are frequently confined, congested water and air space, which makes identification of allies, adversaries, and neutral parties more challenging than in deeper waters. Since an adversary equipped with modern, quiet submarines has the potential to deny all Department of Defense (DoD) forces access to strategic areas of the world, the value of active sonar training has broad effects for all DoD forces.

Mine Warfare (MIW) Training

The use of naval mines is one of the simplest ways for enemies to damage ships and disrupt shipping lanes. Over the past 60 years, at least 14 U.S. ships, including two in the last decade alone, have been damaged or sunk by mines as a result of relatively small-scale mine laying operations. Furthermore, since more than 90 percent of military equipment used in international operations travels by sea, mines have the potential to either delay land and sea military operations by denying access to shallow-water areas, or prevent the delivery of military equipment altogether.

Today, the Navy can expect to encounter a wide spectrum of naval mines, from traditional, low technology mines, to technologically advanced systems. For instance, mines can have irregular shapes, sound-absorbent coatings, and nonmagnetic material composition, which increase their resistance to countermeasures and reduce their maintenance requirements. This means that mines can stay active in the water longer, are harder to find and are more difficult to neutralize (disarm with the use of countermeasures). More advanced mines are designed with remote controls, improved sensors, and counter countermeasures that further complicate efforts to identify, classify, and neutralize them. In addition to improved mine technology, the underwater acoustic conditions often present in shallow waters require the use of specialized technology to successfully detect, avoid, and neutralize mines (DON, 2006a).

Training on MIW sonar is crucial because mines are a proven and cost-effective technology that is continually improving to make them more lethal, reliable, and difficult to detect. Because mines do not emit sound, active sonar technology, rather than passive, provides the warfighter with the capability to quickly and accurately detect, classify, and neutralize mines in small, crowded, shallow-water environments. These MIW capabilities are essential to ensuring the U.S.'s maritime dominance and protecting the Navy's ability to operate on both land and sea, including delivery of military equipment.

As indicated above, the Navy has requested MMPA authorization to take marine mammals incidental to training activities in the AFAST Study Area that would generate sound in the water at or above levels that NMFS has determined will likely result in take (see Acoustic Take Criteria Section), either through the use of MFAS/HFAS or the employment of the IEER system, which includes explosive sonobuoys. Below we discuss the types of sound sources the Navy would utilize and the specific exercise types they would use them in.

Acoustic Sources Used for ASW and MIW Exercises in AFAST

There are two types of sonars, passive and active:

- Passive sonars only listen to incoming sounds and, since they do not emit sound energy in the water, lack the potential to acoustically affect the environment.
- Active sonars generate and emit acoustic energy specifically for the purpose of obtaining information concerning a distant object from the received and processed reflected sound energy.

Modern sonar technology includes a multitude of sonar sensor and processing systems. In concept, the simplest active sonars emit omni-directional pulses (''pings'') and time the arrival of the reflected echoes from the target object to determine range. More sophisticated active sonar can emit an omni-directional ping and then rapidly scan a steered receiving beam to provide directional, as well as range, information. Even more advanced sonars transmit multiple preformed beams and listen to echoes from several directions simultaneously to provide efficient detection of both direction and range.

The tactical sonars to be deployed during testing and training in the AFAST Study Area are designed to detect submarines and mines in tactical training scenarios. These tasks require the use of the sonar mid-frequency range (1 kilohertz [kHz] to 10 kHz) predominantly, as well as a few sources in the high frequency range (above 10 kHz). For this document we will refer to the collective high and mid-frequency sonar sources as MFAS/HFAS. A narrative description of the types of acoustic sources used in ASW and MIW training exercises is included below. Table 1 (below) summarizes the nominal characteristics of the acoustic sources used in the modeling to predict take of marine mammals as well as the estimated annual operation time. Acoustic systems that typically operate at frequencies above 200kHz were not analyzed because they are outside the upper hearing limits of almost all marine mammals and attenuate rapidly due to their extremely high frequencies.

In addition, systems that were found to have similar acoustic output parameters (i.e., frequency, power, deflection angles) were compared. The system with the largest acoustic footprint was modeled as representative of those similar systems that have a smaller acoustic footprint. An example of this representative modeling is the AN/AQS–22 for the AN/AQS–13.

System	Center Frequency (kHz)	Source Level (re 1 μPa)	Associated Platform	System Description	Annual Quantity	Unit
AN/SQS-53	3.5	235	DDG and CG hull-mounted sonar (surface ship)	ASW search, detection, & localization; utilized 70% in search mode and 30% track mode	3214	Hours
AN/SQS-56	7.5	225	FFG hull-mounted sonar (surface ship)	ASW search, detection, & localization; Utilized 70% in search mode and 30% track mode	1684	Hours
AN/SQS-53 and AN/SQS-56 (Kingfisher)	Classified (MF)	Classified	DDG, CG, and FFG hull-mounted sonar (object detection)	Only used when entering and leaving port	216	Hours
AN/BQQ-5 or 10	Classified (MF)	Classified	Submarine hull-mounted sonar	ASW search and attack (approximately one ping per two hours when in use)	9976	Pings
AN/AQS-22 or 13*	4.1	217	Helicopter dipping sonar	ASW sonar lowered from hovering helicopter (approximately 10 pings/dip, 30 seconds between pings)	2952	Dips
MK-48 Torpedo	Classified (HF)	Classified	Submarine fired exercise torpedo (heaveyweight)	Recoverable and non-explosive exercise torpedo; sonar is active approximately 15 min per torpedo run	32	Torpedoes
MK-46 or 54 Torpedo	Classified (HF)	Classified	Surface ship and aircraft fired exercise torpedo (lightweight)	Recoverable and non-explosive exercise torpedo; sonar is active approximately 15 min per torpedo run	24	Torpedoes
Tonal sonobuoy (DICASS) (AN/SSQ-62)	8	201	Helicopter and MPA deployed	Remotely commanded expendable sonar-equipped buoy (approximately 12 pings per use, 30 secs between pings)	5853	Buoys
IEER (AN/SSQ-110A)	Classified (Impulsive - Broadband)	Classified	MPA deployed	ASW system consists of explosive acoustic source buoy (contains two 4.1 lb charges) and expendable passive receiver sonobuoy	872	Buoys
AN/SLQ-25 (NIXIE)	Classified (MF)	Classified	DDG, CG, and FFG towed array (countermeasure)	Towed countermeasure to avert localization and torpedo attacks (approximately 20 mins per use)	332	Hours
AN/SQQ-32	Classified (HF)	Classified	MCM over the side system (mine-hunting)	Used during MIW training events detect, classify, and localize bottom and moored mines	4474	Hours
AN/BQS-15	Classified (HF)	Classified	Submarine navigational sonar	Only used when entering and leaving port	450	Hours
MK-1, MK-2, MK-3, and MK-4 ADCs**	Classified (MF & HF)	Classified	Submarine countermeasure	Expendable acoustic device countermeasure (approximately 20 mins per use)	225	ADCs
Noise Acoustic Emitters (NAE)	Classified (broadband MF-HF)	Classified	Submarine countermeasure	Expendable acoustic countermeasure (20 mins per use)	127	NAEs

Table 1. Acoustic sources used in AFAST exercises that were modeled for effects on marine mammals

*AN/AQS-22 modeling is representative of all helicopter dipping sonar

**MK-3 modeling is representative of all ADCs

ADC – Acoustic Device Countermeasure; CG – Guided Missile Cruiser; DDG – Guided Missile Destroyer; DICASS – Directional Command-Activated Sonobuoy System; DIFAR – Directional Frequency Analysis and Recording; FFG – Fast Frigate; HF – High-Frequency; IEER – Improved Extended Echo Ranging; kHz – Kilohertz; MCM – Mine Countermeasures; MF – Mid-Frequency; MIW – Mine Warfare; MPA – Maritime Patrol Aircraft

Surface Ship Sonars—A variety of surface ships operate the AN/SQS–53 and AN/SQS–56 hull-mounted MFAS during ASW sonar training exercises, currently including 10 guided missile cruisers (CG) (AN/SQS–53), 26 guided missile destroyers (DDG) (AN/SQS–53), and 18 fast frigates (FFG) (AN/SQS 56) on the east coast.

About half of the U.S. Navy ships do not have any onboard tactical sonar systems. Within the AFAST Study Area, these two types of hull-mounted sonar sources account for the majority of the estimated impacts to marine mammals. The AN/SQS–53 hull-mounted sonar, which has a nominal source level of 235 decibels (dB) re 1 μPa and transmits at a center frequency 3.5 kHz, is the Navy's most powerful sonar source used in ASW exercises in the AFAST Study Area.

Hull-mounted sonars occasionally operate in a mode called ''Kingfisher'', which is designed to better detect smaller objects. The Kingfisher mode uses the same source level and frequency as normal search modes, however, it uses a different waveform (designed for small objects), a shorter pulse length (< 1 sec), a higher pulse repetition rate (due to the short ranges), and the ping is not omnidirectional, but directed forward.

Submarine Sonars—Tactical submarines (i.e., 29 nuclear powered attack submarines (SSN) on the east coast) equipped with BQQ–5 or BQQ–10 hull-mounted MFA sonars, are used to detect and target enemy submarines and surface ships. A submarine's mission revolves around its stealth; therefore, MFAS are used very infrequently since the pinging of the MFAS also identifies the location of the submarine. Note that the BQQ–10 is the more predominant system, and that the system is identified throughout the remainder of this document with the understanding that the BQQ–5 and BQQ–10 are similar in those operational parameters with a potential to affect marine mammals. In addition, Seawolf Class attack submarines, Virginia Class attack submarines, Los Angeles Class attack submarines, and Ohio Class nuclear guided missile submarines also have the AN/BQS–15, a sonar that uses both mid- and high-frequency for under-ice navigation and mine-hunting.

Aircraft Sonar Systems—Aircraft sonar systems that would operate in the AFAST Study Area include sonobuoys (AN/SSQ–62 and AN/SSQ–110A) and dipping sonar (AN/AQS–13 or AN/AQS–22).

- Sonobuoys, deployed by both helicopter and fixed-wing Maritime Patrol aircraft (MPA), are expendable devices that are either tonal (active), impulsive (explosive), or listening (passive). The Navy uses a tonal sonobuoy called a Directional Command-Activated sonobuoy System (DICASS AN/SQQ–62) and a sonobuoy system called an IEER system, which consists of an explosive source sonobuoy (AN/SSQ–110A) and a passive receiver sonobuoy (AN/SSQ–101). The Navy also uses a passive sonobuoy called a Directional Frequency Analysis and Recording (DIFAR). Passive listening sonobuoys such as DIFAR (AN/SSQ–53) are deployed from helicopters or maritime patrol aircraft and do not emit active sonar. These systems are used for the detection and tracking of submarine threats.
- Dipping active/passive sonars, present on helicopters, are recoverable devices that are lowered via a cable to detect or maintain contact with underwater targets. The Navy uses the AN/AQS–13 and AN/AQS–22 dipping sonars. Helicopters can be based ashore or aboard a ship.

Torpedoes—Torpedoes are the primary ASW weapons used by surface ships, aircraft, and submarines. The guidance systems of these weapons can be autonomous or electronically controlled from the launching platform through an attached wire. The autonomous guidance systems are acoustically based. They operate either passively by listening for sound generated by the target, or actively by pinging the target and using the echoes for guidance. All torpedoes to be used during ASW activities are recoverable and nonexplosive. The majority of torpedo firings occurring during AFAST activities are air slugs (dry fire) or shapes (i.e., solid masses resembling the weight and shape of a torpedo).

Acoustic Device Countermeasures (ADC)—Several types of countermeasure devices could be deployed during Fleet training exercises, including the Acoustic Device Countermeasure MK–1, MK–2, MK–3, MK–4, and the AN/SLQ–25A (NIXIE). Countermeasure devices act as decoys to avert localization and torpedo attacks. Countermeasures may be towed or free floating sources.

Training Targets—ASW training targets are used to simulate target submarines. They are equipped with one or more of the following devices: (1) Acoustic projectors emanating sounds to simulate submarine acoustic signatures, (2) echo repeaters to simulate the characteristics of the echo of a particular sonar signal reflected from a specific type of submarine, and (3) magnetic sources to trigger magnetic detectors. The Navy uses the Expendable Mobile Acoustic Training Target (EMATT) and the MK–30 acoustic training targets (recovered) during ASW sonar training exercises.

Types of ASW and MIW Exercises in the AFAST Study Area

ASW and MIW training is conducted to meet deployment certification requirements as directed in the FRTP. The U.S. Navy Atlantic Fleet meets these requirements by conducting training activities prior to deployment of forces. The FRTP requires Basic Unit Level Training (ULT), Intermediate, and Sustainment Training. The Navy meets these requirements during Independent ULT, Coordinated ULT, and Strike Group Training. At the beginning of the cycle, basic combat skills are learned and practiced during basic Independent ULT activities, which include training and sonar maintenance activities that each individual unit is required to accomplish in order to become certified prior to deploying or to maintain proficiency. Basic skills are then refined during Coordinated ULT activities, which concentrate on warfare team training and initial multiunit operations. During this phase, vessels and aircraft begin to develop warfare skills in coordination with other units while continuing to maintain unit proficiency. Strike Group Training continues to develop and refine warfare skills and command and control procedures using progressively more difficult, complex, and large scale exercises conducted at an increasing tempo. This training provides the warfighter with the skills necessary to function as part of a coordinated fighting force in a hostile environment with the capacity to accomplish multiple missions.

Additionally, RDT&E activities are conducted to develop new technologies and to ensure their effectiveness prior to implementation. Maintenance activities are conducted pier side and during transit to training exercise locations. Active sonar maintenance is required to ensure the sonar system is operating properly before engaging in the training exercise or when the sonar systems are suspected of performing below optimal levels.

Because the Navy conducts many different types of Independent ULT, Coordinated ULT, Strike Group training, maintenance, and RDT&E active sonar events, the Navy grouped similar events to form representative scenarios. Note that specific training event names and other details do occasionally change as required to meet the current operational needs. Table 2 lists the types of ASW, MIW, and maintenance exercises and indicates: The nature of the exercise, the areas the exercises are conducted in and the area they span, the average duration of an exercise, the average number of exercises/per year, and the sound sources that are used in the exercises.

Table 1 indicates the total number of hours for each source type anticipated for each year for each exercise type.

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Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Possible Event Areas***	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Annual Use per Event Type*
INDEPENDENT UNIT LEVEL TRAINING (INCLUDING RDT&E)								
Surface Ship ASW ULT	One or two surface ships (CG, DDG, and FFG) conducting ASW localization and tracking training.	457	2 to 6 hours	VACAPES, CHPT, JAX/CHASN, and GOMEX OPAREAs	5 NM x 10 NM to 30 NM x 40 NM	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	1 to 2 ships (CG, DDG, or FFG) pinging 1 to 3 hours each	1071 hours AN/SQS-53 and 465 hours AN/SQS-56
						Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-1, MK-2, MK-3, MK 4, or Noise Acoustic Emitter)	2 hours per NIXIE 20 minutes per MK-1, MK-2, MK-3, or MK-4 Noise Acoustic Emitter	158 NIXIE 225 MK-1, MK-2, MK-3, or MK-4 127 Noise Acoustic Emitter
						MK-46 or MK-54 Torpedo	Exercise torpedoes could be used for RDT&E	8 MK-46 or MK-54 exercise torpedoes
						MK-39 EMATT or MK-30 target	1 EMATT or MK-30 (recoverable) per exercise may be used as a target	up to 725 EMATTs expended (total annual use for all exercises)
						Vessel movement	1 to 2 ships maneuvering	Approximately 54 CG, DDG, and FFG surface ships conducting ULT throughout the year
Surface Ship Object Detection ULT	One ship (CG, DDG, and FFG) conducting object detection during transit in/out of port for training and safety during reduced visibility.	108	1 to 2 hours	Sea lanes and Entrance channels to Norfolk, Virginia and Mayport, Florida	5 NM x 10 NM	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56 Kingfisher) operated in object detection mode	1 ship (CG, DDG, or FFG) pinging for 1 to 2 hours	148 hours AN/SQS-53 and 68 hours AN/SQS-56
						Vessel movement	1 ship maneuvering	Approximately 54 CG, DDG, and FFG surface ships on the East Coast conducting object avoidance twice a year
Helicopter ASW ULT	One helicopter conducting ASW training using dipping sonar or sonobuoys	165	2 to 4 hours	VACAPES, CHPT, and JAX/CHASN OPAREAs	20 NM x 30 NM	Helicopter dipping sonar (AN/AQS-13 or AN/AQS-22)	1 helicopter dipping up to two hours (10 pings per five-minute dip)	160 hours
						Tonal sonobuoy (DICASS) (AN/SSQ-62)	Up to 4 tonal sonobuoys (DICASS)	549 sonobuoys
						Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	up to 27,500 sonobuoys expended (total annual use for all exercises)
						MK-46 or MK-54 Torpedo	exercise torpedoes could be used for RDT&E	8 MK-46 or MK-54 exercise torpedoes
						MK-39 EMATT or MK-30 target	1 EMATT or MK-30 (recoverable) per exercise may be used as a target	up to 725 EMATTs expended (total annual use for all exercises)
Submarine ASW ULT	One submarine conducting ASW and SUW training using passive and active sonar.	100	2 to 3 days	Northeast, VACAPES, CHPT, JAX/CHASN, and GOMEX OPAREAs	30 NM x 40 NM	Submarine MFA sonar (AN/BQQ-10)	1 submarine pinging once per two hours (average 36 pings per event)	3600 pings
						MK-48 Torpedo	Number of exercise torpedoes could be used in a single RDT&E event could vary	32 MK-48 exercise torpedoes
						Vessel movement	1 submarine maneuvering	Approximately 25 submarines on the East Coast conducting ULT throughout the year
						MK-39 EMATT or MK-30 target	1 EMATT or MK-30 (recoverable) per exercise may be used as a target	up to 725 EMATTs expended (total annual use for all exercises)
Submarine Navigational	One submarine operating sonar for navigation and object detection during transit in/out of port during reduced visibility.	300	1 to 2 hours	Sea lanes and entrance channels to Norfolk, Virginia; Groton, Connecticut; and Kings Bay, Georgia	5 NM x 10 NM	Submarine MFA object detection sonar (AN/BQQ-10 or AN/BQS-15)	1 submarine pinging 1 to 2 hours	450 hours
						Vessel movement	1 submarine maneuvering	Approximately 30 submarines on the East Coast conducting ULT throughout the year

Table 2a. Descriptions of the activities included in the Navy's AFAST MMPA authorization request.

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Possible Event Areas***	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Annual Use per Event Type*
MPA ASW ULT (tonal sonobuoy)	One MPA conducting ASW submarine localization and tracking training using tonal sonobuoys.	791	2 to 8 hours	Northeast, VACAPES, CHPT, JAX/CHASN, and GOMEX OPAREAs	30 NM x 30 NM to 60 NM x 60 NM	Tonal sonobuoy (DICASS) (AN/SSQ-62)	Up to 10 tonal sonobuoys (DICASS)	3594 sonobuoys
						Passive sonobuoy (DIFAR)_AN/SSQ-53D/E	Number of sonobuoys deployed can vary	up to 27,500 sonobuoys expended (total annual use for all exercises)
						MK-46 or MK-54 Torpedo	exercise torpedoes could be used for RDT&E	8 MK-46 or 54 exercise torpedoes
						MK-39 EMATT (repeater) and or MK-30 Target	1 EMATT or MK-30 (recoverable) per exercise may be used as a target	up to 725 EMATTs expended (total annual use for all exercises)
MPA ASW ULT (explosive source sonobuoy [AN/SSQ-110A])	One MPA conducting ASW submarine localization and tracking training using explosive source sonobuoy (AN/SSQ-110A).	169	2 to 8 hours	Northeast, VACAPES, CHPT, JAX/CHASN, and GOMEX OPAREAs	60 NM x 60 NM	explosive source sonobuoy (AN/SSQ 110A)	Up to 14 AN/SQ-110A sonobuoys	676 sonobuoys
						receiver (ADAR) sonobuoy (AN/SSQ-101)	Up to 5 AN/SSQ-101 sonobuoys	239 sonobuoys
Surface Ship MIW ULT	One ship (MCM) conducting mine localization training.	266	Less than 24 hours	GOMEX OPAREA	1 NM x 2 NM	Surface ship HFA MIW sonar (AN/SQQ-32)	1 ship (MCM) pinging for 1 to 15 hours	2074 hours of AN/SQQ-32
						Vessel movement	1 to 2 ships maneuvering	Approximately 19 MIW surface ships conducting ULT throughout the year
COORDINATED UNIT LEVEL TRAINING								
Southeastern Anti-Submarine Warfare Integrated Training Initiative (SEASWITI) and similar RDT&E	A combined exercise with two DDGs, one FFG with embarked helicopter, two submarines, and one MPA	4 training events and similar RDT&E	5 to 7 days	JAX/CHASN OPAREA	30 NM x 30 NM	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	2 to 3 ships (CG, DDG, or FFG) pinging daily for several hours	440 hours AN/SQS-53 200 hours AN/SQS-56
						Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	1 helicopter dipping several times daily (10 pings per five-minute dip)	10 hours
						Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	1 submarine pinging up to four times daily	100 pings
						Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	2 hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	ADCs may be used during the event; annual total ADC expenditure shown under ASW Surface ULT
						Tonal sonobuoy (DICASS) (AN/SSQ-62)	1 MPA dropping up to 8 sonobuoys in one day; 24 sonobuoys for entire	120 tonal sonobuoys (DICASS)
						Passive sonobuoy (DIFAR)_AN/SSQ-53D/E	Number of sonobuoys deployed can vary	up to 27,500 sonobuoys expended (total annual use for all exercises)
						Vessel movement	3 to 4 ships maneuvering	3 to 4 ships maneuvering over 5-7 days, up to four times a year
Integrated ASW Course (IAC)	A combined exercise with three DDGs, one CG, one FFG, two to three helicopters, one to two submarines, and one MPA	5	2 to 5 days	VACAPES, CHPT, and JAX/CHASN OPAREAs	120NM X 60NM	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	5 ships pinging for up to 10 hours	285 hours AN/SQS-53 100 hours AN/SQS-56
						Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	1 helicopter dipping up to one hour (10 pings per five-minute dip)	5 hours AN/AQS-13 or AN/AQS-22
						Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	1-2 submarines pinging up to 6 times each	60 pings
						Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	2 hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	ADCs may be used during the event; annual total ADCs used shown under ASW Surface ULT
						Tonal sonobuoy (DICASS) (AN/SSQ-62)	Helicopters and/or MPA dropping up to 36 sonobuoys	180 sonobuoys
						Passive sonobuoy (DIFAR)_AN/SSQ-53D/E	Number of sonobuoys deployed can vary	up to 27,500 sonobuoys expended (total annual use for all exercises)

Table 2b. Descriptions of the activities included in the Navy's AFAST MMPA authorization request.

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Possible Event Areas***	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Annual Use per Event Type*
Group Sail	A combined exercise with two DDGs with embarked helicopters, and one submarine.	20	2 to 3 days	VACAPES, CHPT, and JAX/CHASN OPAREAs	30 NM x 30 NM	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	2-3 ships pinging for several hours	240 hours AN/SQS-53 120 hours AN/SQS-56
						Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	1 helicopter dipping up to 6 hours (10 pings per five-minute dip)	60 hours AN/AQS-13 or AN/AQS-22
						Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	1 submarine pinging up to two times	40 pings
						Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	2 hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	ADCs may be used during the event; annual total ADCs used shown under ASW Surface ULT
						Tonal sonobuoy (DICASS) (AN/SSQ-62)	1 helicopter dropping up to 4 sonobuoys	80 sonobuoys
						Passive sonobuoy (DIFAR)_AN/SSQ-53D/E	Number of sonobuoys deployed can vary	up to 27,500 sonobuoys expended (total annual use for all exercises)
						Vessel movement	3 ships maneuvering	3 ships maneuvering over 5-7 days, up to 20 times a year
Submarine Command Course (SCC) Operations	Two submarines operating against each other as part of the SCC for prospective submarine Commanding Officers.	2	3 to 5 days	NE and JAX/CHASN OPAREAs	30 NM x 50 NM	Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	2 submarines pinging up to 12 times each	48 pings
						Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	2 hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	ADCs may be used during the event; annual total ADCs used shown under ASW Surface ULT
						Vessel movement	2 submarines maneuvering	Maneuvering twice a year for 3-5 days
RONEX and GOMEX MIW Exercises	One to five MCM ships conducting mine localization training.	8	10 to 15 days	GOMEX OPAREA	20 NM x 20 NM	Surface ship HFA MIW sonar (AN/SQQ-32 and AN/SLQ-48**)	1 to 5 ships (MCM) 60-90 hours each	2,400 hours AN/SQQ-32
						Vessel movement	1 to 5 ships (MCM) maneuvering	1 to 5 ships maneuvering up to 100 days a year
STRIKE GROUP TRAINING								
ESG COMPTUEX and CSG COMPTUEX and similar RDT&E	Intermediate level battle group exercise designed to create a cohesive CSG/ ESG prior to deployment or JTFEX. Three DDGs, one FFG, helicopters, one MPA, and two submarines.	5 training events and similar RDT&E	21 days	VACAPES, CHPT, JAX/CHASN, and GOMEX OPAREAs	60 NM x 120 NM	Surface ship MFA ASW sonar (AN/SQS-53 and AN/SQS-56)	4 ships (CG, DDG, or FFG) pinging approximately 60 hours each over 10 days	740 hours AN/SQS-53 250 hours AN/SQS-56
						Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	1 to 4 helicopters (10 pings per five-minute dip) during CSG COMPTUEX	9 hours
						Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	2 submarines pinging up to 16 times each	116 pings
						Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	2 hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	ADCs may be used during the event; annual total ADCs used shown under ASW Surface ULT
						Tonal sonobuoy (DICASS) (AN/SSQ-62)	MPA and/or helicopter dropping 3 to 10 sonobuoys for a total of up to 218 sonobuoys over duration of event	982 sonobuoys
						Passive sonobuoy (DIFAR)_AN/SSQ-53D/E	Number of sonobuoys deployed can vary	up to 27,500 sonobuoys expended (total annual use for all exercises)
						explosive source sonobuoy (AN/SSQ-110A)	2 MPA dropping up to 14 AN/SQ-110A sonobuoys	140 sonobuoys
						receiver (ADAR) sonobuoy (AN/SSQ-101)	Up to 5 AN/SSQ-101 sonobuoys	49 sonobuoys
						Vessel movement	6 ships (CG, DDG, FFG, or submarine) maneuvering	6 ships maneuvering up to 147 days a year

Table 2c. Descriptions of the activities included in the Navy's AFAST MMPA authorization request.

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Possible Event Areas***	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Annual Use per Event Type*
JTFEX	Final fleet exercise prior to deployment of the CSG and ESG. Serves as a ready-to-deploy certification for all units. Four DDGs, two FFGs, one helicopter, one MPA, and three submarines.	2	10 days	JAX/CHASN and GOMEX OPAREAs	60 NM x 80 NM up to 180 NM x 180 NM	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	6 ships (CG, DDG, FFG) pinging up to 25 hours each	200 hours AN/SQS-53 100 hours AN/SQS-56
						Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	1 helicopters dipping for up to one hour (10 pings per five-minute dip)	2 hours
						Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	3 submarines pinging twice each	12 pings
						Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	2 hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	ADCs may be used during the event; annual total ADCs used shown under ASW Surface ULT
						Tonal sonobuoy (DICASS) (AN/SSQ-62)	1 MPA and/or 1 helicopter dropping 3 to 10 sonobuoys for a total of up to 174 sonobuoys over duration of event	348 sonobuoys
						Passive sonobuoy (DIFAR)_AN/SSQ-53D/E	Number of sonobuoys deployed can vary	up to 27,500 sonobuoys expended (total annual use for all exercises)
						explosive source sonobuoy (AN/SSQ-110A)	2 MPA dropping up to 14 AN/SSQ-110A sonobuoys	56 sonobuoys
						receiver (ADAR) sonobuoy (AN/SSQ-101)	Up to 5 AN/SSQ-101 sonobuoys	20 sonobuoys
						Vessel movement	9 ships (CG, DDG, FFG, or submarine) maneuvering	Up to 9 ships maneuvering for up to 40 days a year
MAINTENANCE								
Surface Ship Sonar Maintenance	Pier side and at-sea maintenance to sonar system.	410	.2 to 4 hours	Northeast, VACAPES, CHPT, and JAX/CHASN, OPAREAs		Surface ship MFA ASW sonar (AN/SQS-53 OR AN/SQS-56)	1 ship (CG, DDG, or FFG) pinging	238 hours AN/SQS-53 449 hours AN/SQS-56
Submarine Sonar	Pier side and at-sea maintenance to sonar	200	1 hour	Northeast, VACAPES, CHPT,		Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	1 submarine pinging for up to one hour (60 pings per hour)	6000 pings (100 total hours of active sonar)

Table 2d. Descriptions of the activities included in the Navy's AFAST MMPA authorization request.

* Number of events and total hours modeled for acoustic effects analysis.

** The source frequency is greater than 200 kHz, which is above the known hearing range of marine mammals. These sources, therefore, were not modeled for th effects analysis.

*** OPAREAs also include area seaward of each OPAREA unless otherwise noted.

ADC – Acoustic Device Countermeasure; ASW – Antisubmarine Warfare; CHPT – Cherry Point; CG – Guided Missile Cruiser; COMPTUEX – Composite Tra Exercise; CSG – Carrier Strike Group; DDG – Guided Missile Destroyer; DICASS – Directional Command-Activated Sonobuoy System; EMATT – Expendab Acoustic Training Target; ESG – Expeditionary Strike Group; FFG – Fast Frigate; GOMEX – Gulf of Mexico; HFA – High-Frequency Active; IEER – Improved Exte Ranging; kHz – Kilohertz; JAX/CHASN – Jacksonville/Charleston; JTFEX – Joint Task Force Exercise; MCM – Mine Countermeasures; MFA – Mid-Frequency Acti Mine Warfare; MPA – Maritime Patrol Aircraft; NM – Nautical Mile; OPAREA – Operating Area; RONEX – Squadron Exercise; SCC OPS – Submarine Comma Operations; SEASWITI – Southeastern Anti-Submarine Warfare Integrated Training Initiative; SUW – Surface Warfare; TORPEX – Torpedo Exercise; ULT – U Training; VACAPES – Virginia Capes

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The Navy's AFAST EIS and LOA application were designed specifically to cover active sonar training because the need for operational flexibility, a variety of training scenarios, as well as proximity to multiple ports, airfields, and bases along the eastern seaboard in these exercises has long necessitated that the exercises be conducted outside of the boundaries of any one Operating Areas (OPAREA). Alternately, exercises utilizing explosive detonations are typically conducted within a particular OPAREA, and as such are being addressed separately within EISs and LOA requests for the various applicable OPAREAs. With the exception of the Extended Echo Ranging and Improved Extended Echo Ranging (IEER) system, the AFAST proposed authorization does not contain any explosive sources, only MFAS and HFAS. The IEER is included in AFAST because it is most often used in ASW exercises. The IEER Systems are air-launched ASW systems used in conducting ''large area'' searches for submarines. These systems are made up of airborne avionics ASW acoustic processing and sonobuoy types that are deployed in pairs. The IEER System's active sonobuoy component, the AN/SSQ–110A Sonobuoy, would generate a ''ping'' (small detonation, as opposed to a sonar signal) and the passive AN/SSQ–101 ADAR Sonobuoy would ''listen'' for the return echo of the ping that has been bounced off the surface of a submarine. These sonobuoys are designed to provide underwater acoustic data necessary for naval aircrews to quickly and accurately detect submerged submarines. The expendable and commandable sonobuoy pairs are dropped from a fixed-wing aircraft into the ocean in a predetermined pattern (array) with a few buoys covering a very large area. Upon command from the aircraft, the bottom payload is released to sink to a designated operating depth. A second command is required from the aircraft to cause the second payload to release and detonate generating a ''ping''. There is only one detonation in the pattern of buoys at a time.

Additional information on the Navy's proposed activities may be found in the LOA Application and the Navy's AFAST DEIS.

AFAST Study Area

Figure 1–1 in the Navy's application, which may be viewed at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*, depicts the AFAST Study Area, which extends east from the Atlantic Coast of the U.S. to 45° W. long. and south from the Atlantic and Gulf of Mexico Coasts to approximately 23° N. lat., but not encompassing the Bahamas (see Figure 1–1 in the Navy's Application). The Navy's Atlantic Fleet trains in a series of OPAREAs along the U.S. East Coast and in the Gulf of Mexico. Due to the size of the battle space needed for effective conduct of activities, training and testing also occur seaward of these OPAREAs. The OPAREAs include the Northeast OPAREA, the Virginia Capes (VACAPES) OPAREA, the Cherry Point (CHPT) OPAREA, the Jacksonville/Charleston (JAX/CHASN) OPAREA, and the Gulf of Mexico (GOMEX) OPAREA. The locations of the OPAREAs and the shoreward/seaward boundary of the Study Area are depicted in Figure 1–1 of the Navy's application. Note that the Northeast and Gulf of Mexico OPAREAs encompass a series of OPAREAs. The Northeast OPAREA includes the Boston, Atlantic City, and Narragansett Bay OPAREAs. The GOMEX OPAREAs includes the Pensacola, Panama City, Corpus Christi, New Orleans, and Key West OPAREAs. For the purposes of this document, an OPAREA includes the existing OPAREA, as well as adjacent shoreward and seaward areas. Table 3 summarizes the typical number of events per year by OPAREA.

	OPAREA					
	NE	VACAPES	CHPT	JAX/CHASN	GOMEX	TOTAL
Independent ULT						
Surface Ship ASW		69	91	292	5	457
Surface Ship Object Detection/Navigational Sonar		68		40		108
Helicopter ASW		25	25	115		165
Submarine ASW	30	10	14	45	1	100
Submarine Object Detection/Navigational Sonar	165	78		57		300
MPA ASW (tonal sonobuoy)	238	79	111	356	7	791
MPA ASW (explosive source sonobuoy)	34	34	34	34	34	170
Surface Ship MIW					266	266
Coordinated ULT						
SEASWITI				5		5
IAC		0.2	1.4	2.4	1	5
Group Sail		3	4	13		20
SCC Operations	0.4			1.6		2
RONEX and GOMEX Exercises					8	8
Strike Group Training						
ESG and CSG COMPTUEX*		0.2	1.4	2.4	1**	5
JTFEX		0.2	0.6	1.2	0	2
Maintenance						
Surface Ship Sonar Maintenance		61	82	263	4	410
Submarine Sonar Maintenance	30	10	14	45	1	100

* COMPTUEX distribution reflects the typical distribtion of COMPTUEX across OPAREA boundaries.

** All events are considered equally likely to occur at any time during the year, except strike group exercises, which would not occur in the GOMEX OPAREA during hurricane season (summer and fall)

ASW - Antisubmarine warfare; CHPT - Cherry Point; COMPTUEX - Composite Training Unit Exercise; GOMEX - Gulf of Mexico; Jax/CHASN - Jacksonville/Charleston; JTFEX - Joint Task Force Exercise; MIW - Mine Warfare; MPA - Maritime Patrol Aircraft; NE - Northeast; OPAREA - Operating Area; RONEX - Squadron Exercise; SCC OPS - Submarine Command Course Operations; SEASWITI - Southeastern Antisubmarine Warfare Integrated Training Initiative; TORPEX - torpedo Exercise; ULT - Unit Level Trianing; VACAPES - Virginia Capes

Table 3. Summary of Activities by Operating Area

For the purposes of the proposed action that is the subject of this Letter of Authorization (LOA) request, active sonar activities would occur year-round throughout the Study Area. Active sonar activities would occur in locations that maximize active sonar opportunities and meet applicable operational requirements associated with a specific active sonar activity. Below we provide additional detail (beyond Tables 2 and 3), where available (i.e., the advance detail is available and the information is not classified), regarding where certain active sonar training, research, development, test, and evaluation (RDT&E), and maintenance activities would occur.

ASW Training Areas

ASW activities for all platforms could occur within and adjacent to existing East Coast OPAREAS beyond 22.2 km (12 NM) with the exception of sonar dipping activities. However, most ASW training involving submarines or submarine targets would occur in waters greater than 183 m (600 ft) deep due to safety concerns about running aground at shallower depths. ASW active sonar activities occurring in specific locations are discussed below.

Helicopter ASW ULT Areas—This activity would be conducted in the waters of the East Coast OPAREAs typically near fleet concentration areas while embarked on a surface ship. Helicopter ASW ULT events are also conducted by helicopters deployed from shore-based Jacksonville, Florida, units. These helicopter units use established sonar dipping areas offshore Mayport (Jacksonville), Florida, which are located in territorial waters and within the southeast North Atlantic right whale (NARW) critical habitat. This is the only area where helicopter ASW ULT could occur within 22 km (12 NM) of shore.

Southeastern Anti-Submarine Warfare Integrated Training (SEASWITI) Areas—This training exercise generally occurs in deep water off the coast of Jacksonville, Florida.

Group Sail Areas—These events typically take place within and seaward of the VACAPES, CHPT, and JAX/CHASN OPAREAs.

Submarine Command Course (SCC) Operations Areas—This training exercise typically occurs in the JAX/CHASN and Northeast OPAREAs in deep ocean areas.

Strike Group Training Areas—These events typically take place within and seaward of the VACAPES, CHPT, and JAX/CHASN OPAREAs, although an event could occasionally be conducted in the GOMEX OPAREA.

Torpedo Exercise (TORPEX) Areas—TORPEXs can occur anywhere within and adjacent to East Coast and GOMEX OPAREAs. The exception is in the Northeast OPAREA where the North Atlantic right whale critical habitat is located. TORPEX areas that meet current operational requirements for proximity to torpedo and target recovery support facilities in the Northeast were established during previous consultations. Therefore, TORPEX activities in the northeast North Atlantic right whale critical habitat are limited to these established areas. Most torpedo activities would occur near torpedo recovery support facilities in the Northeast or GOMEX OPAREAs.

MIW Training Areas

MIW Training could occur in territorial or non-territorial waters. Independent and Coordinated MIW ULT activities would be conducted within and adjacent to the Pensacola and Panama City OPAREAs in the northern Gulf of Mexico and off the east coast of Texas in the Corpus Christi OPAREA. The Squadron Exercise (RONEX) or GOMEX Exercise would be conducted in both deep and shallow water training areas.

Object Detection/Navigational Training Areas—Surface Ship training would be conducted primarily in the shallow water port entrance and exit lanes for Norfolk, Virginia, and Mayport, Florida. The transit lane servicing Mayport, Florida crosses through the southeast North Atlantic right whale critical habitat. Submarine training would occur primarily in the established submarine transit lanes entering/exiting Groton, Connecticut; Norfolk, Virginia; and Kings Bay, Georgia. The transit lane servicing Kings Bay, Georgia crosses through the southeast North Atlantic right whale critical habitat.

Maintenance Areas

Maintenance activities could occur in homeports located in territorial waters, or in the open ocean during transit in non-territorial waters.

RDT&E Areas

For RDT&E activities included in this analysis, active sonar activities occur in similar locations as representative training events.

National Marine Sanctuaries

At present, the Navy does not conduct active sonar activities in the Stellwagen Bank, USS Monitor, Gray's Reef, Flower Garden Banks, and Florida Keys National Marine Sanctuaries. The Navy would, as appropriate, comply with the National Marine Sanctuaries Act and any applicable regulations if it is determined that an active sonar activity may occur in or near these sanctuaries, and would ensure that naval activities be carried out in a manner that avoids to the maximum extent practicable any adverse impacts on sanctuary resources and qualities. Although activities in the Sanctuaries are not planned or anticipated, NMFS' analysis, for purposes of the MMPA considers the effects on marine mammals of the Navy's conducting activities in the biologically important areas that occur in or near Sanctuaries.

North Atlantic Right Whale (NARW) Critical Habitat

NMFS designated three areas in June 1994 as critical habitat for the western North Atlantic population of the North Atlantic right whale. They include the following:

1. Coastal Florida and Georgia (Sebastian Inlet, FL to the Altamaha River, GA),
2. Great South Channel (east of Cape Cod), and
3. Massachusetts Bay and Cape Cod Bay.

The Navy proposes to conduct two types of activities in the NARW critical habitat. Approximately 84 of the 115 helicopter dipping sonar exercises (2-4 hours each) conducted annually in the CHASN/JAX OPAREA would occur in the designated near-shore training area, which fans out approximately 10 miles from Mayport. Part of the near-shore shore training area overlaps the NARW critical habitat. However, historically, only maintenance of helicopter dipping sonars occured (approximately 30 events) in the portion of the training area that overlaps with NARW critical habitat. Tactical training with helicopter dipping sonar does not typically occur in the NARW critical habitat area at any time of the year. The critical habitat area is used on occasion for post maintenance operational checks and equipment testing due to its proximity to shore. In addition, the Navy would conduct approximately 40 ship object detection/navigational sonar training exercises (1–2 hours each) and 57 submarine object detection/navigational sonar training exercises (1–2 hours each) annually while entering/exiting port at Mayport, FL and Kings Bay, GA, respectively (within approximately 1 mile of the shore). These two activities could occur year round. No other active sonar activities would occur in the southeast critical habitat.

In the northeastern critical habitat, the Navy would conduct TORPEX activities. These activities would be conducted in August, September, and October as prescribed in a prior Endangered Species Act (ESA) Section 7 consultation with NMFS. Water depths in this area are less than the optimal depth for most ASW activities.

In summary, currently active sonar training does not occur in North Atlantic right whale critical habitat with the exception of object detection and navigation off shore Mayport, Florida and Kings Bay, Georgia; helicopter Anti-Submarine Warfare (ASW) offshore Mayport, Florida; and torpedo exercises (TORPEXs) in the northeast critical habitat during August, September, and October.

Description of Marine Mammals in the Area of the Specified Activities

There are 43 marine mammal species with possible or confirmed occurrence in the AFAST Study Area. As indicated in Table 4, there are 36 cetacean species (7 mysticetes and 29 odontocetes), six pinnipeds, and one sirenian (manatee). Six marine mammal species listed as federally endangered under the Endangered Species Act (ESA) and under the jurisdiction of NMFS occur in the AFAST Study Area: The North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, and sperm whale. Manatees are managed by the U.S. Fish and Wildlife Service and will not be addressed further here.

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Common Name	Scientific Name	ESA Status	Possible Location
Suborder Mysticeti (baleen whales)			
Family Balaenidae (right whales)			
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	East Coast
Family Balaenopteridae (rorquals)			
Humpback whale	*Megaptera novaeangliae*	Endangered	East Coast
Minke whale	*Balaenoptera acutorostrata*		East Coast
Bryde's whale	*Balaenoptera edeni*		East Coast and Gulf of Mexico
Sei whale	*Balaenoptera borealis*	Endangered	East Coast
Fin whale	*Balaenoptera physalus*	Endangered	East Coast and Gulf of Mexico
Blue whale	*Balaenoptera musculus*	Endangered	East Coast
Suborder Odontoceti (toothed whales)			
Family Physeteridae (sperm whale)			
Sperm whale	*Physeter macrocephalus*	Endangered	East Coast and Gulf of Mexico
Family Kogiidae			
Pygmy sperm whale	*Kogia breviceps*		East Coast and Gulf of Mexico
Dwarf sperm whale	*Kogia sima*		East Coast and Gulf of Mexico
Family Monodontidae (buluga and narwhal whales)			
Beluga whale	*Delphinapterus leucas*		East Coast
Family Ziphiidae (beaked whales)			
Cuvier's beaked whale	*Ziphius cavirostris*		East Coast and Gulf of Mexico
True's beaked whale	*Mesoplodon mirus*		East Coast
Gervais' beaked whale	*Mesoplodon europaeus*		East Coast and Gulf of Mexico
Sowerby's beaked whale	*Mesoplodon bidens*		East Coast
Blainville's beaked whale	*Mesoplodon densirostris*		East Coast and Gulf of Mexico
Northern bottlenose whale	*Hyperoodon ampullatus*		East Coast
Family Delphinidae (dolphins)			
Rough-toothed dolphin	*Steno bredanensis*		East Coast and Gulf of Mexico
Common bottlenose dolphin	*Tursiops truncatus*		East Coast and Gulf of Mexico
Pantropical spotted dolphin	*Stenella attenuate*		East Coast and Gulf of Mexico
Atlantic spotted dolphin	*Stenella frontalis*		East Coast and Gulf of Mexico
Spinner dolphin	*Stenella longirostris*		East Coast and Gulf of Mexico
Clymene dolphin	*Stenella clymene*		East Coast and Gulf of Mexico
Striped dolphin	*Stenella coeruleoalba*		East Coast and Gulf of Mexico
Common dolphin	*Delphinus* spp.		East Coast
Fraser's dolphin	*Lagenodelphis hosei*		East Coast and Gulf of Mexico
Risso's dolphin	*Grampus griseus*		East Coast and Gulf of Mexico
Atlantic white-sided dolphin	*Lagenorhynchus acutus*		East Coast and Gulf of Mexico
White-beaked dolphin	*Lagenorhynchus albirostris*		East Coast and Gulf of Mexico
Melon-headed whale	*Peponocephala electra*		East Coast and Gulf of Mexico
Pygmy killer whale	*Feresa attenuate*		East Coast and Gulf of Mexico
False killer whale	*Pseudorca crassidens*		East Coast and Gulf of Mexico
Killer whale	*Orcinus orca*		East Coast and Gulf of Mexico
Long-finned pilot whale	*Globicephala melas*		East Coast and Gulf of Mexico
Short-finned pilot whale	*Globicephala macrorhynchus*		East Coast and Gulf of Mexico
Family Phocoenidae			
Harbor porpoise	*Phocoena phocoena*		East Coast
Order Carnivora			
Suborder Pinnipedia			
Family Phocidae (true seals)			
Hooded seal	*Cystophora cristata*		East Coast
Harp seal	*Pagophilus groenlandica*		East Coast
Gray seal	*Halichoerus grypus*		East Coast
Harbor seal	*Phoca vitulina*		East Coast
Ringed seal	*Pusa hispida*		East Coast
Walrus	*Odobenus rosmarus*		East Coast
Order Sirenia			
Family Trichechidae (manatees)			
West Indian manatee	*Trichechus manatus*	Endangered	East Coast and Gulf of Mexico

Table 4. Species with possible or confirmed occurrence in the AFAST Study Area

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The Navy has compiled information on the abundance, behavior, status and distribution, and vocalizations of marine mammal species in the AFAST Study Area waters from peer reviewed literature, the Navy Marine Resource Assessments, NMFS Stock Assessment Reports, and marine mammal surveys using acoustics or visual observations from aircraft or ships. This information may be viewed in the Navy's LOA application and/or the Navy's EIS for AFAST (*see* Availability). Additional information is available in NMFS Stock Assessment Reports, which may be viewed at: *http://www.nmfs.noaa.gov/pr/sars/species.htm*.

Neither the beluga whale nor ringed seals have stocks designated in the Northwest Atlantic Ocean or the Gulf of Mexico. The St. Lawrence estuary is at the southern limit of the distribution of the beluga whale (Lesage and Kingsley, 1998). Beluga distribution does not include the Gulf of Mexico or the southeastern Atlantic Coast and they are considered extralimital in the Northeast. The ringed seal has a circumpolar distribution throughout the Arctic Ocean, Hudson Bay, and Baltic and Bering seas (Reeves *et al.*, 2002b) and is expected only as far south as Newfoundland (Frost and Lowry, 1981). Based on their rare occurrence in the AFAST study area, the Navy and NMFS do not anticipate any take of ringed seals or beluga whales, and, therefore, they are not addressed further in this document.

Important Areas

Because the consideration of areas where marine mammals are known to selectively breed or calve/pup are important to both the negligible impact finding necessary for the issuance of an MMPA authorization and the need for NMFS to put forth the means of effecting the least practicable adverse impact paying particular attention to rookeries, mating grounds, and other areas of similar significance, we are emphasizing known important reproductive and feeding areas within this section.

Little is known about the breeding and calving behaviors of many of the marine mammals that occur in the AFAST Study Area. For rorquals (humpback whale, minke whale, Bryde's whale, sei whale, fin whale, and blue whale) and sperm whales, mating is generally thought to occur in tropical and sub-tropical waters between mid-winter and mid-summer in deep off-shore waters. Delphinids (Melon-headed Whale, Killer Whale, Pygmy Killer Whale, False Killer Whale, Pilot Whale, Common Dolphin, Atlantic Spotted Dolphin, Clymene Dolphin, Pantropical Spotted Dolphin, Spinner Dolphin, Striped Dolphin, Rough-toothed Dolphin, Common Bottlenose Dolphin, Risso's Dolphin, Fraser's Dolphin, Atlantic White-sided Dolphin, White-beaked Dolphin) may mate within any area of their distribution throughout the year. For pinnipeds, mating and pupping typically occurs in coastal waters near northeast rookeries. With one notable exception, no specific breeding or calving/pupping areas have been identified in the AFAST Study Area for the species that occur there. However, critical habitat has been designated, pursuant to the Endangered Species Act (ESA), for the North Atlantic right whale.

North Atlantic Right Whale

Most North Atlantic right whale sightings follow a well-defined seasonal migratory pattern through several consistently utilized habitats (Winn *et al.*, 1986). It should be noted, however, that some individuals may be sighted in these habitats outside the typical time of year and that migration routes are poorly known (there may be a regular offshore component). The population migrates as two separate components, although some whales may remain in the feeding grounds throughout the winter (Winn *et al.*, 1986; Kenney *et al.*, 2001). Pregnant females and some juveniles migrate from the feeding grounds to the calving grounds off the southeastern United States in late fall to winter. The cow-calf pairs return northward in late winter to early spring. The majority of the right whale population leaves the feeding grounds for unknown habitats in the winter but returns to the feeding grounds coinciding with the return of the cow-calf pairs. Some individuals as well as cow-calf pairs can be seen through the fall and winter on the feeding grounds with feeding being observed (e.g., Sardi *et al.*, 2005).

During the spring through early summer, North Atlantic right whales are found on feeding grounds off the northeastern United States and Canada. Individuals may be found in Cape Cod Bay in February through April (Winn *et al.*, 1986; Hamilton and Mayo, 1990) and in the Great South Channel east of Cape Cod in April through June (Winn *et al.*, 1986; Kenney *et al.*, 1995). Right whales are found throughout the remainder of summer and into fall (June through November) on two feeding grounds in Canadian waters (Gaskin, 1987 and 1991), with peak abundance in August, September, and early October. The majority of summer/fall sightings of mother/calf pairs occur east of Grand Manan Island (Bay of Fundy), although some pairs might move to other unknown locations (Schaeff *et al.*, 1993). Jeffreys Ledge appears to be important habitat for right whales, with extended whale residences; this area appears to be an important fall feeding area for right whales and an important nursery area during summer (Weinrich *et al.*, 2000). The second feeding area is off the southern tip of Nova Scotia in the Roseway Basin between Browns, Baccaro, and Roseway banks (Mitchell *et al.*, 1986; Gaskin, 1987; Stone *et al.*, 1988; Gaskin, 1991). The Cape Cod Bay and Great South Channel feeding grounds are formally designated as critical habitats under the ESA (Silber and Clapham, 2001).

During the winter (as early as November and through March), North Atlantic right whales may be found in coastal waters off North Carolina, Georgia, and northern Florida (Winn *et al.*, 1986). The waters off Georgia and northern Florida are the only known calving ground for western North Atlantic right whales; it is formally designated as a critical habitat under the ESA. Calving occurs from December through March (Silber and Clapham, 2001). On 1 January 2005, the first observed birth on the calving grounds was reported (Zani *et al.*, 2005). The majority of the population is not accounted for on the calving grounds, and not all reproductively active females return to this area each year (Kraus *et al.*, 1986a).

The coastal waters of the Carolinas are suggested to be a migratory corridor for the right whale (Winn *et al.*, 1986). The Southeast U.S. Coast Ground, consisting of coastal waters between North Carolina and northern Florida, was mainly a winter and early spring (January-March) right whaling ground during the late 1800s (Reeves and Mitchell, 1986). The whaling ground was centered along the coasts of South Carolina and Georgia (Reeves and Mitchell, 1986). An examination of sighting records from all sources between 1950 and 1992 found that wintering right whales were observed widely along the coast from Cape Hatteras, North Carolina, to Miami, Florida (Kraus *et al.*, 1993). Sightings off the Carolinas were comprised of single individuals that appeared to be transients (Kraus *et al.*, 1993). These observations are consistent with the hypothesis that the coastal waters of the Carolinas are part of a migratory corridor for the right whale (Winn *et al.*, 1986). Knowlton *et al.* (2002) analyzed sightings data collected in the mid-Atlantic from northern Georgia to southern New England and found that the majority of right whale sightings occurred within approximately 56 km (30 NM) from shore. Until better information is available on the right whale's migratory corridor, it has been recommended that management considerations are needed for the coastal areas along the mid-Atlantic migratory corridor within 65 km (35 NM) from shore (Knowlton, 1997).

Critical habitat for the North Atlantic population of the North Atlantic right whale exists in portions of the JAX/CHASN and Northeast OPAREAs (Figures 4–1 and 4–2 of the Navy's Application). The following three areas occur in U.S. waters and were designated by NMFS as critical habitat in June 1994 (NMFS, 2005):

- Coastal Florida and Georgia (Sebastian Inlet, Florida, to the Altamaha River, Georgia),
- The Great South Channel, east of Cape Cod, and
- Cape Cod and Massachusetts Bays.

The northern critical habitat areas serve as feeding and nursery grounds, while the southern area from the mid-Georgia coast extending southward along Florida serves as calving grounds. The waters off Georgia and northern Florida are the only known calving ground for western North Atlantic right whales. A large portion of this habitat lies within the coastal waters of the JAX/CHASN OPAREA. The physical features correlated with the distribution of right whales in the southern critical habitat area provide an optimum environment for calving. For example, the bathymetry of the inner and nearshore middle shelf area minimizes the effect of strong winds and offshore waves, limiting the formation of large waves and rough water. The average temperature of critical habitat waters is cooler during the time right whales are present due to a lack of influence by the Gulf Stream and cool freshwater runoff from coastal areas. The water temperatures may provide an optimal balance between offshore waters that are too warm for nursing mothers to tolerate, yet not too cool for calves that may only have minimal fatty insulation. On the calving grounds, the reproductive females and calves are expected to be concentrated near the critical habitat in the JAX/CHASN OPAREA from December through April.

Humpback Whale

In the North Atlantic Ocean, humpbacks are found from spring through fall on feeding grounds that are located from south of New England to northern Norway (NMFS, 1991). The Gulf of Maine is one of the principal summer feeding grounds for humpback whales in the North Atlantic. The largest numbers of humpback whales are present from mid-April to mid-November. Feeding locations off the northeastern United States include Stellwagen Bank, Jeffreys Ledge, the Great South Channel, the edges and shoals of Georges Bank, Cashes Ledge, Grand Manan Banks, the banks on the Scotian Shelf, the Gulf of St. Lawrence, and the Newfoundland Grand Banks (CETAP, 1982; Whitehead, 1982; Kenney and Winn, 1986; Weinrich *et al.*, 1997). Distribution in this region has been largely correlated to prey species and abundance, although behavior and bottom topography are factors in foraging strategy (Payne *et al.*, 1986; Payne *et al.*, 1990b). Humpbacks typically return to the same feeding areas each year. Feeding most often occurs in relatively shallow waters over the inner continental shelf and sometimes in deeper waters. Large multi-species feeding aggregations (including humpback whales) have been observed over the shelf break on the southern edge of Georges Bank (CETAP, 1982; Kenney and Winn, 1987) and in shelf break waters off the U.S. mid-Atlantic coast (Smith *et al.*, 1996).

Sperm Whale

The region of the Mississippi River Delta (Desoto Canyon) has been recognized for high densities of sperm whales and appears to represent an important calving and nursery area for these animals (Townsend, 1935; Collum and Fritts, 1985; Mullin *et al.*, 1994a; Wursig *et al.*, 2000; Baumgartner *et al.*, 2001; Davis *et al.*, 2002; Mullin *et al.*, 2004; Jochens *et al.*, 2006). Sperm whales typically exhibit a strong affinity for deep waters beyond the continental shelf, though in the area of the Mississippi Delta they also occur on the outer continental shelf break.

Marine Mammal Density Estimates

Density estimates for cetaceans were either modeled for each region (Northeast, Southeast, and GOMEX) using available line-transect survey data or derived in order of preference: (1) Through spatial models using line-transect survey data provided by NMFS; (2) using abundance estimates from Mullin and Fulling (2003), Fulling *et al.* (2003), and/or Mullin and Fulling (2004); (3) or based on the cetacean abundance estimates found in the most current NOAA stock assessment report (SAR) (Waring *et al.*, 2007). The Navy derived the densities the following way for each area:

- Northeast OPAREAs: The traditional line-transect methods used in the preliminary Northeast NODE (DON, 2006c) and abundance estimates from the North Atlantic Right Whale Consortium (NARWC, 2006). Density estimates for pinnipeds in these OPAREAs were derived from abundance estimates found in the NOAA stock assessment report (Waring *et al.*, 2007) or from the scientific literature (Barlas, 1999).
- Southeast OPAREAs: Abundance estimates found in the NOAA stock assessment report (Waring *et al.*, 2007) or in Mullin and Fulling (2003).
- Gulf of Mexico OPAREAs: Abundance estimates found in the NOAA stock assessment report (Waring *et al.*, 2007) based on Mullin and Fulling (2004).

Using the indicated data, the Navy was able to estimate densities for most species, by OPAREA (and sometimes in greater detail—like for the area around Mayport) and by season.

The detailed density estimate methods and results may be viewed in the Navy OPAREA Density Estimates (NODE) for the Northeast OPAREAS report (DON, 2007e), the NODE for the Southeast OPAREAS report (DON, 2007f), and the NODE for the GOMEX OPAREA report (DON, 2007g), which are available at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.* NMFS has also posted a summary of the density estimates on our Web site: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.*

Brief Background on Sound

An understanding of the basic properties of underwater sound is necessary to comprehend many of the concepts and analyses presented in this document. A summary is included below.

Sound is a wave of pressure variations propagating through a medium (for the sonar considered in this proposed rule, the medium is marine water). Pressure variations are created by compressing and relaxing the medium. Sound measurements can be expressed in two forms: intensity and pressure. Acoustic intensity is the average rate of energy transmitted through a unit area in a specified direction and is expressed in watts per square meter (W/m^2). Acoustic intensity is rarely measured directly, it is derived from ratios of pressures; the standard reference pressure for underwater sound is 1 microPascal (μPa); for airborne sound, the standard reference pressure is 20 μPa (Richardson *et al.*, 1995).

Acousticians have adopted a logarithmic scale for sound intensities, which is denoted in decibels (dB). Decibel measurements represent the ratio between a measured pressure value and a reference pressure value (in this case 1 μPa or, for airborne sound, 20 μPa.). The logarithmic nature of the scale means that each 10 dB increase is a ten-fold increase in power (e.g., 20 dB is a 100-fold increase, 30 dB is a 1,000-fold increase). Humans perceive a 10-dB increase in noise as a doubling of sound level, or a 10 dB decrease in noise as a halving of sound level. The term ''sound pressure level'' implies a decibel measure and a reference pressure that is used as the denominator of the ratio. Throughout this document, NMFS uses 1 microPascal (denoted re: 1μPa) as a standard reference pressure unless noted otherwise.

It is important to note that decibels underwater and decibels in air are not the same and cannot be directly compared. To estimate a comparison between sound in air and underwater, because of the different densities of air and water and the different decibel standards (i.e., reference pressures) in water and air, a sound with the same intensity (i.e., power) in air and in water would be approximately 63 dB quieter in air. Thus a sound that is 160 dB loud underwater would have the same approximate effective intensity as a sound that is 97 dB loud in air.

Sound frequency is measured in cycles per second, or Hertz (abbreviated Hz), and is analogous to musical pitch; high-pitched sounds contain high frequencies and low-pitched sounds contain low frequencies. Natural sounds in the ocean span a huge range of frequencies: from earthquake noise at 5 Hz to harbor porpoise clicks at 150,000 Hz (150 kHz). These sounds are so low or so high in pitch that humans cannot even hear them; acousticians call these infrasonic (typically below 20 Hz) and ultrasonic (typically above 20,000 Hz) sounds, respectively. A single sound may be made up of many different frequencies together. Sounds made up of only a small range of frequencies are called ''narrowband'', and sounds with a broad range of frequencies are called ''broadband''; explosives are an example of a broadband sound source and tactical sonars are an example of a narrowband sound source.

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Based on available behavioral data, audiograms derived using auditory evoked potential (AEP) techniques, anatomical modeling, and other data, Southall *et al.* (2007) designate ''functional hearing groups'' for marine mammals and estimate the lower and upper frequencies of functional hearing of the groups. Further, the frequency range in which each groups hearing is estimated as being most sensitive is represented in the flat part of the M-weighting functions developed for each group. More specific data is available for certain species (Table 13a and b). The functional groups and the associated frequencies are indicated below:

• Low frequency cetaceans (13 species of mysticetes): functional hearing is estimated to occur between approximately 7 Hz and 22 kHz;

• Mid-frequency cetaceans (32 species of dolphins, six species of larger toothed whales, and 19 species of beaked and bottlenose whales): functional hearing is estimated to occur between approximately 150 Hz and 160 kHz;

• High frequency cetaceans (eight species of true porpoises, six species of river dolphins, Kogia, the franciscana, and four species of cephalorhynchids): functional hearing is estimated to occur between approximately 200 Hz and 180 kHz;

• Pinnipeds in Water: functional hearing is estimated to occur between approximately 75 Hz and 75 kHz, with the greatest sensitivity between approximately 700 Hz and 20 kHz.

Because ears adapted to function underwater are physiologically different from human ears, comparisons using decibel measurements in air would still not be adequate to describe the effects of a sound on a whale. When sound travels away from its source, its loudness decreases as the distance traveled (propagates) by the sound increases. Thus, the loudness of a sound at its source is higher than the loudness of that same sound a kilometer distant. Acousticians often refer to the loudness of a sound at its source (typically measured one meter from the source) as the source level and the loudness of sound elsewhere as the received level. For example, a humpback whale three kilometers from an airgun that has a source level of 230 dB may only be exposed to sound that is 160 dB loud, depending on how the sound propagates (in this example, it is spherical spreading). As a result, it is important not to confuse source levels and received levels when discussing the loudness of sound in the ocean or its impacts on the marine environment.

As sound travels from a source, its propagation in water is influenced by various physical characteristics, including water temperature, depth, salinity, and surface and bottom properties that cause refraction, reflection, absorption, and scattering of sound waves. Oceans are not homogeneous and the contribution of each of these individual factors is extremely complex and interrelated. The physical characteristics that determine the sound's speed through the water will change with depth, season, geographic location, and with time of day (as a result, in actual sonar operations, crews will measure oceanic conditions, such as sea water temperature and depth, to calibrate models that determine the path the sonar signal will take as it travels through the ocean and how strong the sound signal will be at a given range along a particular transmission path). As sound travels through the ocean, the intensity associated with the wavefront diminishes, or attenuates. This decrease in intensity is referred to as propagation loss, also commonly called transmission loss.

Metrics Used in This Document

This section includes a brief explanation of the two sound measurements (sound pressure level (SPL) and sound exposure level (SEL)) frequently used in the discussions of acoustic effects in this document.

SPL

Sound pressure is the sound force per unit area, and is usually measured in micropascals (μPa), where 1 Pa is the pressure resulting from a force of one newton exerted over an area of one square meter. SPL is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in underwater acoustics is 1 μPa, and the units for SPLs are dB re: 1 μPa.

SPL (in dB) = 20 log (pressure / reference pressure)

SPL is an instantaneous measurement and can be expressed as the peak, the peak-peak, or the root mean square (rms). Root mean square, which is the square root of the arithmetic average of the squared instantaneous pressure values, is typically used in discussions of the effects of sounds on vertebrates and all references to SPL in this document refer to the root mean square. SPL does not take the duration of a sound into account. SPL is the applicable metric used in the risk continuum, which is used to estimate behavioral harassment takes (see Level B Harassment Risk Function (Behavioral Harassment) Section).

SEL

SEL is an energy metric that integrates the squared instantaneous sound pressure over a stated time interval. The units for SEL are dB re: 1 $\mu Pa^2 - s$.

SEL = SPL + 10 log (duration in seconds)

As applied to tactical sonar, the SEL includes both the SPL of a sonar ping and the total duration. Longer duration pings and/or pings with higher SPLs will have a higher SEL. If an animal is exposed to multiple pings, the SEL in each individual ping is summed to calculate the total SEL. The total SEL depends on the SPL, duration, and number of pings received. The thresholds that NMFS uses to indicate at what received level the onset of temporary threshold shift (TTS) and permanent threshold shift (PTS) in hearing are likely to occur are expressed in SEL.

Potential Effects of Specified Activities on Marine Mammals

Exposure to MFAS/HFAS

The Navy has requested authorization for the take of marine mammals that may occur incidental to training activities in the AFAST Study Area utilizing MFAS/HFAS or the IEER system, which includes an explosive sonobuoy. The Navy has analyzed the potential impacts to marine mammals from AFAST, including ship strike, entanglement in or direct strike by expended materials, ship noise, and others, and in consultation with NMFS as a cooperating agency for the AFAST EIS, has determined that take of marine mammals incidental to these non-acoustic components of AFAST is unlikely (see the Navy's LOA application and March addendum to the application) and, therefore, has not requested authorization for take of marine mammals that might occur incidental to these non-acoustic components. In this document, NMFS analyzes the potential effects on marine mammals from exposure to MFAS/HFAS and underwater detonations from the IEER.

For the purpose of MMPA authorizations, NMFS' effects assessments serve three primary purposes: (1) To put forth the permissible methods of taking within the context of MMPA Level B Harassment (behavioral harassment), Level A Harassment (injury), and mortality (i.e., identify the number and types of take that will occur); (2) to determine whether the specified activity will have a negligible impact on the affected species or stocks of marine mammals (based on the likelihood that the activity will adversely affect the species or stock through effects on annual rates of recruitment or survival); and (3) to determine whether the specified activity will have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (however, there are no subsistence communities that would be affected in the AFAST Study Area, so this determination is inapplicable for AFAST).

More specifically, for activities involving active tactical sonar or underwater detonations, NMFS' analysis will identify the probability of lethal responses, physical trauma, sensory impairment (permanent and temporary threshold shifts and acoustic masking), physiological responses (particular stress responses), behavioral disturbance (that rises to the level of harassment), and social responses that would be classified as behavioral harassment or injury and/or would be likely to adversely affect the species or stock through effects on annual rates of recruitment or survival. In this section, we will focus qualitatively on the different ways that MFAS/HFAS and underwater explosive detonations (IEER) may affect marine mammals (some of which NMFS would not classify as harassment). Then, in the Estimated Take of Marine Mammals Section, NMFS will relate the potential effects to marine mammals from MFAS/HFAS and underwater detonation of explosives to the MMPA regulatory definitions of Level A and Level B Harassment and attempt to quantify those effects.

In its April 14, 2008, Biological Opinion of the U.S. Navy's proposal to conduct four training exercises in the Cherry Point, Virginia Capes, and Jacksonville Range Complexes NMFS presented a conceptual model of the potential responses of endangered and threatened species upon being exposed to active sonar and the pathways by which those responses might affect the fitness of individual animals that have been exposed, which may then affect the reproduction and/or survival of those individuals. Literature supporting the framework, with examples drawn from many taxa (both aquatic and terrestrial) was included in the ''Application of this Approach'' and ''Response Analyses'' sections of that document (available at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*). This conceptual framework may also be used to describe the responses and pathways for non-endangered and non-threatened species and is included in the Biological Opinion of the U.S. Navy's proposal to conduct four training exercises in the Cherry Point, Virginia Capes, and Jacksonville Range Complexes.

Direct Physiological Effects

Based on the literature, there are two basic ways that MFAS/HFAS might directly result in physical trauma or damage: noise-induced loss of hearing sensitivity (more commonly-called ''threshold shift'') and acoustically mediated bubble growth. Separately, an animal's behavioral reaction to an acoustic exposure might lead to physiological effects that might ultimately lead to injury or death, which is discussed later in the Stranding section.

Threshold Shift (Noise-Induced Loss of Hearing)

When animals exhibit reduced hearing sensitivity (i.e., sounds must be louder for an animal to recognize them) following exposure to a sufficiently intense sound, it is referred to as a noise-induced threshold shift (TS). An animal can experience temporary threshold shift (TTS) or permanent threshold shift (PTS). TTS can last from minutes or hours to days (i.e., there is recovery), occurs in specific frequency ranges (i.e., an animal might only have a temporary loss of hearing sensitivity between the frequencies of 1 and 10 kHz), and can be of varying amounts (for example, an animal's hearing sensitivity might be reduced by only 6 dB or reduced by 30 dB). PTS is permanent (i.e., there is no recovery), but also occurs in a specific frequency range and amount as mentioned above for TTS.

The following physiological mechanisms are thought to play a role in inducing auditory TSs: Effects to sensory hair cells in the inner ear that reduce their sensitivity, modification of the chemical environment within the sensory cells, residual muscular activity in the middle ear, displacement of certain inner ear membranes, increased blood flow, and post-stimulatory reduction in both efferent and sensory neural output (Southall *et al.*, 2007). The amplitude, duration, frequency, temporal pattern, and energy distribution of sound exposure all affect the amount of associated TS and the frequency range in which it occurs. As amplitude and duration of sound exposure increase, so, generally, does the amount of TS, along with the recovery time. For continuous sounds, exposures of equal energy (the same SEL) will lead to approximately equal effects. For intermittent sounds, less TS will occur than from a continuous exposure with the same energy (some recovery will occur between intermittent exposures) (Kryter *et al.*, 1966; Ward, 1997). For example, one short but loud (higher SPL) sound exposure may induce the same impairment as one longer but softer sound, which in turn may cause more impairment than a series of several intermittent softer sounds with the same total energy (Ward, 1997). Additionally, though TTS is temporary, very prolonged exposure to sound strong enough to elicit TTS, or shorter-term exposure to sound levels well above the TTS threshold, can cause PTS, at least in terrestrial mammals (Kryter, 1985) (although in the case of MFAS/HFAS, animals are not expected to be exposed to levels high enough or durations long enough to result in PTS).

PTS is considered auditory injury (Southall *et al.*, 2007). Irreparable damage to the inner or outer cochlear hair cells may cause PTS, however, other mechanisms are also involved, such as exceeding the elastic limits of certain tissues and membranes in the middle and inner ears and resultant changes in the chemical composition of the inner ear fluids (Southall *et al.*, 2007).

Although the published body of scientific literature contains numerous theoretical studies and discussion papers on hearing impairments that can occur with exposure to a loud sound, only a few studies provide empirical information on the levels at which noise-induced loss in hearing sensitivity occurs in nonhuman animals. For cetaceans, published data are limited to the captive bottlenose dolphin and beluga (Finneran *et al.*, 2000, 2002b, 2005a; Schlundt *et al.*, 2000; Nachtigall *et al.*, 2003, 2004). For pinnipeds in water, data are limited to Kastak *et al.*'s measurement of TTS in one harbor seal, one elephant seal, and one California sea lion.

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (i.e., recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious (similar to those discussed in auditory masking, below). For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that takes place during a time when the animal is traveling through the open ocean, where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical for successful mother/calf interactions could have more serious impacts. Also, depending on the degree and frequency range, the effects of PTS on an animal could range in severity, although it is considered generally more serious because it is a permanent condition. Of note, reduced hearing sensitivity as a simple function of development and aging has been observed in marine mammals, as well as humans and other taxa (Southall *et al.*, 2007), so we can infer that strategies exist for coping with this condition to some degree, though likely not without cost. There is no empirical evidence that exposure to MFAS/HFAS can cause PTS in any marine mammals; instead the probability of PTS has been inferred from studies of TTS (see Richardson *et al.*, 1995).

Acoustically Mediated Bubble Growth

One theoretical cause of injury to marine mammals is rectified diffusion (Crum and Mao, 1996), the process of increasing the size of a bubble by exposing it to a sound field. This process could be facilitated if the environment in which the ensonified bubbles exist is supersaturated with gas. Repetitive diving by marine mammals can cause the blood and some tissues to accumulate gas to a greater degree than is supported by the surrounding environmental pressure (Ridgway and Howard, 1979). The deeper and longer dives of some marine mammals (for example, beaked whales) are theoretically predicted to induce greater supersaturation (Houser *et al.*, 2001b). If rectified diffusion were possible in marine mammals exposed to high-level sound, conditions of tissue supersaturation could theoretically speed the rate and increase the size of bubble growth. Subsequent effects due to tissue trauma and emboli would presumably mirror those observed in humans suffering from decompression sickness.

It is unlikely that the short duration of sonar pings would be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis has also been suggested: Stable bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. In such a scenario the marine mammal would need to be in a gas-supersaturated state for a long enough period of time for bubbles to become of a problematic size.

Yet another hypothesis (decompression sickness) has speculated that rapid ascent to the surface following exposure to a startling sound might produce tissue gas saturation sufficient for the evolution of nitrogen bubbles (Jepson *et al.*, 2003; Fernandez *et al.*, 2005). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. Collectively, these hypotheses can be referred to as ''hypotheses of acoustically mediated bubble growth.''

Although theoretical predictions suggest the possibility for acoustically mediated bubble growth, there is considerable disagreement among scientists as to its likelihood (Piantadosi and Thalmann, 2004; Evans and Miller, 2003). Crum and Mao (1996) hypothesized that received levels would have to exceed 190 dB in order for there to be the possibility of significant bubble growth due to supersaturation of gases in the blood (i.e., rectified diffusion). More recent work conducted by Crum *et al.* (2005) demonstrated the possibility of rectified diffusion for short duration signals, but at SELs and tissue saturation levels that are highly improbable to occur in diving marine mammals. To date, Energy Levels (ELs) predicted to cause in vivo bubble formation within diving cetaceans have not been evaluated (NOAA, 2002b). Although it has been argued that traumas from some recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson *et al.*, 2003), there is no conclusive evidence of this. However, Jepson *et al.* (2003, 2005) and Fernandez *et al.* (2004, 2005) concluded that in vivo bubble formation, which may be exacerbated by deep, long-duration, repetitive dives may explain why beaked whales appear to be particularly vulnerable to sonar exposures. Further investigation is needed to further assess the potential validity of these hypotheses. More information regarding hypotheses that attempt to explain how behavioral responses to MFAS/HFAS can lead to strandings is included in the Behaviorally Mediated Bubble Growth Section, after the summary of strandings.

Acoustic Masking

Marine mammals use acoustic signals for a variety of purposes, which differ among species, but include communication between individuals, navigation, foraging, reproduction, and learning about their environment (Erbe and Farmer, 2000, Tyack, 2000). Masking, or auditory interference, generally occurs when sounds in the environment are louder than and of a similar frequency to, auditory signals an animal is trying to receive. Masking is a phenomenon that affects animals that are trying to receive acoustic information about their environment, including sounds from other members of their species, predators, prey, and sounds that allow them to orient in their environment. Masking these acoustic signals can disturb the behavior of individual animals, groups of animals, or entire populations.

The extent of the masking interference depends on the spectral, temporal, and spatial relationships between the signals an animal is trying to receive and the masking noise, in addition to other factors. In humans, significant masking of tonal signals occurs as a result of exposure to noise in a narrow band of similar frequencies. As the sound level increases, though, the detection of frequencies above those of the masking stimulus decreases also. This principle is expected to apply to marine mammals as well because of common biomechanical cochlear properties across taxa.

Richardson *et al.* (1995b) argued that the maximum radius of influence of an industrial noise (including broadband low frequency sound transmission) on a marine mammal is the distance from the source to the point at which the noise can barely be heard. This range is determined by either the hearing sensitivity of the animal or the background noise level present. Industrial masking is most likely to affect some species' ability to detect communication calls and natural sounds (i.e., surf noise, prey noise, etc.; Richardson *et al.*, 1995).

The echolocation calls of toothed whales are subject to masking by high frequency sound. Human data indicate low-frequency sound can mask high-frequency sounds (i.e., upward masking). Studies on captive odontocetes by Au *et al.* (1974, 1985, 1993) indicate that some species may use various processes to reduce masking effects (e.g., adjustments in echolocation call intensity or frequency as a function of background noise conditions). There is also evidence that the directional hearing abilities of odontocetes are useful in reducing masking at the high-frequencies these cetaceans use to echolocate, but not at the low-to-moderate frequencies they use to communicate (Zaitseva *et al.*, 1980).

As mentioned previously, the functional hearing ranges of mysticetes, odontocetes, and pinnipeds underwater all encompass the frequencies of the sonar sources used in the Navy's MFAS/HFAS training exercises. Additionally, in almost all species, vocal repertoires span across the frequencies of these sonar sources used by the Navy. The closer the characteristics of the masking signal to the signal of interest, the more likely masking is to occur. For hull-mounted sonar—which accounts for the largest part of the takes of marine mammals (because of the source strength and number of hours it's conducted), the pulse length and duty cycle of the MFAS/HFAS signal (~ 1 second pulse twice a minute) makes it less likely that masking will occur as a result.

Impaired Communication

In addition to making it more difficult for animals to perceive acoustic cues in their environment, anthropogenic sound presents separate challenges for animals that are vocalizing. When they vocalize, animals are aware of environmental conditions that affect the "active space" of their vocalizations, which is the maximum area within which their vocalizations can be detected before it drops to the level of ambient noise (Brenowitz, 2004; Brumm *et al.*, 2004; Lohr *et al.*, 2003). Animals are also aware of environment conditions that affect whether listeners can discriminate and recognize their vocalizations from other sounds, which is more important than simply detecting that a vocalization is occurring (Brenowitz, 1982; Brumm *et al.*, 2004; Dooling, 2004, Marten and Marler, 1977; Patricelli *et al.*, 2006). Most animals that vocalize have evolved with an ability to make adjustments to their vocalizations to increase the signal-to-noise ratio, active space, and recognizability/distinguishability of their vocalizations in the face of temporary changes in background noise (Brumm *et al.*, 2004; Patricelli *et al.*, 2006). Vocalizing animals can make one or more of the following adjustments to their vocalizations: Adjust the frequency structure; adjust the amplitude; adjust temporal structure; or adjust temporal delivery (see Biological Opinion).

Many animals will combine several of these strategies to compensate for high levels of background noise. Anthropogenic sounds that reduce the signal-to-noise ratio of animal vocalizations, increase the masked auditory thresholds of animals listening for such vocalizations, or reduce the active space of an animal's vocalizations impair communication between animals. Most animals that vocalize have evolved strategies to compensate for the effects of short-term or temporary increases in background or ambient noise on their songs or calls. Although the fitness consequences of these vocal adjustments remain unknown, like most other trade-offs animals must make, some of these strategies probably come at a cost (Patricelli *et al.*, 2006). For example, vocalizing more loudly in noisy environments may have energetic costs that decrease the net benefits of vocal adjustment and alter a bird's energy budget (Brumm, 2004; Wood and Yezerinac, 2006). Shifting songs and calls to higher frequencies may also impose energetic costs (Lambrechts, 1996).

Stress Responses

Classic stress responses begin when an animal's central nervous system perceives a potential threat to its homeostasis. That perception triggers stress responses regardless of whether a stimulus actually threatens the animal; the mere perception of a threat is sufficient to trigger a stress response (Moberg, 2000; Sapolsky *et al.*, 2005; Seyle, 1950). Once an animal's central nervous system perceives a threat, it mounts a biological response or defense that consists of a combination of the four general biological defense responses: Behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune response.

In the case of many stressors, an animal's first and most economical (in terms of biotic costs) response is behavioral avoidance of the potential stressor or avoidance of continued exposure to a stressor. An animal's second line of defense to stressors involves the sympathetic part of the autonomic nervous system and the classical "fight or flight" response which includes the cardiovascular system, the gastrointestinal system, the exocrine glands, and the adrenal medulla to produce changes in heart rate, blood pressure, and gastrointestinal activity that humans commonly associate with "stress." These responses have a relatively short duration and may or may not have significant long-term effect on an animal's welfare.

An animal's third line of defense to stressors involves its neuroendocrine or sympathetic nervous systems; the system that has received the most study has been the hypothalmus-pituitary-adrenal system (also known as the HPA axis in mammals or the hypothalamus-pituitary-interrenal axis in fish and some reptiles). Unlike stress responses associated with the autonomic nervous system, virtually all neuro-endocrine functions that are affected by stress—including immune competence, reproduction, metabolism, and behavior—are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction (Moberg, 1987; Rivier, 1995) and altered metabolism (Elasser *et al.*, 2000), reduced immune competence (Blecha, 2000) and behavioral disturbance. Increases in the circulation of glucocorticosteroids (cortisol, corticosterone, and aldosterone in marine mammals; see Romano *et al.*, 2004) have been equated with stress for many years.

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and distress is the biotic cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose a risk to the animal's welfare. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other biotic function, which impairs those functions that experience the diversion. For example, when mounting a stress response diverts energy away from growth in young animals, those animals may experience stunted growth. When mounting a stress response diverts energy from a fetus, an animal's reproductive success and its fitness will suffer. In these cases, the animals will have entered a pre-pathological or pathological state which is called ''distress'' (sensu Seyle 1950) or ''allostatic loading'' (sensu McEwen and Wingfield, 2003). This pathological state will last until the animal replenishes its biotic reserves sufficient to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses have also been documented fairly well through controlled experiment; because this physiology exists in every vertebrate that has been studied, it is not surprising that stress responses and their costs have been documented in both laboratory and free-living animals (for examples see, Holberton *et al.*, 1996; Hood *et al.*, 1998; Jessop *et al.*, 2003; Krausman *et al.*, 2004; Lankford *et al.*, 2005; Reneerkens *et al.*, 2002; Thompson and Hamer, 2000). Although no information has been collected on the physiological responses of marine mammals to exposure to anthropogenic sounds, studies of other marine animals and terrestrial animals would lead us to expect some marine mammals to experience physiological stress responses and, perhaps, physiological responses that would be classified as ''distress'' upon exposure to high frequency, mid-frequency and low-frequency sounds.

For example, Jansen (1998) reported on the relationship between acoustic exposures and physiological responses that are indicative of stress responses in humans (for example, elevated respiration and increased heart rates). Jones (1998) reported on reductions in human performance when faced with acute, repetitive exposures to acoustic disturbance. Trimper *et al.* (1998) reported on the physiological stress responses of osprey to low-level aircraft noise while Krausman *et al.* (2004) reported on the auditory and physiology stress responses of endangered Sonoran pronghorn to military overflights. Smith *et al.* (2004a, 2004b) identified noise-induced physiological transient stress responses in hearing-specialist fish (*i.e.*, goldfish) that accompanied short- and long-term hearing losses. Welch and Welch (1970) reported physiological and behavioral stress responses that accompanied damage to the inner ears of fish and several mammals.

Hearing is one of the primary senses marine mammals use to gather information about their environment and to communicate with conspecifics. Although empirical information on the relationship between sensory impairment (TTS, PTS, and acoustic masking) on marine mammals remains limited, it seems reasonable to assume that reducing an animal's ability to gather information about its environment and to communicate with other members of its species would be stressful for animals that use hearing as their primary sensory mechanism. Therefore, we assume that acoustic exposures sufficient to trigger onset PTS or TTS would be accompanied by physiological stress responses because terrestrial animals exhibit those responses under similar conditions (NRC, 2003). More importantly, marine mammals might experience stress responses at received levels lower than those necessary to trigger onset TTS. Based on empirical studies of the time required to recover from stress responses (Moberg, 2000), we also assume that stress responses are likely to persist beyond the time interval required for animals to recover from TTS and might result in pathological and pre-pathological states that would be as significant as behavioral responses to TTS.

Behavioral Disturbance

Behavioral responses to sound are highly variable and context-specific. Many different variables can influence an animal's perception of and response to (nature and magnitude) an acoustic event. An animal's prior experience with a sound or sound source effects whether it is less likely (habituation) or more likely (sensitization) to respond to certain sounds in the future (animals can also be innately pre-disposed to respond to certain sounds in certain ways) (Southall *et al.*, 2007). Related to the sound itself, the perceived nearness of the sound, bearing of the sound (approaching vs. retreating), similarity of a sound to biologically relevant sounds in the animal's environment (i.e., calls of predators, prey, or conspecifics), and familiarity of the sound may effect the way an animal responds to the sound (Southall *et al.*, 2007). Individuals (of different age, gender, reproductive status, etc.) among most populations will have variable hearing capabilities, and differing behavioral sensitivities to sounds that will be affected by prior conditioning, experience, and current activities of those individuals. Often, specific acoustic features of the sound and contextual variables (i.e., proximity, duration, or recurrence of the sound or the current behavior that the marine mammal is engaged in or its prior experience), as well as entirely separate factors such as the physical presence of a nearby vessel, may be more relevant to the animal's response than the received level alone.

Exposure of marine mammals to sound sources can result in (but is not limited to) the following observable responses: Increased alertness; orientation or attraction to a sound source; vocal modifications; cessation of feeding; cessation of social interaction; alteration of movement or diving behavior; habitat abandonment (temporary or permanent); and, in severe cases, panic, flight, stampede, or stranding, potentially resulting in death (Southall *et al.*, 2007). A review of marine mammal responses to anthropogenic sound was first conducted by Richardson and others in 1995. A more recent review (Nowacek *et al.*, 2007) addresses studies conducted since 1995 and focuses on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated. The following sub-sections provide examples of behavioral responses that provide an idea of the variability in behavioral responses that would be expected given the differential sensitivities of marine mammal species to sound and the wide range of potential acoustic sources to which a marine mammal may be exposed. Estimates of the types of behavioral responses that could occur for a given sound exposure should be determined from the literature that is available for each species, or extrapolated from closely related species when no information exists.

Flight Response—A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996). Flight responses have been speculated as being a component of marine mammal strandings associated with sonar activities (Evans and England, 2001).

Response to Predator—Evidence suggests that at least some marine mammals have the ability to acoustically identify potential predators. For example, harbor seals that reside in the coastal waters off British Columbia are frequently targeted by certain groups of killer whales, but not others. The seals discriminate between the calls of threatening and non-threatening killer whales (Deecke *et al.*, 2002), a capability that should increase survivorship while reducing the energy required for attending to and responding to all killer whale calls. The occurrence of masking or hearing impairment provides a means by which marine mammals may be prevented from responding to the acoustic cues produced by their predators. Whether or not this is a possibility depends on the duration of the masking/hearing impairment and the likelihood of encountering a predator during the time that predator cues are impeded.

Diving—Changes in dive behavior can vary widely. They may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive. Variations in dive behavior may reflect interruptions in biologically significant activities (e.g., foraging) or they may be of little biological significance. Variations in dive behavior may also expose an animal to potentially harmful conditions (e.g., increasing the chance of ship-strike) or may serve as an avoidance response that enhances survivorship. The impact of a variation in diving resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Nowacek *et al.* (2004) reported disruptions of dive behaviors in foraging North Atlantic right whales when exposed to an alerting stimulus, an action, they noted, that could lead to an increased likelihood of ship strike. However, the whales did not respond to playbacks of either right whale social sounds or vessel noise, highlighting the importance of the sound characteristics in producing a behavioral reaction. Conversely, Indo-Pacific humpback dolphins have been observed to dive for longer periods of time in areas where vessels were present and/or approaching (Ng and Leung, 2003). In both of these studies, the influence of the sound exposure cannot be decoupled from the physical presence of a surface vessel, thus complicating intepretations of the relative contribution of each stimulus to the response. Indeed, the presence of surface vessels, their approach and speed of approach, seemed to be significant factors in the response of the Indo-Pacific humpback dolphins (Ng and Leung, 2003). Low frequency signals of the Acoustic Thermometry of Ocean Climate (ATOC) sound source were not found to affect dive times of humpback whales in Hawaiian waters (Frankel and Clark, 2000) or to overtly affect elephant seal dives (Costa *et al.*, 2003). They did, however, produce subtle effects that varied in direction and degree among the individual seals, illustrating the equivocal nature of behavioral effects and consequent difficulty in defining and predicting them.

Due to past incidents of beaked whale strandings associated with sonar operations, feedback paths are provided between avoidance and diving and indirect tissue effects. This feedback accounts for the hypothesis that variations in diving behavior and/or avoidance responses can possibly result in nitrogen tissue supersaturation and nitrogen off-gassing, possibly to the point of deleterious vascular bubble formation (Jepson *et al.*, 2003).

Foraging—Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (e.g., bubble nets or sediment plumes), or changes in dive behavior. Noise from seismic surveys was not found to impact the feeding behavior in western grey whales off the coast of Russia (Yazvenko *et al.*, 2007) and sperm whales engaged in foraging dives did not abandon dives when exposed to distant signatures of seismic airguns (Madsen *et al.*, 2006). Balaenopterid whales exposed to moderate low-frequency signals similar to the ATOC sound source demonstrated no variation in foraging activity (Croll *et al.*, 2001), whereas five out of six North Atlantic right whales exposed to an acoustic alarm interrupted their foraging dives (Nowacek *et al.*, 2004). Although the received sound pressure level at the animals was similar in the latter two studies, the frequency, duration, and temporal pattern of signal presentation were different. These factors, as well as differences in species sensitivity, are likely contributing factors to the differential response. A determination of whether foraging disruptions incur fitness consequences will require information on or estimates of the energetic requirements of the individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Breathing—Variations in respiration naturally vary with different behaviors and variations in respiration rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Mean exhalation rates of gray whales at rest and while diving were found to be unaffected by seismic surveys conducted adjacent to the whale feeding grounds (Gailey *et al.*, 2007). Studies with captive harbor porpoises showed increased respiration rates upon introduction of acoustic alarms (Kastelein *et al.*, 2001; Kastelein *et al.*, 2006a) and emissions for underwater data transmission (Kastelein *et al.*, 2005). However, exposure of the same acoustic alarm to a striped dolphin under the same conditions did not elicit a response (Kastelein *et al.*, 2006a), again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure.

Social relationships—Social interactions between mammals can be affected by noise via the disruption of communication signals or by the displacement of individuals. Disruption of social relationships therefore depends on the disruption of other behaviors (e.g., caused avoidance, masking, etc.) and no specific overview is provided here. However, social disruptions must be considered in context of the relationships that are affected. Long-term disruptions of mother/calf pairs or mating displays have the potential to affect the growth and survival or reproductive effort/success of individuals, respectively.

Vocalizations (also see Masking Section)—Vocal changes in response to anthropogenic noise can occur across the repertoire of sound production modes used by marine mammals, such as whistling, echolocation click production, calling, and singing. Changes may result in response to a need to compete with an increase in background noise or may reflect an increased vigilance or startle response. For example, in the presence of low-frequency active sonar, humpback whales have been observed to increase the length of their ''songs'' (Miller *et al.*, 2000; Fristrup *et al.*, 2003), possibly due to the overlap in frequencies between the whale song and the low-frequency active sonar. A similar compensatory effect for the presence of low frequency vessel noise has been suggested for right whales; right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.*, 2007). Killer whales off the northwestern coast of the United States have been observed to increase the duration of primary calls once a threshold in observing vessel density (e.g., whale watching) was reached, which has been suggested as a response to increased masking noise produced by the vessels (Foote *et al.*, 2004). In contrast, both sperm and pilot whales potentially ceased sound production during the Heard Island feasibility test (Bowles *et al.*, 1994), although it cannot be absolutely determined whether the inability to acoustically detect the animals was due to the cessation of sound production or the displacement of animals from the area.

Avoidance—Avoidance is the displacement of an individual from an area as a result of the presence of a sound. Richardson *et al.* (1995) noted that avoidance reactions are the most obvious manifestations of disturbance in marine mammals. It is qualitatively different from the flight response, but also differs in the magnitude of the response (i.e., directed movement, rate of travel, etc.). Oftentimes avoidance is temporary, and animals return to the area once the noise has ceased. Longer term displacement is possible, however, which can lead to changes in abundance or distribution patterns of the species in the affected region if they do not become acclimated to the presence of the sound (Blackwell *et al.*, 2004; Bejder *et al.*, 2006; Teilmann *et al.*, 2006). Acute avoidance responses have been observed in captive porpoises and pinnipeds exposed to a number of different sound sources (Kastelein *et al.*, 2001; Finneran *et al.*, 2003; Kastelein *et al.*, 2006a; Kastelein *et al.*, 2006b). Short term avoidance of seismic surveys, low frequency emissions, and acoustic deterrants has also been noted in wild populations of odontocetes (Bowles *et al.*, 1994; Goold, 1996; 1998; Stone *et al.*, 2000; Morton and Symonds, 2002) and to some extent in mysticetes (Gailey *et al.*, 2007), while longer term or repetitive/chronic displacement for some dolphin groups and for manatees has been suggested to be due to the presence of chronic vessel noise (Haviland-Howell *et al.*, 2007; Miksis-Olds *et al.*, 2007).

Orientation—A shift in an animal's resting state or an attentional change via an orienting response represent behaviors that would be considered mild disruptions if occurring alone. As previously mentioned, the responses may co-occur with other behaviors; for instance, an animal may initially orient toward a sound source, and then move away from it. Thus, any orienting response should be considered in context of other reactions that may occur.

There are few empirical studies of avoidance responses of free-living cetaceans to mid-frequency sonars. Much more information is available on the avoidance responses of free-living cetaceans to other acoustic sources, such as seismic airguns and low frequency tactical sonar, than mid-frequency active sonar.

Behavioral Responses (Southall et al. (2007))

Southall *et al.* (2007) reports the results of the efforts of a panel of experts in acoustic research from behavioral, physiological, and physical disciplines that convened and reviewed the available literature on marine mammal hearing and physiological and behavioral responses to human-made sound with the goal of proposing exposure criteria for certain effects. This peer-reviewed compilation of literature is very valuable, though Southall *et al.* (2007) note that not all data are equal, some have poor statistical power, insufficient controls, and/or limited information on received levels, background noise, and other potentially important contextual variables—such data were reviewed and sometimes used for qualitative illustration but were not included in the quantitative analysis for the criteria recommendations. All of the studies considered, however, contain an estimate of the received sound level when the animal exhibited the indicated response.

In the Southall *et al.* (2007) publication, for the purposes of analyzing responses of marine mammals to anthropogenic sound and developing criteria, the authors differentiate between single pulse sounds, multiple pulse sounds, and non-pulse sounds. MFAS/HFAS sonar is considered a non-pulse sound. Southall *et al.* (2007) summarize the studies associated with low-frequency, mid-frequency, and high-frequency cetacean and pinniped responses to non-pulse sounds, based strictly on received level, in Appendix C of their article (incorporated by reference and summarized in the three paragraphs below).

The studies that address responses of low frequency cetaceans to non-pulse sounds include data gathered in the field and related to several types of sound sources (of varying similarity to MFAS/HFAS) including: Vessel noise, drilling and machinery playback, low-frequency M-sequences (sine wave with multiple phase reversals) playback, tactical low-frequency active sonar playback, drill ships, Acoustic Thermometry of Ocean Climate (ATOC) source, and non-pulse playbacks. These studies generally indicate no (or very limited) responses to received levels in the 90 to 120 dB re: 1 μPa range and an increasing likelihood of avoidance and other behavioral effects in the 120 to 160 dB range. As mentioned earlier, though, contextual variables play a very important role in the reported responses and the severity of effects is not linear when compared to received level. Also, few of the laboratory or field datasets had common conditions, behavioral contexts or sound sources, so it is not surprising that responses differ.

The studies that address responses of mid-frequency cetaceans to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to MFAS/HFAS) including: Pingers, drilling playbacks, ship and ice-breaking noise, vessel noise, Acoustic Harassment Devices (AHDs), Acoustic Deterrent Devices (ADDs), MFAS, and non-pulse bands and tones. Southall *et al.* (2007) were unable to come to a clear conclusion regarding the results of these studies. In some cases, animals in the field showed significant responses to received levels between 90 and 120 dB, while in other cases these responses were not seen in the 120 to 150 dB range. The disparity in results was likely due to contextual variation and the differences between the results in the field and laboratory data (animals typically responded at lower levels in the field).

The studies that address responses of high frequency cetaceans to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to MFAS/HFAS) including: Pingers, AHDs, and various laboratory non-pulse sounds. All of these data were collected from harbor porpoises. Southall *et al.* (2007) concluded that the existing data indicate that harbor porpoises are likely sensitive to a wide range of anthropogenic sounds at low received levels (~90–120 dB), at least for initial exposures. All recorded exposures above 140 dB induced profound and sustained avoidance behavior in wild harbor porpoises (Southall *et al.,* 2007). Rapid habituation was noted in some but not all studies. There is no data to indicate whether other high frequency cetaceans are as sensitive to anthropogenic sound as harbor porpoises are.

The studies that address the responses of pinnipeds in water to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to MFAS/HFAS) including: AHDs, ATOC, various non-pulse sounds used in underwater data communication; underwater drilling, and construction noise. Few studies exist with enough information to include them in the analysis. The limited data suggested that exposures to non-pulse sounds between 90 and 140 dB generally do not result in strong behavioral responses in pinnipeds in water, but no data exist at higher received levels.

In addition to summarizing the available data, the authors of Southall *et al.* (2007) developed a severity scaling system with the intent of ultimately being able to assign some level of biological significance to a response. Following is a summary of their scoring system; a comprehensive list of the behaviors associated with each score may be found in the report:

• 0–3 (Minor and/or brief behaviors) includes, but is not limited to: no response; minor changes in speed or locomotion (but with no avoidance); individual alert behavior; minor cessation in vocal behavior; minor changes in response to trained behaviors (in laboratory).

• 4–6 (Behaviors with higher potential to affect foraging, reproduction, or survival) includes, but is not limited to: moderate changes in speed, direction, or dive profile; brief shift in group distribution; prolonged cessation or modification of vocal behavior (duration > duration of sound), minor or moderate individual and/or group avoidance of sound; brief cessation of reproductive behavior; or refusal to initiate trained tasks (in laboratory).

• 7–9 (Behaviors considered likely to affect the aforementioned vital rates) includes, but is not limited to: Extensive or prolonged aggressive behavior; moderate, prolonged or significant separation of females and dependent offspring with disruption of acoustic reunion mechanisms; long-term avoidance of an area; outright panic, stampede, stranding; threatening or attacking sound source (in laboratory).

In Table 5 we have summarized the scores that Southall *et al.* (2007) assigned to the papers that reported behavioral responses of low-frequency cetaceans, mid-frequency cetaceans, and pinnipeds in water to non-pulse sounds. This table is included simply to summarize the findings of the studies and opportunistic observations (all of which were capable of estimating received level) that Southall *et al.* (2007) compiled in the effort to develop acoustic criteria.

	Received RMS Sound Pressure Level (dB re: 1 μPa)											
Response Score	80 to < 90	90 to < 100	100 to < 110	110 to < 120	120 to < 130	130 to < 140	140 to < 150	150 to < 160	160 to < 170	170 to < 180	180 to < 190	190 to <200
9												
8		M	M		M		M				M	M
7						L	L					
6	H	L/H	L/P/H	L/M/H	L/M/H	L	L/H	H	M/H	M		
5			H	H	M							
4				L/M	L/M/P	P	L					
3		M	L/M	L/M	M/P	P						
2			L	L/M	L	L	L					
1			M	M	M							
0	L/H/P	L/H/P	L/M/H	L/M/H/P	L/M/H/P	L	M				M	M

Table 5. Data compiled from three tables from Southall et al. (2007) indicating when marine mammals (low-frequency cetaceans = L, mid-frequency cetaceans = M, high frequency cetaceans = H, and pinnipeds = P) were reported as having a behavioral response of the indicated severity to a non-pulse sound of the indicated received level. As discussed in the text, responses are highly variable and context specific.

Potential Effects of Behavioral Disturbance

The different ways that marine mammals respond to sound are sometimes indicators of the ultimate effect that exposure to a given stimulus will have on the well-being (survival, reproduction, etc.) of an animal (see Figure 1). There is little marine mammal data quantitatively relating the exposure of marine mammals to sound to effects on reproduction or survival, though data exists for terrestrial species to which we can draw comparisons for marine mammals.

Attention is the cognitive process of selectively concentrating on one aspect of an animal's environment while ignoring other things (Posner, 1994). Because animals (including humans) have limited cognitive resources, there is a limit to how much sensory information they can process at any time. The phenomenon called ''attentional capture'' occurs when a stimulus (usually a stimulus that an animal is not concentrating on or attending to) ''captures'' an animal's attention. This shift in attention can occur consciously or unconsciously (for example, when an animal hears sounds that it associates with the approach of a predator) and the shift in attention can be sudden (Dukas, 2002; van Rij, 2007). Once a stimulus has captured an animal's attention, the animal can respond by ignoring the stimulus, assuming a ''watch and wait'' posture, or treat the stimulus as a disturbance and respond accordingly, which includes scanning for the source of the stimulus or ''vigilance'' (Cowlishaw *et al.*, 2004).

Vigilance is normally an adaptive behavior that helps animals determine the presence or absence of predators, assess their distance from conspecifics, or to attend cues from prey (Bednekoff and Lima, 1998; Treves, 2000). Despite those benefits, however, vigilance has a cost of time: when animals focus their attention on specific environmental cues, they are not attending to other activities such a foraging. These costs have been documented best in foraging animals, where vigilance has been shown to substantially reduce feeding rates (Saino, 1994; Beauchamp and Livoreil, 1997; Fritz *et al.*, 2002).

Animals will spend more time being vigilant, which may translate to less time foraging or resting, when disturbance stimuli approach them more directly, remain at closer distances, have a greater group size (for example, multiple surface vessels), or when they co-occur with times that an animal perceives increased risk (for example, when they are giving birth or accompanied by a calf). Most of the published literature, however, suggests that direct approaches will increase the amount of time animals will dedicate to being vigilant. For example, bighorn sheep and Dall's sheep dedicated more time to being vigilant, and less time resting or foraging, when aircraft made direct approaches over them (Frid, 2001; Stockwell *et al.*, 1991).

Several authors have established that long-term and intense disturbance stimuli can cause population declines by reducing the body condition of individuals that have been disturbed, followed by reduced reproductive success, reduced survival, or both (Daan *et al.*, 1996; Madsen, 1994; White, 1983). For example, Madsen (1994) reported that pink-footed geese (*Anser brachyrhynchus*) in undisturbed habitat gained body mass and had about a 46-percent reproductive success rate compared with geese in disturbed habitat (being consistently scared off the fields on which they were foraging) which did not gain mass and has a 17 percent reproductive success rate. Similar reductions in reproductive success have been reported for mule deer (*Odocoileus hemionus*) disturbed by all-terrain vehicles (Yarmoloy *et al.*, 1988), caribou disturbed by seismic exploration blasts (Bradshaw *et al.*, 1998), caribou disturbed by low-elevation military jet-fights (Luick *et al.*, 1996), and caribou disturbed by low-elevation jet flights (Harrington and Veitch, 1992). Similarly, a study of elk (*Cervus elaphus*) that were disturbed experimentally by pedestrians concluded that the ratio of young to mothers was inversely related to disturbance rate (Phillips and Alldredge, 2000).

The primary mechanism by which increased vigilance and disturbance appear to affect the fitness of individual animals is by disrupting an animal's time budget and, as a result, reducing the time they might spend foraging and resting (which increases an animal's activity rate and energy demand). For example, a study of grizzly bears (*Ursus horribilis*) reported that bears disturbed by hikers reduced their energy intake by an average of 12 kcal/min (50.2×10^3kJ/min), and spent energy fleeing or acting aggressively toward hikers (White *et al.*, 1999).

On a related note, many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hr cycle). Substantive behavioral reactions to noise exposure (such as disruption of critical life functions, displacement, or avoidance of important habitat) are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.*, 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.*, 2007).

Stranding and Mortality

When a live or dead marine mammal swims or floats onto shore and becomes ''beached'' or incapable of returning to sea, the event is termed a ''stranding'' (Geraci *et al.*, 1999; Perrin and Geraci, 2002; Geraci and Lounsbury, 2005; National Marine Fisheries Service, 2007p). The legal definition for a stranding within the United States is that (A) ''a marine mammal is dead and is (i) on a beach or shore of the United States; or (ii) in waters under the jurisdiction of the United States (including any navigable waters); or (B) a marine mammal is alive and is (i) on a beach or shore of the United States and is unable to return to the water; (ii) on a beach or shore of the United States and, although able to return to the water, is in need of apparent medical attention; or (iii) in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance.'' (16 U.S.C. 1421h).

Marine mammals are known to strand for a variety of reasons, such as infectious agents, biotoxicosis, starvation, fishery interaction, ship strike, unusual oceanographic or weather events, sound exposure, or combinations of these stressors sustained concurrently or in series. However, the cause or causes of most strandings are unknown (Geraci *et al.*, 1976; Eaton, 1979, Odell *et al.*, 1980; Best, 1982). Numerous studies suggest that the physiology, behavior, habitat relationships, age, or condition of cetaceans may cause them to strand or might pre-dispose them the strand when exposed to another phenomenon. These suggestions are consistent with the conclusions of numerous other studies that have demonstrated that combinations of dissimilar stressors commonly combine to kill an animal or dramatically reduce its fitness, even though one exposure without the other does not produce the same result (Chroussos, 2000; Creel, 2005; DeVries *et al.*, 2003; Fair and Becker, 2000; Foley *et al.*, 2001; Moberg, 2000; Relyea, 2005a; 2005b, Romero, 2004; Sih *et al.*, 2004).

Several sources have published lists of mass stranding events of cetaceans during attempts to identify relationships between those stranding events and military sonar (Hildebrand, 2004; IWC, 2005; Taylor *et al.*, 2004). For example, based on a review of stranding records between 1960 and 1995, the International Whaling Commission (2005) identified ten mass stranding events of Cuvier's beaked whales that had been reported and one mass stranding of four Baird's beaked whale (*Berardius bairdii*). The IWC concluded that, out of eight stranding events reported from the mid-1980s to the summer of 2003, seven had been coincident with the use of tactical mid-frequency sonar, one of those seven had been associated with the use of tactical low-frequency sonar, and the remaining stranding event had been associated with the use of seismic airguns.

Most of the stranding events reviewed by the International Whaling Commission involved beaked whales. A mass stranding of Cuvier's beaked whales in the eastern Mediterranean Sea occurred in 1996 (Franzis, 1998) and mass stranding events involving Gervais' beaked whales, Blainville's beaked whales, and Cuvier's beaked whales occurred off the coast of the Canary Islands in the late 1980s (Simmonds and Lopez-Jurado, 1991). The stranding events that occurred in the Canary Islands and Kyparissiakos Gulf in the late 1990s and the Bahamas in 2000 have been the most intensively-studied mass stranding events and have been associated with naval maneuvers involving the use of tactical sonar.

Between 1960 and 2006, 48 strandings (68 percent) involved beaked whales, 3 (4 percent) involved dolphins, and 14 (20 percent) involved whale species. Cuvier's beaked whales were involved in the greatest number of these events (48 or 68 percent), followed by sperm whales (7 or 10 percent), and Blainville's and Gervais' beaked whales (4 each or 6 percent). Naval activities that might have involved active sonar are reported to have coincided with 9 (13 percent) or 10 (14 percent) of those stranding events. Between the mid-1980s and 2003 (the period reported by the International Whaling Commission), we identified reports of 44 mass cetacean stranding events of which at least 7 were coincident with naval exercises that were using mid-frequency sonar.

Strandings Associated With MFAS

Over the past 12 years, there have been five stranding events coincident with military mid-frequency sonar use in which exposure to sonar is believed to have been a contributing factor: Greece (1996); the Bahamas (2000); Madeira (2000); Canary Islands (2002); and Spain (2006). A number of other stranding events coincident with the operation of mid-frequency sonar including the death of beaked whales or other species (minke whales, dwarf sperm whales, pilot whales) have been reported, however, the majority have not been investigated to the degree necessary to determine the cause of the stranding.

Greece (1996)

Twelve Cuvier's beaked whales stranded atypically (in both time and space) along a 38.2-kilometer strand of the coast of the Kyparissiakos Gulf on May 12 and 13, 1996 (Frantzis, 1998). From May 11 through May 15, the NATO research vessel Alliance was conducting sonar tests with signals of 600 Hz and 3 kHz and source levels of 228 and 226 dB re: 1μPa, respectively (D'Amico and Verboom, 1998; D'Spain *et al.*, 2006). The timing and the location of the testing encompassed the time and location of the whale strandings (Frantzis, 1998).

Necropsies of eight of the animals were performed but were limited to basic external examination and sampling of stomach contents, blood, and skin. No ears or organs were collected, and no histological samples were preserved. No apparent abnormalities or wounds were found (Frantzis, 2004). Examination of photos of the animals, taken soon after their death, revealed that the eyes of at least four of the individuals were bleeding. Photos were taken soon after their death (Frantzis, 2004). Stomach contents contained the flesh of cephalopods, indicating that feeding had recently taken place (Frantzis, 1998).

All available information regarding the conditions associated with this stranding event were compiled, and many potential causes were examined including major pollution events, prominent tectonic activity, unusual physical or meteorological events, magnetic anomalies, epizootics, and conventional military activities (International Council for the Exploration of the Sea, 2005a). However, none of these potential causes coincided in time or space with the mass stranding, or could explain its characteristics (International Council for the Exploration of the Sea, 2005a). The robust condition of the animals, plus the recent stomach contents, is inconsistent with pathogenic causes (Frantzis, 2004). In addition, environmental causes can be ruled out as there were no unusual environmental circumstances or events before or during this time period and within the general proximity (Frantzis, 2004).

It was determined that because of the rarity of this mass stranding of Cuvier's beaked whales in the Kyparissiakos Gulf (first one in history), the probability for the two events (the military exercises and the strandings) to coincide in time and location, while being independent of each other, was extremely low (Frantzis, 1998). However, because full necropsies had not been conducted, and no abnormalities were noted, the cause of the strandings could not be precisely determined (Cox *et al.*, 2006). The analysis of this stranding event provided support for, but no clear evidence for, the cause-and-effect relationship of tactical sonar training activities and beaked whale strandings (Cox *et al.*, 2006).

Bahamas (2000)

NMFS and the Navy prepared a joint report addressing the multi-species stranding in the Bahamas in 2000, which took place within 24 hours of U.S. Navy ships using MFAS as they passed through the Northeast and Northwest Providence Channels on March 15–16, 2000. The ships, which operated both AN/SQS–53C and AN/SQS–56, moved through the channel while emitting sonar pings approximately every 24 seconds. Of the 17 cetaceans that stranded over a 36-hr period (Cuvier's beaked whales, Blainville's beaked whales, Minke whales, and a spotted dolphin), seven animals died on the beach (5 Cuvier's beaked whales, 1 Blainville's beaked whale, and the spotted dolphin), while the other 10 were returned to the water alive (though their ultimate fate is unknown).

Necropsies were performed on five of the stranded beaked whales. All five necropsied beaked whales were in good body condition, showing no signs of infection, disease, ship strike, blunt trauma, or fishery related injuries, and three still had food remains in their stomachs. Auditory structural damage was discovered in four of the whales, specifically bloody effusions or hemorrhaging around the ears. Bilateral intracochlear and unilateral temporal region subarachnoid hemorrhage, with blood clots in the lateral ventricles, were found in two of the whales. Three of the whales had small hemorrhages in their acoustic fats (located along the jaw and in the melon).

A comprehensive investigation was conducted and all possible causes of the stranding event were considered, whether they seemed likely at the outset or not. Based on the way in which the strandings coincided with ongoing naval activity involving tactical MFAS use, in terms of both time and geography, the nature of the physiological effects experienced by the dead animals, and the absence of any other acoustic sources, the investigation team concluded that MFAS aboard U.S. Navy ships that were in use during the sonar exercise in question were the most plausible source of this acoustic or impulse trauma to beaked whales. This sound source was active in a complex environment that included the presence of a surface duct, unusual and steep bathymetry, a constricted channel with limited egress, intensive use of multiple, active sonar units over an extended period of time, and the presence of beaked whales that appear to be sensitive to the frequencies produced by these sonars. The investigation team concluded that the cause of this stranding event was the confluence of the Navy MFAS and these contributory factors working together, and further recommended that the Navy avoid operating MFAS in situations where these five factors would be likely to occur. This report does not conclude that all five of these factors must be present for a stranding to occur, nor that beaked whales are the only species that could potentially be affected by the confluence of the other factors. Based on this, NMFS believes that the operation of MFAS in situations where surface ducts exist, or in marine environments defined by steep bathymetry and/or constricted channels may increase the likelihood of producing a sound field with the potential to cause cetaceans (especially beaked whales) to strand, and therefore, suggests the need for increased vigilance while operating MFAS in these areas, especially when beaked whales (or potentially other deep divers) are likely present.

Madeira, Spain (2000)

From May 10–14, 2000, three Cuvier's beaked whales were found atypically stranded on two islands in the Madeira archipelago, Portugal (Cox *et al.*, 2006). A fourth animal was reported floating in the Madeiran waters by fisherman but did not come ashore (Woods Hole Oceanographic Institution, 2005). Joint NATO amphibious training peacekeeping exercises involving participants from 17 countries 80 warships, took place in Portugal during May 2–15, 2000.

The bodies of the three stranded whales were examined post mortem (Woods Hole Oceanographic Institution, 2005), though only one of the stranded whales was fresh enough (24 hours after stranding) to be necropsied (Cox *et al.*, 2006). Results from the necropsy revealed evidence of hemorrhage and congestion in the right lung and both kidneys (Cox *et al.*, 2006). There was also evidence of intercochlear and intracranial hemorrhage similar to that which was observed in the whales that stranded in the Bahamas event (Cox *et al.*, 2006). There were no signs of blunt trauma, and no major fractures (Woods Hole Oceanographic Institution, 2005). The cranial sinuses and airways were found to be clear with little or no fluid deposition, which may indicate good preservation of tissues (Woods Hole Oceanographic Institution, 2005).

Several observations on the Madeira stranded beaked whales, such as the pattern of injury to the auditory system, are the same as those observed in the Bahamas strandings. Blood in and around the eyes, kidney lesions, pleural hemorrhages, and congestion in the lungs are particularly consistent with the pathologies from the whales stranded in the Bahamas, and are consistent with stress and pressure related trauma. The similarities in pathology and stranding patterns between these two events suggest that a similar pressure event may have precipitated or contributed to the strandings at both sites (Woods Hole Oceanographic Institution, 2005).

Even though no definitive causal link can be made between the stranding event and naval exercises, certain conditions may have existed in the exercise area that, in their aggregate, may have contributed to the marine mammal strandings (Freitas, 2004): Exercises were conducted in areas of at least 547 fathoms (1,000 m) depth near a shoreline where there is a rapid change in bathymetry on the order of 547 to 3,281 (1,000—6,000 m) fathoms occurring across a relatively short horizontal distance (Freitas, 2004); multiple ships were operating around Madeira, though it is not known if MFA sonar was used, and the specifics of the sound sources used are unknown (Cox *et al.,* 2006, Freitas, 2004); exercises took place in an area surrounded by landmasses separated by less than 35 nm (65 km) and at least 10 nm (19 km) in length, or in an embayment. Exercises involving multiple ships employing MFA near land may produce sound directed towards a channel or embayment that may cut off the lines of egress for marine mammals (Freitas, 2004).

Canary Islands, Spain (2002)

The southeastern area within the Canary Islands is well known for aggregations of beaked whales due to its ocean depths of greater than 547 fathoms (1,000 m) within a few hundred meters of the coastline (Fernandez *et al.*, 2005). On September 24, 2002, 14 beaked whales were found stranded on Fuerteventura and Lanzarote Islands in the Canary Islands (International Council for Exploration of the Sea, 2005a). Seven whales died, while the remaining seven live whales were returned to deeper waters (Fernandez *et al.*, 2005). Four beaked whales were found stranded dead over the next 3 days either on the coast or floating offshore. These strandings occurred within near proximity of an international naval exercise that utilized MFAS and involved numerous surface warships and several submarines. Strandings began about 4 hours after the onset of MFA sonar activity (International Council for Exploration of the Sea, 2005a; Fernandez *et al.*, 2005).

Eight Cuvier's beaked whales, one Blainville's beaked whale, and one Gervais' beaked whale were necropsied, six of them within 12 hours of stranding (Fernandez *et al.*, 2005). No pathogenic bacteria were isolated from the carcasses (Jepson *et al.*, 2003). The animals displayed severe vascular congestion and hemorrhage especially around the tissues in the jaw, ears, brain, and kidneys, displaying marked disseminated microvascular hemorrhages associated with widespread fat emboli (Jepson *et al.*, 2003; International Council for Exploration of the Sea, 2005a). Several organs contained intravascular bubbles, although definitive evidence of gas embolism in vivo is difficult to determine after death (Jepson *et al.*, 2003). The livers of the necropsied animals were the most consistently affected organ, which contained macroscopic gas-filled cavities and had variable degrees of fibrotic encapsulation. In some animals, cavitary lesions had extensively replaced the normal tissue (Jepson *et al.*, 2003). Stomachs contained a large amount of fresh and undigested contents, suggesting a rapid onset of disease and death (Fernandez *et al.*, 2005). Head and neck lymph nodes were enlarged and congested, and parasites were found in the kidneys of all animals (Fernandez *et al.*, 2005).

The association of NATO MFA sonar use close in space and time to the beaked whale strandings, and the similarity between this stranding event and previous beaked whale mass strandings coincident with sonar use, suggests that a similar scenario and causative mechanism of stranding may be shared between the events. Beaked whales stranded in this event demonstrated brain and auditory system injuries, hemorrhages, and congestion in multiple organs, similar to the pathological findings of the Bahamas and Madeira stranding events. In addition, the necropsy results of Canary Islands stranding event lead to the hypothesis that the presence of disseminated and widespread gas bubbles and fat emboli were indicative of nitrogen bubble formation, similar to what might be expected in decompression sickness (Jepson *et al.*, 2003; Fernandez *et al.*, 2005).

Spain (2006)

The Spanish Cetacean Society reported an atypical mass stranding of four beaked whales that occurred January 26, 2006, on the southeast coast of Spain, near Mojacar (Gulf of Vera) in the Western Mediterranean Sea. According to the report, two of the whales were discovered the evening of January 26 and were found to be still alive. Two other whales were discovered during the day on January 27, but had already died. The fourth animal was found dead on the afternoon of January 27, a few kilometers north of the first three animals. From January 25–26, 2006, Standing North Atlantic Treaty Organization (NATO) Response Force Maritime Group Two (five of seven ships including one U.S. ship under NATO Operational Control) had conducted active sonar training against a Spanish submarine within 50 nm (93 km) of the stranding site.

Veterinary pathologists necropsied the two male and two female Cuvier's beaked whales. According to the pathologists, the most likely primary cause of this type of beaked whale mass stranding event was anthropogenic acoustic activities, most probably anti-submarine MFAS used during the military naval exercises. However, no positive acoustic link was established as a direct cause of the stranding. Even though no causal link can be made between the stranding event and naval exercises, certain conditions may have existed in the exercise area that, in their aggregate, may have contributed to the marine mammal strandings (Freitas, 2004): exercises were conducted in areas of at least 547 fathoms (1000 m) depth near a shoreline where there is a rapid change in bathymetry on the order of 547 to 3,281 fathoms (1000–6000 m) occurring across a relatively short horizontal distance (Freitas, 2004); multiple ships (in this instance, five) were operating MFAS in the same area over extended periods of time (in this case, 20 hours) in close proximity; Exercises took place in an area surrounded by landmasses, or in an embayment. Exercises involving multiple ships employing MFA sonar near land may have produced sound directed towards a channel or embayment that may have cut off the lines of egress for the affected marine mammals (Freitas, 2004).

Association Between Mass Stranding Events and Exposure to MFAS

Several authors have noted similarities between some of these stranding incidents: they occurred in islands or archipelagoes with deep water nearby, several appeared to have been associated with acoustic waveguides like surface ducting, and the sound fields created by ships transmitting MFAS (Cox *et al.*, 2006, D'Spain *et al.*, 2006). Although Cuvier's beaked whales have been the most common species involved in these stranding events (81 percent of the total number of stranded animals), other beaked whales (including *Mesoplodon europeaus, M. densirostris*, and *Hyperoodon ampullatus*) comprise 14 percent of the total. Other species (*Stenella coeruleoalba, Kogia breviceps* and *Balaenoptera acutorostrata*) have stranded, but in much lower numbers and less consistently than beaked whales.

Based on the evidence available, however, we cannot determine whether (a) Cuvier's beaked whale is more prone to injury from high-intensity sound than other species, (b) their behavioral responses to sound makes them more likely to strand, or (c) they are more likely to be exposed to MFAS than other cetaceans (for reasons that remain unknown). Because the association between active sonar exposures and marine mammals mass stranding events is not consistent—some marine mammals strand without being exposed to sonar and some sonar transmissions are not associated with marine mammal stranding events despite their co-occurrence—other risk factors or a grouping of risk factors probably contribute to these stranding events.

Behaviorally Mediated Responses to MFAS That May Lead to Stranding

Although the confluence of Navy MFAS with the other contributory factors noted in the report was identified as the cause of the 2000 Bahamas stranding event, the specific mechanisms that led to that stranding (or the others) are not understood, and there is uncertainty regarding the ordering of effects that led to the stranding. It is unclear whether beaked whales were directly injured by sound (acoustically mediated bubble growth, addressed above) prior to stranding or whether a behavioral response to sound occurred that ultimately caused the beaked whales to be injured and strand.

Although causal relationships between beaked whale stranding events and active sonar remain unknown, several authors have hypothesized that stranding events involving these species in the Bahamas and Canary Islands may have been triggered when the whales changed their dive behavior in a startled response to exposure to active sonar or to further avoid exposure (Cox *et al.*, 2006, Rommel *et al.*, 2006). These authors proposed three mechanisms by which the behavioral responses of beaked whales upon being exposed to active sonar might result in a stranding event. These include: gas bubble formation caused by excessively fast surfacing; remaining at the surface too long when tissues are supersaturated with nitrogen; or diving prematurely when extended time at the surface is necessary to eliminate excess nitrogen. More specifically, beaked whales that occur in deep waters that are in close proximity to shallow waters (for example, the ''canyon areas'' that are cited in the Bahamas stranding event; see D'Spain and D'Amico, 2006), may respond to active sonar by swimming into shallow waters to avoid further exposures and strand if they were not able to swim back to deeper waters. Second, beaked whales exposed to active sonar might alter their dive behavior. Changes in their dive behavior might cause them to remain at the surface or at depth for extended periods of time which could lead to hypoxia directly by increasing their oxygen demands or indirectly by increasing their energy expenditures (to remain at depth) and increase their oxygen demands as a result. If beaked whales are at depth when they detect a ping from an active sonar transmission and change their dive profile, this could lead to the formation of significant gas bubbles, which could damage multiple organs or interfere with normal physiological function (Cox *et al.*, 2006; Rommel *et al.*, 2006; Zimmer and Tyack, 2007). Baird *et al.* (2005) found that slow ascent rates from deep dives and long periods of time spent within 50 m of the surface were typical for both Cuvier's and Blainville's beaked whales, the two species involved in mass strandings related to naval sonar. These two behavioral mechanisms may be necessary to purge excessive dissolved nitrogen concentrated in their tissues during their frequent long dives (Baird *et al.*, 2005). Baird *et al.* (2005) further suggests that abnormally rapid ascents or premature dives in response to high-intensity sonar could indirectly result in physical harm to the beaked whales, through the mechanisms described above (gas bubble formation or non-elimination of excess nitrogen).

Because many species of marine mammals make repetitive and prolonged dives to great depths, it has long been assumed that marine mammals have evolved physiological mechanisms to protect against the effects of rapid and repeated decompressions. Although several investigators have identified physiological adaptations that may protect marine mammals against nitrogen gas supersaturation (alveolar collapse and elective circulation; Kooyman *et al.*, 1972; Ridgway and Howard, 1979), Ridgway and Howard (1979) reported that bottlenose dolphins (*Tursiops truncatus*) that were trained to dive repeatedly had muscle tissues that were substantially supersaturated with nitrogen gas. Houser *et al.* (2001) used these data to model the accumulation of nitrogen gas within the muscle tissue of other marine mammal species and concluded that cetaceans that dive deep and have slow ascent or descent speeds would have tissues that are more supersaturated with nitrogen gas than other marine mammals. Based on these data, Cox *et al.* (2006) hypothesized that a critical dive sequence might make beaked whales more prone to stranding in response to acoustic exposures. The sequence began with (1) very deep (to depths as deep as 2 kilometers) and long (as long as 90 minutes) foraging dives with (2) relatively slow, controlled ascents, followed by (3) a series of ''bounce'' dives between 100 and 400 meters in depth (also see Zimmer and Tyack, 2007). They concluded that acoustic exposures that disrupted any part of this dive sequence (for example, causing beaked whales to spend more time at surface without the bounce dives that are necessary to recover from the deep dive) could produce excessive levels of nitrogen supersaturation in their tissues, leading to gas bubble and emboli formation that produces pathologies similar to decompression sickness.

Recently, Zimmer and Tyack (2007) modeled nitrogen tension and bubble growth in several tissue compartments for several hypothetical dive profiles and concluded that repetitive shallow dives (defined as a dive where depth does not exceed the depth of alveolar collapse, approximately 72 m for *Ziphius*), perhaps as a consequence of an extended avoidance reaction to sonar sound, could pose a risk for decompression sickness and that this risk should increase with the duration of the response. Their models also suggested that unrealistically rapid ascent rates of ascent from normal dive behaviors are unlikely to result in supersaturation to the extent that bubble formation would be expected. Tyack *et al.* (2006) suggested that emboli observed in animals exposed to mid-frequency range sonar (Jepson *et al.*, 2003; Fernandez *et al.*, 2005) could stem from a behavioral response that involves repeated dives shallower than the depth of lung collapse. Given that nitrogen gas accumulation is a passive process (i.e. nitrogen is metabolically inert), a bottlenose dolphin was trained to repetitively dive a profile predicted to elevate nitrogen saturation to the point that nitrogen bubble formation was predicted to occur. However, inspection of the vascular system of the dolphin via ultrasound did not demonstrate the formation of asymptomatic nitrogen gas bubbles (Houser *et al.*, 2007).

If marine mammals respond to a Navy vessel that is transmitting active sonar in the same way that they might respond to a predator, their probability of flight responses should increase when they perceive that Navy vessels are approaching them directly, because a direct approach may convey detection and intent to capture (Burger and Gochfeld, 1981, 1990; Cooper, 1997, 1998). The probability of flight responses should also increase as received levels of active sonar increase (and the ship is, therefore, closer) and as ship speeds increase (that is, as approach speeds increase). For example, the probability of flight responses in Dall's sheep (*Ovis dalli dalli*) (Frid 2001a, b), ringed seals (*Phoca hispida*) (Born *et al.*, 1999), Pacific brant (*Branta bernic nigricans*) and Canada geese (*B. canadensis*) increased as a helicopter or fixed-wing aircraft approached groups of these animals more directly (Ward *et al.*, 1999). Bald eagles (*Haliaeetus leucocephalus*) perched on trees alongside a river were also more likely to flee from a paddle raft when their perches were closer to the river or were closer to the ground (Steidl and Anthony, 1996).

Despite the many theories involving bubble formation (both as a direct cause of injury (see Acoustically Mediated Bubble Growth Section) and an indirect cause of stranding (See Behaviorally Mediated Bubble Growth Section), Southall *et al.* (2007) summarizes that there is either scientific disagreement or a lack of information regarding each of the following important points: (1) Received acoustical exposure conditions for animals involved in stranding events; (2) pathological interpretation of observed lesions in stranded marine mammals; (3) acoustic exposure conditions required to induce such physical trauma directly; (4) whether noise exposure may cause behavioral reactions (such as atypical diving behavior) that secondarily cause bubble formation and tissue damage; and (5) the extent the post mortem artifacts introduced by decomposition before sampling, handling, freezing, or necropsy procedures affect interpretation of observed lesions.

During AFAST exercises there will be use of multiple sonar units in areas where six species of beaked whale species may be present. A surface duct may be present in a limited area for a limited period of time. Although most of the ASW training events will take place in the deep ocean, some will occur in areas of high bathymetric relief. However, none of the training events will take place in a location having a constricted channel with limited egress similar to the Bahamas (because none exist in the AFAST Study Area). Consequently, not all five of the environmental factors believed to contribute to the Bahamas stranding (mid-frequency sonar, beaked whale presence, surface ducts, steep bathymetry, and constricted channels with limited egress) will be present during AFAST exercises. However, as mentioned previously, NMFS recommends caution when steep bathymetry, surface ducting conditions, or a constricted channel is present when mid-frequency tactical sonar is employed and cetaceans (especially beaked whales) are present.

IEER (Underwater Detonation of Small Explosive Charges)

IEER includes the underwater detonation of small (4.1 lb) charges. Underwater detonations send a shock wave and blast noise through the water and can release gaseous by-products, create an oscillating bubble, or cause a plume of water to shoot up from the water surface (IEER charges do not cause a plume because of their relatively small size). The shock wave and accompanying noise are of most concern to marine animals. Depending on the intensity of the shock wave and size, location, and depth of the animal, an animal can be injured, killed, suffer non-lethal physical effects, experience hearing related effects with or without behavioral responses, or exhibit temporary behavioral responses or tolerance from hearing the blast sound. Generally, exposures to higher levels of impulse and pressure levels would result in greater impacts to an individual animal. Animals would need to be very close to the smaller explosives used in the IEER exercises to be exposed to levels of pressure or sound that would likely result in the more severe effects discussed here.

Injuries resulting from a shock wave take place at boundaries between tissues of different densities. Different velocities are imparted to tissues of different densities, and this can lead to their physical disruption. Blast effects are greatest at the gas-liquid interface (Landsberg, 2000). Gas-containing organs, particularly the lungs and gastrointestinal tract, are especially susceptible (Goertner, 1982; Hill, 1978; Yelverton *et al.*, 1973). In addition, gas-containing organs including the nasal sacs, larynx, pharynx, trachea, and lungs may be damaged by compression/expansion caused by the oscillations of the blast gas bubble (Reidenberg and Laitman, 2003). Intestinal walls can bruise or rupture, with subsequent hemorrhage and escape of gut contents into the body cavity. Less severe gastrointestinal tract injuries include contusions, petechiae (small red or purple spots caused by bleeding in the skin), and slight hemorrhaging (Yelverton *et al.*, 1973).

Because the ears are the most sensitive to pressure, they are the organs most sensitive to injury (Ketten, 2000). Sound-related damage associated with blast noise can be theoretically distinct from injury from the shock wave, particularly farther from the explosion. If an animal is able to hear a noise, at some level it can damage its hearing by causing decreased sensitivity (Ketten, 1995) (See Noise-induced Threshold

Shift Section above). Sound-related trauma can be lethal or sublethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source and are not, technically, pure acoustic trauma (Ketten, 1995). Sublethal impacts include hearing loss, which is caused by exposures to perceptible sounds. Severe damage (from the shock wave) to the ears includes tympanic membrane rupture, fracture of the ossicles, damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear. Moderate injury implies partial hearing loss due to tympanic membrane rupture and blood in the middle ear. Permanent hearing loss also can occur when the hair cells are damaged by one very loud event, as well as by prolonged exposure to a loud noise or chronic exposure to noise. The level of impact from blasts depends on both an animal's location and, at outer zones, on its sensitivity to the residual noise (Ketten, 1995).

There have been fewer studies addressing the behavioral effects of explosives on marine mammals than MFAS/HFAS. However, though the nature of the sound waves emitted from an explosion are different (in shape and rise time) from MFAS/HFAS, we still anticipate the same sorts of behavioral responses (see Exposure to MFAS/HFAS: Behavioral Disturbance Section) to result from repeated explosive detonations (a smaller range of likely less severe responses (i.e., not rising to the level of MMPA harassment) would be expected to occur as a result of exposure to a single explosive detonation that was not powerful enough or close enough to the animal to cause TTS or injury).

Mitigation

In order to issue an incidental take authorization (ITA) under Section 101(a)(5)(A) of the MMPA, NMFS must set forth the ''permissible methods of taking pursuant to such activity, and other means of effecting the least practicable adverse impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.'' The NDAA of 2004 amended the MMPA as it relates to military readiness activities and the incidental take authorization process such that ''least practicable adverse impact'' shall include consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the ''military readiness activity''. The training activities described in the AFAST application are considered military readiness activities.

NMFS reviewed the proposed AFAST activities and the proposed AFAST mitigation measures presented in the Navy's application to determine whether the activities and mitigation measures were capable of achieving the least practicable adverse effect on marine mammals. NMFS determined that further discussion was necessary regarding: (1) general minimization of marine mammal impacts; (2) minimization of impacts within the southeastern NARW critical habitat; and (3) the potential relationship between the operation of MFAS/HFAS and marine mammal strandings. NMFS worked with the Navy to identify additional practicable and effective mitigation measures, which included a careful balancing of the likely benefit of any particular measure to the marine mammals with the likely effect of that measure on personnel safety, practicality of implementation, and impact on the ''military readiness activity''.

NMFS and the Navy developed additional mitigation measures that address the concerns mentioned above, including the development of Planning Awareness Areas (PAAs), additional minimization of impacts in the southeastern NARW critical habitat, and a Stranding Response Plan. Included below are the mitigation measures the Navy initially proposed (see ''Mitigation Measures Proposed in the Navy's LOA Application'') and the additional measures that NMFS and the Navy developed (see ''Additional Measures Developed by NMFS and the Navy'' below).

Separately, NMFS has previously received comments from the public expressing concerns regarding potential delays between when marine mammals are visually detected by watchstanders and when the tactical sonar is actually powered or shut down. NMFS and the Navy have discussed this issue and determined the following: Naval operators and lookouts are aware of the potential for a very small delay (up to about 4 seconds) between detecting a marine mammal and powering down or shutting down the tactical sonar and will take the actions necessary to ensure that sonar is powered down or shut down when detected animals are within the specified powerdown or shutdown zone (for example, by initiating shutdown when animals are approaching, but not quite within the designated distance).

Mitigation Measures Proposed in the Navy's LOA Application

This section includes the protective measures proposed by the Navy and is taken directly from their application (with the exception of headings, which have been modified for increased clarity within the context of this proposed rule).

Navy's Protective Measures for MFAS/HFAS

Current protective measures employed by the Navy include applicable training of personnel and implementation of activity specific procedures resulting in minimization and/or avoidance of interactions with protected resources.

Navy shipboard lookout(s) are highly qualified and experienced marine observers. At all times, the shipboard lookouts are required to sight and report, to the Officer of the Deck, all objects found in the water. Objects (e.g., trash, periscope) or disturbances (e.g., surface disturbance, discoloration) in the water may indicate a threat to the vessel and its crew. Navy lookouts undergo extensive training to qualify as a watchstander. This training includes on-the-job instruction under the supervision of an experienced watchstander, followed by completion of the Personal Qualification Standard (PQS) program, certifying that they have demonstrated the necessary skills to detect and report partially submerged objects. In addition to these requirements, many watchstanders periodically undergo a two-day refresher training course.

For the past few years, the Navy has implemented marine mammal spotter training for its bridge lookout personnel on ships and submarines. This training has been revamped and updated as the Marine Species Awareness Training (MSAT) and is provided to all applicable units. The lookout training program incorporates MSAT, which addresses the lookout's role in environmental protection, laws governing the protection of marine species, Navy stewardship commitments, and general observation information including more detailed information for spotting marine mammals. MSAT has been reviewed by NMFS and acknowledged as suitable training. MSAT would also be provided to the following personnel:

- Bridge personnel on ships and submarines—Personnel would continue to use the current marine mammal spotting training and any updates.
- Aviation units—Pilots and air crew personnel whose airborne duties during ASW training activities include searching for submarine periscopes would be trained in marine mammal spotting. These personnel would also be trained on the details of the mitigation

measures specific to both their platform and that of the surface combatants with which they are associated.

• Sonar personnel on ships, submarines, and ASW aircraft—Both passive and active sonar operators on ships, submarines, and aircraft utilize protective measures relative to their platform. The Navy issues a Letter of Instruction for each Major Exercise which mandates specific actions to be taken if a marine mammal is detected, and these actions are standard operating procedure throughout the exercise.

The following procedures would be implemented to maximize the ability of operators to recognize instances when marine mammals are in the vicinity.

Personnel Training

(a) All lookouts onboard platforms involved in ASW training events will review the NMFS-approved MSAT material prior to use of active sonar.

(b) All Commanding Officers, Executive Officers, and officers standing watch on the bridge will have reviewed the MSAT material prior to a training event employing the use of MFAS.

(c) Navy lookouts will undertake extensive training in order to qualify as a watchstander in accordance with the Lookout Training Handbook (NAVEDTRA, 12968–D).

(d) Lookout training will include on-the-job instruction under the supervision of a qualified, experienced watchstander. Following successful completion of this supervised training period, lookouts will complete the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects). This does not forbid personnel being trained as lookouts from being counted as those listed in previous measures so long as supervisors monitor their progress and performance.

(e) Lookouts would be trained to quickly and effectively communicate within the command structure in order to facilitate implementation of protective measures if marine species are spotted.

Lookout and Watchstander Responsibilities

(a) On the bridge of surface ships, there will always be at least three people on watch whose duties include observing the water surface around the vessel.

(b) All surface ships participating in ASW exercises will, in addition to the three personnel on watch noted previously, have at all times during the exercise at least two additional personnel on watch as lookouts.

(c) Personnel on lookout and officers on watch on the bridge will have at least one set of binoculars available for each person to aid in the detection of marine mammals.

(d) On surface vessels equipped with mid-frequency active sonar, pedestal mounted ‘‘Big Eye’’ (20x110) binoculars will be present and in good working order to assist in the detection of marine mammals in the vicinity of the vessel.

(e) Personnel on lookout will employ visual search procedures employing a scanning methodology in accordance with the Lookout Training Handbook (NAVEDTRA 12968–D).

(f) Surface lookouts would scan the water from the ship to the horizon and be responsible for all contacts in their sector. In searching the assigned sector, the lookout would always start at the forward part of the sector and search aft (toward the back). To search and scan, the lookout would hold the binoculars steady so the horizon is in the top third of the field of vision and direct the eyes just below the horizon. The lookout would scan for approximately five seconds in as many small steps as possible across the field seen through the binoculars. They would search the entire sector in approximately five-degree steps, pausing between steps for approximately five seconds to scan the field of view. At the end of the sector search, the glasses would be lowered to allow the eyes to rest for a few seconds, and then the lookout would search back across the sector with the naked eye.

(g) After sunset and prior to sunrise, lookouts will employ Night Lookouts Techniques in accordance with the Lookout Training Handbook.

(h) At night, lookouts would not sweep the horizon with their eyes because eyes do not see well when they are moving. Lookouts would scan the horizon in a series of movements that would allow their eyes to come to periodic rests as they scan the sector. When visually searching at night, they would look a little to one side and out of the corners of their eyes, paying attention to the things on the outer edges of their field of vision.

(i) Personnel on lookout will be responsible for informing the Officer of the Deck of all objects or anomalies sighted in the water (regardless of the distance from the vessel), since any object or disturbance (e.g., trash, periscope, surface disturbance, discoloration) in the water may be indicative of a threat to the vessel and its crew or indicative of a marine species that may need to be avoided as warranted.

Operating Procedures

(a) Commanding Officers will make use of marine species detection cues and information to limit interaction with marine species to the maximum extent possible consistent with safety of the ship.

(b) All personnel engaged in passive acoustic sonar operation (including aircraft, surface ships, or submarines) will monitor for marine mammal vocalizations and report the detection of any marine mammal to the appropriate watch station for dissemination and appropriate action. The Navy can detect sounds within the human hearing range due to an operator listening to the incoming sounds. Passive acoustic detection systems are used during all ASW activities.

(c) Units shall use trained lookouts to survey for marine mammals prior to commencement and during the use of active sonar.

(d) During operations involving sonar, personnel will utilize all available sensor and optical systems (such as Night Vision Goggles) to aid in the detection of marine mammals.

(e) Navy aircraft participating in exercises at sea will conduct and maintain, when operationally feasible and safe, surveillance for marine species of concern as long as it does not violate safety constraints or interfere with the accomplishment of primary operational duties.

(f) Aircraft with deployed sonobuoys will use only the passive capability of sonobuoys when marine mammals are detected within 200 yards (183 m) of the sonobuoy.

(g) Marine mammal detections will be immediately reported to assigned Aircraft Control Unit (if participating) for further dissemination to ships in the vicinity of the marine species. This action would occur when it is reasonable to conclude that the course of the ship will likely close the distance between the ship and the detected marine mammal.

(h) Safety Zones—When marine mammals are detected by any means (aircraft, shipboard lookout, or acoustically) the Navy will ensure that sonar transmission levels are limited to at least 6 dB below normal operating levels if any detected marine mammals are within 1000 yards (914 m) of the sonar dome (the bow).

(i) Ships and submarines will continue to limit maximum transmission levels by this 6-dB factor until the marine mammal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards (1828

m) beyond the location of the last detection.

(ii) Should a marine mammal be detected within or closing to inside 457 m (500 yd) of the sonar dome, active sonar transmissions would be limited to at least 10 dB below the equipment's normal operating level. Ships and submarines will continue to limit maximum ping levels by this 10-dB factor until the marine mammal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2000 yards (1828 m) beyond the location of the last detection.

(iii) Should the marine mammal be detected within or closing to inside 183 m (200 yd) of the sonar dome, active sonar transmissions would cease. Sonar will not resume until the marine mammal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards (1828 m) beyond the location of the last detection.

(iv) If the need for power-down should arise as detailed in ''Safety Zones'' above, Navy shall follow the requirements as though they were operating at 235 dB—the normal operating level (i.e., the first power-down will be to 229 dB, regardless of at what level above 235 sonar was being operated).

(i) Prior to start up or restart of active sonar, operators will check that the Safety Zone radius around the sound source is clear of marine mammals.

(j) Sonar levels (generally)—Navy will operate active sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives.

(k) Helicopters shall observe/survey the vicinity of an ASW Operation for 10 minutes before the first deployment of active (dipping) sonar in the water.

(l) Helicopters shall not dip their active sonar within 200 yards (183 m) of a marine mammal and shall cease pinging if a marine mammal closes within 200 yards (183 m) after pinging has begun.

(m) Submarine sonar operators will review detection indicators of close-aboard marine mammals prior to the commencement of ASW training activities involving active MFAS.

(n) If, after conducting an initial maneuver to avoid close quarters with dolphins, the ship concludes that dolphins are deliberately closing in on the ship to ride the vessel's bow wave, no further mitigation actions would be necessary because dolphins are out of the main transmission axis of the active sonar while in the shallow-wave area of the vessel bow.

Additional Mitigation for TORPEXs in the Northeast NARW Critical Habitat

TORPEXs in locations other than the Northeast will utilize the measures described above. TORPEXs conducted in the five TORPEX training areas off of Cape Cod, which may occur in right whale critical habitat, will implement the following measures.

(a) All torpedo-firing operations shall take place during daylight hours.

(b) During the conduct of each test, visual surveys of the test area shall be conducted by all vessels and aircraft involved in the exercise to detect the presence of marine mammals. Additionally, trained observers shall be placed on the submarine, spotter aircraft, and the surface support vessel. All participants will be required to report sightings of any marine mammals, including negative reports, prior to torpedo firings. Reporting requirements will be outlined in the test plans and procedures written for each individual exercise, and will be emphasized as part of pre-exercise briefings conducted with all participants.

(c) Observers shall receive NMFS-approved training in field identification, distribution, and relevant behaviors of marine mammals of the western north Atlantic. Currently, this training is provided by a professor at the University of Rhode Island, Graduate School of Oceanography. Observers shall fill out Standard Sighting Forms and the data will be housed at the Naval Undersea Warfare Center Division Newport (NUWCDIVNPT). Any sightings of North Atlantic right whales shall be immediately communicated to the Sighting Advisory System (SAS). All platforms shall have onboard a copy of

• The Guide to Marine Mammals and Turtles of the U.S. Atlantic and Gulf of Mexico (Wynne and Schwartz 1999).

• The NMFS Critical Sightings Program placard.

• Right Whales, Guidelines to Mariners placard.

(d) In addition to the visual surveillance discussed above, dedicated aerial surveys shall be conducted utilizing a fixed-wing aircraft. An aircraft with an overhead wing (i.e., Cessna Skymaster or similar) will be used to facilitate a clear view of the test area. Two trained observers, in addition to the pilot, shall be embarked on the aircraft. Surveys will be conducted at an approximate altitude of 1000 ft (305 m) flying parallel track lines at a separation of 1 nmi (1.85 km), or as necessary to facilitate good visual coverage of the sea surface. While conducting surveillance, the aircraft shall maintain an approximate speed of 100 knots (185 km/hr). Since factors that affect visibility are highly dependent on the specific time of day of the survey, the flight operator will have the flexibility to adjust the flight pattern to reduce glare and improve visibility. The entire test site will be surveyed initially, but once preparations are being made for an actual test launch, survey effort will be concentrated over the vicinity of the individual test location. Further, for approximately ten minutes immediately prior to launch, the aircraft will racetrack back and forth between the launch vessel and the target vessel.

(e) Commencement of an individual torpedo test scenario shall not occur until observers from all vessels and aircraft involved in the exercise have reported to the Officer in Tactical Command (OTC) and the OTC has declared that the range is clear of marine mammals. Should protected animals be present within or seen moving toward the test area, the test shall be either delayed or moved as required to avoid interference with the animals.

(f) The TORPEX will be suspended if the Beaufort Sea State exceeds 3 or if visibility precludes safe operations.

(g) Vessel speeds:

• During transit through the North Atlantic right whale critical habitat, surface vessels and submarines shall maintain a speed of no more than 10 knots (19 km/hr) while not actively engaged in the exercise procedures.

• During TORPEX operations, a firing vessel will likely not exceed 10 knots. When a submarine is used as a target, vessel speeds would not likely exceed 18 knots. However, on occasion, when surface vessels are used as targets, the vessel may exceed 18 kts in order to fully test the functionality of the torpedoes. This increased speed would occur for a short period of time (e.g., 10–15 minutes) to evade the torpedo when fired upon.

(h) In the event of an animal strike, or if an animal is discovered that appears to be in distress, a report will immediately be promulgated through the appropriate Navy chain of Command (see Stranding Plan for additional details).

Potential Mitigation Under Development

The Navy is working to develop the capability to detect, identify, and localize vocalizing marine mammals using the installed sensors. Based on the current status of acoustic monitoring science, it is not yet possible to use installed systems as a mitigation tools; however, as this science develops, it will be incorporated into the AFAST mitigation plan as appropriate.

The Navy is also actively engaged in acoustic monitoring research involving a variety of methodologies (e.g., underwater gliders); to date, none of the methodologies have been developed to the point where they could be used as an actual mitigation tool. The Navy will continue to coordinate passive monitoring and detection research specific to the proposed use of active sonar. As technology and methodologies become available, their applicability and viability will be evaluated for incorporation into this mitigation plan.

Navy's Protective Measures for IEER

(a) Crews will conduct visual reconnaissance of the drop area prior to laying their intended sonobuoy pattern. This search should be conducted below 500 yards (457 m) at a slow speed, if operationally feasible and weather conditions permit. In dual aircraft training activities, crews are allowed to conduct coordinated area clearances.

(b) Crews shall conduct a minimum of 30 minutes of visual and acoustic monitoring of the search area prior to commanding the first post detonation. This 30-minute observation period may include pattern deployment time.

(c) For any part of the briefed pattern where a post (source/receiver sonobuoy pair) will be deployed within 1,000 yards (914 m) of observed marine mammal activity, deploy the receiver ONLY and monitor while conducting a visual search. When marine mammals are no longer detected within 1,000 yards (914 m) of the intended post position, co-locate the explosive source sonobuoy (AN/SSQ–110A) (source) with the receiver.

(d) When able, crews will conduct continuous visual and aural monitoring of marine mammal activity. This is to include monitoring of own-aircraft sensors from first sensor placement to checking off station and out of communication range of these sensors.

(e) Aural Detection: If the presence of marine mammals is detected aurally, then that should cue the aircrew to increase the diligence of their visual surveillance. Subsequently, if no marine mammals are visually detected, then the crew may continue multi-static active search.

(f) Visual Detection: If marine mammals are visually detected within 1,000 yards (914 m) of the explosive source sonobuoy (AN/SSQ–110A) intended for use, then that payload shall not be detonated. Aircrews may utilize this post once the marine mammals have not been re-sighted for 30 minutes, or are observed to have moved outside the 1,000 yards (914 m) safety buffer. Aircrews may also shift their multi-static active search to another post, where marine mammals are outside the 1,000 yards (914 m) safety buffer.

(g) Aircrews shall make every attempt to manually detonate the unexploded charges at each post in the pattern prior to departing the operations area by using the ''Payload 1 Release'' command followed by the ''Payload 2 Release'' command. Aircrews shall refrain from using the ''Scuttle'' command when two payloads remain at a given post. Aircrews will ensure that a 1,000 yard (914 m) safety buffer, visually clear of marine mammals, is maintained around each post as is done during active search operations.

(h) Aircrews shall only leave posts with unexploded charges in the event of a sonobuoy malfunction, an aircraft system malfunction, or when an aircraft must immediately depart the area due to issues such as fuel constraints, inclement weather, and in-flight emergencies. In these cases, the sonobuoy will self-scuttle using the secondary or tertiary method.

(i) Ensure all payloads are accounted for. Explosive source sonobuoys (AN/SSQ–110A) that cannot be scuttled shall be reported as unexploded ordnance via voice communications while airborne, then upon landing via naval message.

(j) Marine mammal monitoring shall continue until out of own-aircraft sensor range.

Mitigation Measures Related to Vessel Transit and North Atlantic Right Whales

Mid-Atlantic, Offshore of the Eastern United States

For purposes of these measures, the Mid-Atlantic is defined broadly to include ports south and east of Block Island Sound southward to South Carolina. The procedure described below would be established as mitigation measures for Navy vessel transits during North Atlantic right whale migratory seasons near ports located off the western North Atlantic, offshore of the eastern United States. The mitigation measures would apply to all Navy vessel transits, including those vessels that would transit to and from East Coast ports and OPAREAs. Seasonal migration of right whales is generally described as occurring from October 15 through April 30, when right whales migrate between feeding grounds farther north and calving grounds farther south.

NMFS has identified ports located in the western Atlantic Ocean, offshore of the southeastern United States, where vessel transit during right whale migration is of highest concern for potential ship strike. The ports include the Hampton Roads entrance to the Chesapeake Bay, which includes the concentration of Atlantic Fleet vessels in Norfolk, Virginia. Navy vessels are required to use extreme caution and operate at a slow, safe speed consistent with mission and safety during the months indicated in Table 6 and within a 37 km (20 NM) arc (except as noted) of the specified reference points.

Region	Months	Port Reference Points
South and East of Block Island	Sep–Oct and Mar–Apr	37 km (20 NM) seaward of line between 41-4.49N 071-51.15W and 41-18.58N 070-50.23W
New York / New Jersey	Sep–Oct and Feb-Apr	40-30.64N 073-57.76W
Delaware Bay (Philadelphia)	Oct–Dec and Feb–Mar	38-52.13N 075-1.93W
Chesapeake Bay (Hampton Roads and Baltimore)	Nov-Dec and Feb–Apr	37-1.11N 075-57.56W
North Carolina	Dec–Apr	34-41.54N 076-40.20W
South Carolina	Oct–Apr	33-11.84N 079-8.99W and 32-43.39N 079-48.72W

Table 6. Times and Areas of Increased Caution to prevent Ship Strike of Right Whales

During the indicated months, Navy vessels would practice increased vigilance with respect to avoidance of vessel-whale interactions along the mid-Atlantic coast, including transits to and from any mid-Atlantic ports not specifically identified above. All surface units transiting within 56 km (30 NM) of the coast in the mid-Atlantic would ensure at least two watchstanders are posted, including at least one lookout that has completed required MSAT training. Furthermore, Navy vessels would not knowingly approach any whale head on and would maneuver to keep at least 457 m (1,500 ft) away from any observed whale, consistent with vessel safety.

Southeast Atlantic, Offshore of the Eastern United States

For purposes of these measures, the southeast encompasses sea space from Charleston, South Carolina, southward to Sebastian Inlet, Florida, and from the coast seaward to 148 km (80 NM) from shore. The mitigation measures described in this section were developed specifically to protect the North Atlantic right whale during its calving season (Typically from December 1st through March 31st). During this period, North Atlantic right whales give birth and nurse their calves in and around a federally designated critical habitat off the coast of Georgia and Florida. This critical habitat is the area from 31–15N to 30–15N extending from the coast out to 28 km (15 NM), and the area from 28–00N to 30–15N from the coast out to 9 km (5 NM). All mitigation measures that apply to the critical habitat also apply to an associated area of concern which extends 9 km (5 NM) seaward of the designated critical boundaries.

Prior to transiting or training in the critical habitat or associated area of concern, ships will contact Fleet Area Control and Surveillance Facility, Jacksonville, to obtain latest whale sighting and other information needed to make informed decisions regarding safe speed and path of intended movement. Subs shall contact Commander, Submarine Group Ten for similar information.

Specific mitigation measures related to activities occurring within the critical habitat or associated area of concern include the following:

- When transiting within the critical habitat or associated area of concern, vessels will exercise extreme caution and proceed at a slow safe speed. The speed will be the slowest safe speed that is consistent with mission, training and operations.
- Speed reductions (adjustments) are required when a whale is sighted by a vessel or when the vessel is within 9 km (5 NM) of a reported new sighting less then 12 hours old.
- Additionally, circumstances could arise where, in order to avoid North Atlantic right whale(s), speed reductions could mean vessel must reduce speed to a minimum at which it can safely keep on course or vessels could come to an all stop.
- Vessels will avoid head-on approaches to North Atlantic right whale(s) and will maneuver to maintain at least 457 m (500 yd) of separation from any observed whale if deemed safe to do so. These requirements do not apply if a vessel's safety is threatened, such as when change of course would create an imminent and serious threat to person, vessel, or aircraft, and to the extent vessels are restricted in the ability to maneuver.
- Ships shall not transit through the critical habitat or associated area of concern in a North-South direction.
- Ship, surfaced submarines, and aircraft will report any whale sightings to Fleet Area Control and Surveillance Facility, Jacksonville, by most convenient and fast means. Sighting report will include the time, latitude/longitude, direction of movement and number and description of whale (i.e., adult/calf).

Northeast Atlantic, Offshore of the Eastern United States

Prior to transiting the Great South Channel or Cape Cod Bay critical habitat areas, ships will obtain the latest right whale sightings and other information needed to make informed decisions regarding safe speed. The Great South Channel critical habitat is defined by the following coordinates: 41–00 N, 69–05 W; 41–45 N, 69–45 W; 42–10 N, 68–31 W; 41–38 N, 68–13 W. The Cape Cod Bay critical habitat is defined by the following coordinates: 42–04.8 N, 70–10 W; 42–12 N, 70–15 W; 42–12 N, 70–30 W; 41–46.8 N, 70–30 W.

Ships, surfaced subs, and aircraft will report any North Atlantic right whale sightings (if the whale is identifiable as a right whale) off the northeastern U.S. to Patrol and Reconnaissance Wing (COMPATRECONWING). The report will include the time of sighting, lat/long, direction of movement (if apparent) and number and description of the whale(s). In addition, vessels or aircraft that observe whale carcasses will record the location and time of the sighting and report this information as soon as possible to the cognizant regional environmental coordinator. All whale strikes must be reported. Report will include the date, time, and location of the strike; vessel course and speed; operations being conducted by the vessel; weather conditions, visibility, and sea state; description of the whale; narrative of incident; and indication of whether photos/videos were taken. Units are encouraged to take photos whenever possible. See AFAST Stranding Plan for additional detail.

Specific mitigation measures related to activities occurring within the critical habitat or associated area of concern include the following:

- Vessels will avoid head-on approaches to North Atlantic right whale(s) and will maneuver to maintain at least 457 m (500 yd) of separation from any observed whale if deemed safe to do so. These requirements do not apply if a vessel's safety is threatened, such as when change of course would create an imminent and serious threat to person, vessel, or aircraft, and to the extent vessels are restricted in the ability to maneuver.
- When transiting within the critical habitat or associated area of concern, vessels shall use extreme caution and operate at a safe speed so as to be able to avoid collisions with North Atlantic right whales and other marine mammals, and stop within a distance appropriate to the circumstances and conditions.
- Speed reductions (adjustments) are required when a whale is sighted by a vessel or when the vessel is within 9 km (5 NM) of a reported new sighting less than one week old.
- Ships transiting in the Cape Cod Bay and Great South Channel critical habitats will obtain information on recent whale sightings in the vicinity of the critical habitat. Any vessel operating in the vicinity of a North Atlantic right whale shall consider additional speed reductions as per Rule 6 of International Navigational Rules.

Additional Mitigation Measures Developed by NMFS and the Navy

As mentioned above, NMFS worked with the Navy to identify additional practicable and effective mitigation measures to address the following two issues of concern: (1) General minimization of marine mammal impacts; (2) minimization of impacts within the southeastern NARW critical habitat; and (3) the potential relationship between the operation of MFAS/HFAS and marine mammal strandings. Any mitigation measure(s) prescribed by NMFS should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the general goals listed below:

(a) Avoidance or minimization of injury or death of marine mammals wherever possible (goals b, c, and d may contribute to this goal).

(b) A reduction in the numbers of marine mammals (total number or number at biologically important time or location) exposed to received levels of MFAS/HFAS, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing harassment takes only).

(c) A reduction in the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels of MFAS/HFAS, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing harassment takes only).

(d) A reduction in the intensity of exposures (either total number or number at biologically important time or location) to received levels of MFAS/HFAS, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing the severity of harassment takes only).

(e) A reduction in adverse effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time.

(f) For monitoring directly related to mitigation—an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation (shut-down zone, etc.).

NMFS and the Navy had extensive discussions regarding mitigation, in which we explored several mitigation options and their respective practicability. Ultimately, NMFS and the Navy developed the measures listed below, which we believe support (or contribute) to the goals mentioned in a–e above.

Planning Awareness Areas

The Navy has designated several Planning Awareness Areas (PAAs) (see Figure 2) based on areas of high productivity that have been correlated with high concentrations of marine mammals (such as persistent oceanographic features like upwellings associated with the Gulf Stream front where it is deflected off the east coast near the Outer Banks), and areas of steep bathymetric contours that are frequented by deep diving marine mammals such as beaked whales and sperm whales. In developing the PAAs, U.S. Fleet Forces (USFF) was able to consider these factors because of geographic flexibility in conducting ASW training. USFF is not tied to a specific range support structure for the majority of the training for AFAST. Additionally, the topography and bathymetry along the East Coast and in the Gulf of Mexico is unique in that there is a wide continental shelf leading to the shelf break affording a wider range of training opportunities.

- The Navy proposes to avoid planning major exercises in the specified planning awareness areas (yellow areas on map). Should national security require the conduct of more than four major exercises (COMPTUEX, JTFEX, SEASWITI, or similar scale event) in these areas (meaning all or a portion of the exercise) per year the Navy would provide NMFS with prior notification and include the information in any associated after-action or monitoring reports.
- To the extent operationally feasible, the Navy plans to conduct no more than one of the four above-mentioned major exercises (COMPTUEX, JTFEX, SEASWITI or similar scale event) per year in the Gulf of Mexico. Based on operational requirements, the exercise area for this one exercise may include the De Soto Canyon. If national security needs require more than one major exercise to be conducted in the PAAs, which includes portions of the DeSoto Canyon, the Navy would provide NMFS with prior notification and include the information in any associated after-action or monitoring reports.
- The PAAs identified on the attached figure will be included in the Navy's Protective Measures Assessment Protocol (PMAP) (implemented by the Navy for use in the protection of the marine environment) for unit level situational awareness (i.e., exercises other than COMPTUEX, JTFEX, SEASWITI). The goal of PMAP is to raise awareness in the fleet and ensure common sense and informed oversight are injected into planning processes for testing and training evolutions.

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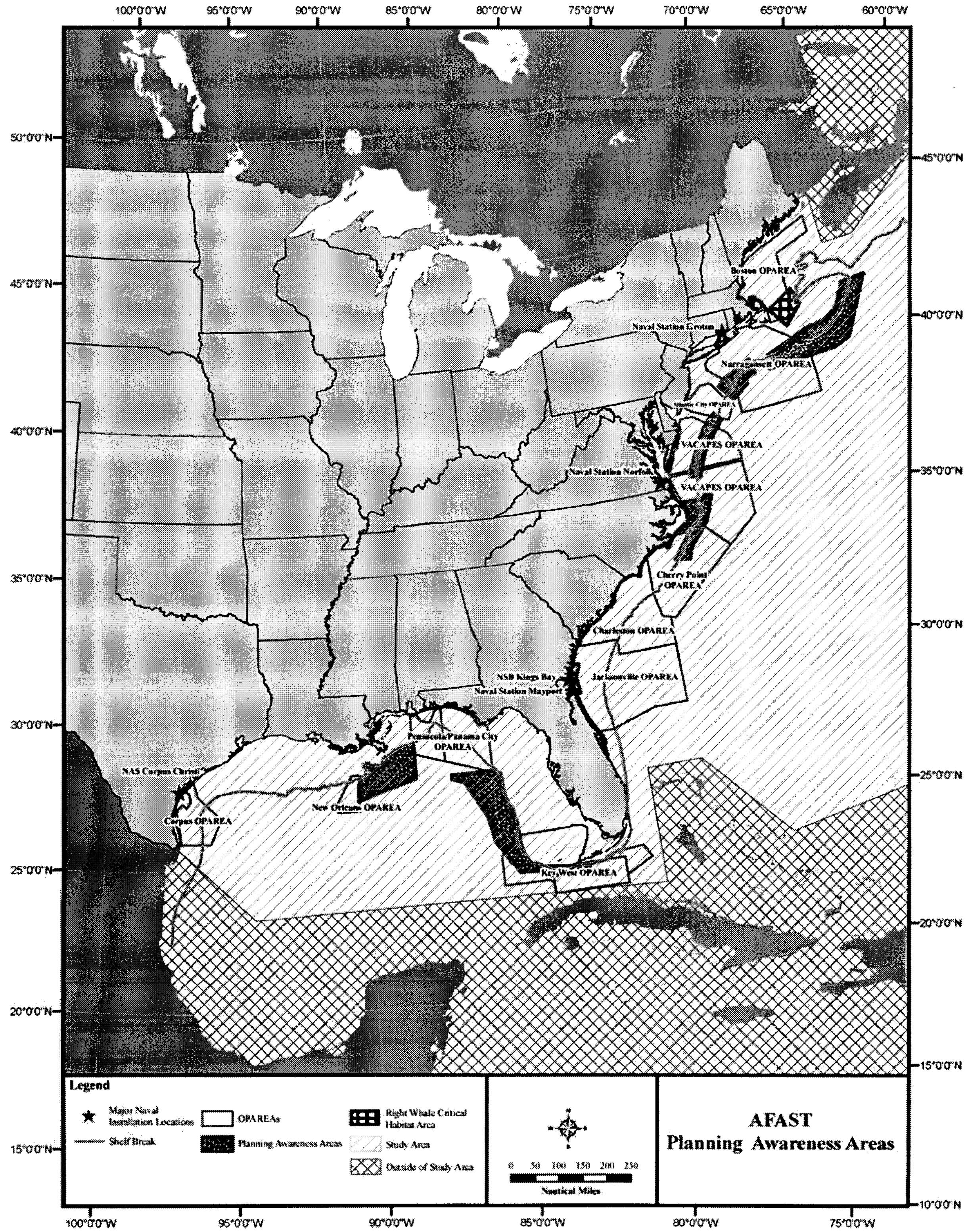

Figure 2. Planning Awareness Areas

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Helicopter Dipping Sonar in NARW Critical Habitat

Helicopter Dipping Sonar is one of the two activity types that has been identified as planned to occur in the southern North Atlantic right whale (NARW) critical habitat. Historically, only maintenance of helicopter dipping sonars occurs within a portion of the NARW critical habitat. Tactical training with helicopter dipping sonar does not typically occur in the NARW critical habitat area at any time of the year. The critical habitat area is used on occasion for post maintenance operational checks and equipment testing due to its proximity to shore. Unless otherwise dictated by national security needs, the Navy will minimize helicopter dipping sonar maintenance within the SE right whale critical habitat from November 15–April 15.

Object Detection Exercises in NARW Critical Habitat

Object detection training requirements are another type of activity that have been identified as planned to occur in the southern North Atlantic right whale (NARW) critical habitat. The Navy recognizes the significance of the NARW calving area and has explored ways of affecting the least practicable impact (which includes a consideration of practicality of implementation and impacts to training fidelity) to right whales. Navy units will incorporate data from the Early Warning System (EWS) into exercise pre-planning efforts. As NMFS is aware, USFF contributes more than $150,000 annually for aerial surveys that support the EWS, a communication network that assists afloat commands to avoid interactions with right whales. Fleet Area Control and Surveillance Facility, Jacksonville (FACSFACJAX) houses the Whale Fusion Center, which disseminates the latest right whale sighting information to Navy ships, submarines, and aircraft. Through the Fusion Center, FACSFACJAX coordinates ship and aircraft movement into the right whale critical habitat and the surrounding operating areas based on season, water temperature, weather conditions, and frequency of whale sightings and provides right whale reports to ships, submarines and aircraft, including coast guard vessels and civilian shipping. All sighting data is maintained on a Web site, *http://www.facsfacjax.navy.mil.* The Navy proposes to:

• Reduce the time spent conducting object detection exercises in the NARW critical habitat.

• Prior to conducting surface ship object detection exercises in the SE right whale critical habitat during the time of November 15–April 15, ships will contact FACSFACJAX to obtain the latest right whale sighting information. FACSFACJAX will advise ships of all reported whale sightings in the vicinity of the critical habitat and AAOC. To the extent operationally feasible, ships will avoid conducting training in the vicinity of recently sighted right whales. Ships will maneuver to maintain at least 500 yards separation from any observed whale, consistent with the safety of the ship.

Stranding Response Plan for Major Navy Training Exercises in the AFAST Study Area

NMFS and the Navy have developed a draft Stranding Response Plan for Major Exercises in the AFAST Study Area (available at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*). Pursuant to 50 CFR Section 216.105, the plan will be included as part of (attached to) the Navy's MMPA Letter of Authorization (LOA), which contains the conditions under which the Navy is authorized to take marine mammals pursuant to training activities involving MFAS/HFAS or explosives (IEER) in the AFAST Study Area. The Stranding Response plan is specifically intended to outline the applicable requirements the authorization is conditioned upon in the event that a marine mammal stranding is reported in the AFAST Study Area during a major training exercise (MTE) (see glossary below). As mentioned above, NMFS considers all plausible causes within the course of a stranding investigation and this plan in no way presumes that any strandings in the AFAST Study Area are related to, or caused by, Navy training activities, absent a determination made in a Phase 2 Investigation as outlined in Paragraph 7 of this plan, indicating that MFAS or explosive detonation in the AFAST Study Area were a cause of the stranding. This plan is designed to address the following three issues:

• Mitigation—When marine mammals are in a situation that can be defined as a stranding (see glossary of plan), they are experiencing physiological stress. When animals are stranded, and alive, NMFS believes that exposing these compromised animals to additional known stressors would likely exacerbate the animal's distress and could potentially cause its death. Regardless of the factor(s) that may have initially contributed to the stranding, it is NMFS' goal to avoid exposing these animals to further stressors. Therefore, when live stranded cetaceans are in the water and engaged in what is classified as an Uncommon Stranding Event (USE) (see glossary of plan), the shutdown component of this plan is intended to minimize the exposure of those animals to MFAS and explosive detonations, regardless of whether or not these activities may have initially played a role in the event.

• Monitoring—This plan will enhance the understanding of how MFAS/HFAS or IEER (as well as other environmental conditions) may, or may not, be associated with marine mammal injury or strandings. Additionally, information gained from the investigations associated with this plan may be used in the adaptive management of mitigation or monitoring measures in subsequent LOAs, if appropriate.

• Compliance—The information gathered pursuant to this protocol will inform NMFS' decisions regarding compliance with Sections 101(a)(5)(B and C) of the MMPA.

The Stranding Response Plan has several components:

Shutdown Procedures—When an uncommon stranding event (USE—defined in the plan) occurs during a major exercise in the AFAST Study Area, and a live cetacean(s) is in the water exhibiting indicators of distress (defined in the plan), NMFS will advise the Navy that they should cease MFAS/HFAS operation and explosive detonations within 14 nm (26 km) in the Atlantic and 17 nm (29 km) in the Gulf of Mexico of the live animal involved in the USE (NMFS and the Navy will maintain a dialogue, as needed, regarding the identification of the USE and the potential need to implement shutdown procedures). These distances (14 and 17 nm) (26 and 29 km) are the approximate distances at which sound from the sonar sources are anticipated to attenuate to 145 dB (SPL). The risk function predicts that less than 1 percent of the animals exposed to sonar at this level (mysticete or odontocete) would respond in a manner that NMFS considers Level B Harassment. The following special shutdown provisions for right whales are also included: (1) The Navy will automatically cease sonar operation (without waiting for the notification from NMFS) within 14 or 17 nm (Atlantic or GOM, respectively) of an injured or entangled right whale found at sea during an MTE; and (2) The Navy will alert NMFS immediately if a dead right whale is found at sea during an MTE and increase vigilance in the area of the whale.

Memorandum of Agreement (MOA)—The Navy and NMFS will develop an MOA, or other mechanism consistent with federal fiscal law requirements (and all other applicable laws), that allows the Navy to assist NMFS with the Phase 1 and 2 Investigations of USEs through the provision of in-kind services, such as (but not limited to) the use of plane/boat/truck for transport of stranding responders or animals, use of Navy property for necropsies or burial, or assistance with aerial surveys to discern the extent of a USE. The Navy may assist NMFS with the Investigations by providing one or more of the in-kind services outlined in the MOA, when available and logistically feasible and when the provision does not negatively affect Fleet operational commitments.

Communication Protocol—Effective communication is critical to the successful implementation of this Stranding Response Plan. Very specific protocols for communication, including identification of the Navy personnel authorized to implement a shutdown and the NMFS personnel authorized to advise the Navy of the need to implement shutdown procedures (NMFS Protected Resources HQ—senior administrators) and the associated phone trees, etc. are currently in development and will be refined and finalized for the Stranding Response Plan prior to the issuance of a final rule (and updated yearly).

Stranding Investigation—The Stranding Response Plan also outlines the way that NMFS plans to investigate any strandings (providing staff and resources are available) that occur during major training exercises in the AFAST Study Area.

Mitigation Conclusions

NMFS believes that the range clearance procedures and shutdown/safety zone/exclusion zone measures the Navy has proposed will enable the Navy to avoid injuring any marine mammals and will enable them to minimize the numbers of marine mammals exposed to levels associated with TTS for the following reasons:

MFAS/HFAS

The Navy's standard protective measures indicate that they will ensure powerdown of MFAS/HFAS by 6 dB when a marine mammal is detected within 1000 yd (914 km), powerdown of 4 more dB (or 10 dB total) when a marine mammal is detected within 500 yd (457 km), and will cease MFAS/HFAS transmissions when a marine mammal is detected within 200 yd (183 km).

PTS/Injury—NMFS believes that the proposed mitigation measures will allow the Navy to avoid exposing marine mammals to received levels of MFAS/HFAS sound that would result in injury for the following reasons:

- The estimated distance from the most powerful source at which an animal would receive a level of 215 dB SEL (threshold for PTS/injury/Level A Harassment) is approximately 10 m (10.9 yd).
- NMFS believes that the probability that a marine mammal would approach within 10 m (10.9 yd) of the sonar dome (to the sides or below) without being seen by the watchstanders (who would then activate a shutdown if the animal was within 200 yd (183 m) is very low, especially considering that animals would likely avoid approaching a source transmitting at that level at that distance.
- The model predicted that some animals would be exposed to levels associated with injury, however, the model does not consider the mitigation or likely avoidance behaviors and NMFS believes that injury is unlikely when those factors are considered.

TTS—NMFS believes that the proposed mitigation measures will allow the Navy to minimize exposure of marine mammals to received levels of MFAS/HFAS sound associated with TTS for the following reasons:

- The estimated range of maximum distances from the most powerful source at which an animal would receive 195 dB SEL (the TTS threshold) is from approximately 275–500 m (301–547 yd) from the source in most operating environments.
- Based on the size of the animals, average group size, behavior, and average dive time, NMFS believes that the probability that Navy watchstanders will visually detect mysticetes or sperm whales, dolphins, and social pelagic species (pilot whales, melon-headed whales, etc.) at some point within the 1000-yd (914 km) safety zone before they are exposed to the TTS threshold levels is high, which means that the Navy would be able to shutdown or powerdown to avoid exposing these species to sound levels associated with TTS.
- However, more cryptic (animals that are difficult to detect and observe), deep-diving species (beaked whales and *Kogia* sp.) are less likely to be visually detected and could potentially be exposed to levels of MFAS/HFAS expected to cause TTS. Additionally, the Navy's bow-riding mitigation exception for dolphins may sometimes allow dolphins to be exposed to levels of MFAS/HFAS likely to result in TTS.

IEER

The Navy utilizes a 1000-yd exclusion zone (wherein explosive detonation will not occur if animals are within the zone) for the IEER and they begin observations at least 30 minutes before any detonations. Based on the explosive criteria (see Acoustic Take Criteria Section), a marine mammal would need to be within 24–78 m of the explosive sonobuoy detonation to be exposed to levels that could cause death, within 79–179 m to be exposed to levels that could cause injury, and within 209–348 m to be exposed to levels that could result in TTS (the maximum range varies with acoustic propagation environment).

Mortality and Injury—Though the model predicted that 3 animals would be exposed to levels that would result in PTS (0 mortality), NMFS believes that the mitigation measures will allow the Navy to avoid exposing marine mammals to underwater detonations from IEER that would result in injury or mortality for the following reasons:

- Surveillance (including aerial and passive acoustic) begins two hours before the exercise and extends 1000-yd from the charges.
- Animals would need to approach within less than approximately 24–78 m of the source unnoticed to be exposed to the mortality threshold (we note here that this threshold is conservatively based on the exposure of a dolphin calf—most marine mammals are much larger and effects to these larger animals would likely be less severe). Additionally, the model predicted no exposures to levels associated with mortality.
- Animals would need to approach within less than approximately 79–179 m of the sonobuoy to be injured
- Unlike for sonar, an animal would need to be present at the exact moment of the explosion(s).

TTS–NMFS believes that the proposed mitigation measures will allow the Navy to minimize the exposure of marine mammals to underwater detonations that would result in TTS for the following reasons:

- 31 animals were predicted to be exposed to explosive levels that would result in TTS, however, for the same reasons as above (i.e., surveillance and close approach to source), NMFS believes that most modeled TTS takes can be avoided, especially dolphins, mysticetes and sperm whales, and social pelagic species.
- However, more cryptic, deep-diving species (beaked whales and Kogia sp.) are less likely to be visually detected and could potentially be exposed to explosive levels expected to cause TTS.

The Stranding Response Plan will minimize the probability of distressed live-stranded animals responding to the proximity of sonar in a manner that further stresses them or increases the potential likelihood of mortality.

The incorporation of the Navy's proposed PAAs into their planning process along with the plan not to conduct more than 4 major exercises within these areas should ultimately result in a reduction in the number of marine mammals exposed to MFAS/HFAS (because these PAAs are anticipated to have higher densities of animals), a reduction in the number of animals exposed while engaged in feeding behaviors (because these areas are particularly productive), and an increased awareness of their potential presence when conducting activities in those important areas. Additionally, the Navy's plan to minimize both the helicopter dipping and object detection activities within the NARW critical habitat during the time when the most calves and mothers are present should result in the minimization of exposure of cow/calf pairs to MFAS/HFAS.

NMFS has preliminarily determined that the Navy's proposed mitigation measures (from the LOA application), along with the Planning Awareness Areas, the helicopter dipping and object detection minimization measures, and the Stranding Response Plan (and when the Adaptive Management (see Adaptive Management below) component is taken into consideration) are adequate means of effecting the least practicable adverse impacts on marine mammals species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, while also considering personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

These mitigation measures may be refined, modified, removed, or added to prior to the issuance of the final rule based on the comments and information received during the public comment period.

Research and Conservation Measures for Marine Mammals

The Navy is working towards a better understanding of marine mammals and sound in ways that are not directly related to the MMPA process. The Navy highlights some of those ways in the section below. Further, NMFS is working on a long-term stranding study that will be supported by the Navy by way of a funding and information sharing component (see below).

Navy Research

The Navy provides a significant amount of funding and support to marine research. The agency is providing approximately $26 million annually between FY07–FY09 to universities, research institutions, federal laboratories, private companies, and independent researchers around the world to study marine mammals. The U.S. Navy sponsors 50 percent of all U.S. research concerning the effects of human-generated sound on marine mammals and 50 percent of such research conducted both in the U.S. and worldwide. Major topics of Navy-supported research include the following:

- Better understanding of marine species distribution and important habitat areas,
- Developing methods to detect and monitor marine species before and during training,
- Understanding the effects of sound on marine mammals, sea turtles, fish, and seabirds, and
- Developing tools to model and estimate potential effects of sound.

This research is directly applicable to Atlantic Fleet training activities, particularly with respect to the investigations of the potential effects of underwater noise sources on marine mammals and other protected species. Proposed training activities employ sonar and underwater explosives, which introduce sound into the marine environment.

The Marine Life Sciences Division of the Office of Naval Research currently coordinates six programs that examine the marine environment and are devoted solely to studying the effects of noise and/or the implementation of technology tools that will assist the Navy in studying and tracking marine mammals. The six programs are:

1. Environmental Consequences of Underwater Sound,
2. Non-Auditory Biological Effects of Sound on Marine Mammals,
3. Effects of Sound on the Marine Environment,
4. Sensors and Models for Marine Environmental Monitoring,
5. Effects of Sound on Hearing of Marine Animals, and
6. Passive Acoustic Detection, Classification, and Tracking of Marine Mammals.

The Navy has also developed the technical reports referenced within this document, which include the Marine Resource Assessments and the Navy OPAREA Density Estimates reports. Furthermore, research cruises by the NMFS and by academic institutions have received funding from the U.S. Navy. For instance, the ONR contributed financially to the Sperm Whale Seismic Survey (SWSS) in the Gulf of Mexico, coordinated by Texas A&M. The goals of the SWSS are to examine effects of the oil and gas industry on sperm whales and what mitigations would be employed to minimize adverse effects to the species. All of this research helps in understanding the marine environment and the effects that may arise from the use of underwater noise in the Gulf of Mexico and western North Atlantic Ocean.

The Navy has sponsored several workshops to evaluate the current state of knowledge and potential for future acoustic monitoring of marine mammals. The workshops brought together acoustic experts and marine biologists from the Navy and other research organizations to present data and information on current acoustic monitoring research efforts and to evaluate the potential for incorporating similar technology and methods on instrumented ranges. However, acoustic detection, identification, localization, and tracking of individual animals still requires a significant amount of research effort to be considered a reliable method for marine mammal monitoring. The Navy supports research efforts on acoustic monitoring and will continue to investigate the feasibility of passive acoustics as a potential mitigation and monitoring tool.

Overall, the Navy will continue to fund ongoing marine mammal research, and is planning to coordinate long-term monitoring/studies of marine mammals on various established ranges and OPAREAS. The Navy will continue to research and contribute to university/external research to improve the state of the science regarding marine species biology and acoustic effects. These efforts include mitigation and monitoring programs; data sharing with NMFS and via the literature for research and development efforts; and future research as described previously.

Long-Term Prospective Study

Apart from this proposed rule, NMFS, with input and assistance from the Navy and several other agencies and entities, will perform a longitudinal observational study of marine mammal strandings to systematically observe for and record the types of pathologies and diseases and investigate the relationship with potential causal factors (e.g., tactical sonar, seismic, weather). The study will not be a true ''cohort'' study, because we will be unable to quantify or estimate specific sonar or other sound exposures for individual animals that strand. However, a cross-sectional or correlational analysis, a method of descriptive rather than analytical epidemiology, can be conducted to compare population characteristics, e.g., frequency of strandings and types of specific pathologies between general periods of various anthropogenic activities and non-activities within a prescribed geographic space. In the long-term study, we will more fully and consistently collect and analyze data on the demographics of strandings in specific locations and consider anthropogenic activities and physical, chemical, and biological environmental parameters. This approach in conjunction with true cohort studies (tagging animals, measuring received sounds, and evaluating behavior or injuries) in the presence of activities and non-activities will provide critical information needed to further define the impacts of MTEs and other anthropogenic and non-anthropogenic stressors. In coordination with the Navy and other federal and non-federal partners, the comparative study will be designed and conducted for specific sites during intervals of the presence of anthropogenic activities such as sonar transmission or other sound exposures and absence to evaluate demographics of morbidity and mortality, lesions found, and cause of death or stranding. Additional data that will be collected and analyzed in an effort to control potential confounding factors include variables such as average sea temperature (or just season), meteorological or other environmental variables (e.g., seismic activity), fishing activities, etc. All efforts will be made to include appropriate controls (i.e., no tactical sonar or no seismic); environmental variables may complicate the interpretation of ''control'' measurements. The Navy and NMFS along with other partners are evaluating mechanisms for funding this study.

Monitoring

In order to issue an ITA for an activity, Section 101(a)(5)(A) of the MMPA states that NMFS must set forth ''requirements pertaining to the monitoring and reporting of such taking''. The MMPA implementing regulations at 50 CFR Section 216.104(a)(13) indicate that requests for LOAs must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present.

Monitoring measures prescribed by NMFS should accomplish one or more of the following general goals:

(a) An increase in the probability of detecting marine mammals, both within the safety zone (thus allowing for more effective implementation of the mitigation) and in general to generate more data to contribute to the analyses mentioned below.

(b) An increase in our understanding of how many marine mammals are likely to be exposed to levels of MFAS/HFAS (or explosives or other stimuli) that we associate with specific adverse effects, such as behavioral harassment, TTS, or PTS.

(c) An increase in our understanding of how marine mammals respond to MFAS/HFAS (at specific received levels), explosives, or other stimuli expected to result in take and how anticipated adverse effects on individuals (in different ways and to varying degrees) may impact the population, species, or stock (specifically through effects on annual rates of recruitment or survival) through any of the following methods:

- Behavioral observations in the presence of MFAS/HFAS compared to observations in the absence of sonar (need to be able to accurately predict received level and report bathymetric conditions, distance from source, and other pertinent information.
- Physiological measurements in the presence of MFAS/HFAS compared to observations in the absence of tactical sonar (need to be able to accurately predict received level and report bathymetric conditions, distance from source, and other pertinent information).
- Pre-planned and thorough investigation of stranding events that occur coincident to naval activities.
- Distribution and/or abundance comparisons in times or areas with concentrated MFAS/HFAS versus times or areas without MFAS/HFAS.

(d) An increased knowledge of the affected species.

(e) An increase in our understanding of the effectiveness of certain mitigation and monitoring measures.

Proposed Monitoring Plan for the AFAST Study Area

The Navy has submitted a draft Monitoring Plan for AFAST, which may be viewed at NMFS' Web site: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.* NMFS and the Navy have worked together on the development of this plan in the months preceding the publication of this proposed rule; however, we are still refining the plan and anticipate that it will contain more details by the time it is finalized in advance of the issuance of the final rule. Additionally, the plan may be modified or supplemented based on comments or new information received from the public during the public comment period. A summary of the primary components of the plan follows.

The draft Monitoring Plan for AFAST has been designed as a collection of focused ''studies'' (described fully in the AFAST Monitoring Plan) to gather data that will allow the Navy to address the following questions:

(a) Are marine mammals exposed to MFAS, especially at levels associated with adverse effects (i.e., based on NMFS' criteria for behavioral harassment, TTS, or PTS)? If so, at what levels are they exposed?

(b) If marine mammals are exposed to MFAS in the AFAST Study Area, do they redistribute geographically as a result of continued exposure? If so, how long does the redistribution last?

(c) If marine mammals are exposed to MFAS, what are their behavioral responses to various levels?

(d) Is the Navy's suite of mitigation measures for MFAS (e.g., measures agreed to by the Navy through permitting) effective at avoiding TTS, injury, and mortality of marine mammals?

Data gathered in these studies will be collected by qualified, professional marine mammal biologists that are experts in their field. They will use a combination of the following methods to collect data:

- Contracted vessel and aerial surveys.
- Passive acoustics.
- Marine mammal observers on Navy ships.

In the four proposed study designs (all of which cover multiple years), the above methods will be used separately or in combination to monitor marine mammals in different combinations before, during, and after training activities utilizing MFAS/HFAS. Table 7 contains a summary of the monitoring effort that is planned for each study in each year.

This monitoring plan has been designed to gather data on all species of marine mammals that are observed in the AFAST study area. The Plan recognizes that deep-diving and cryptic species of marine mammals such as beaked whales have a low probability of detection (Barlow and Gisiner, 2006). Therefore, methods will be utilized to attempt to address this issue (e.g., passive acoustic monitoring).

North Atlantic right whales will also be given particular attention during monitoring in the AFAST study area, although monitoring methods will be the same for all species. Within the AFAST study area, the Northwestern Atlantic provides unique breeding and calving habitat for North Atlantic right whales, and as a result, critical habitat has been designated for one calving ground (off Georgia and northern Florida) and two feeding areas (Cape Cod Bay and the Great South Channel). North Atlantic right whales will be given particular attention in the form of focal follows (e.g., collect behavioral data using the Big Eyes binoculars, and observe the behavior of any animals that are seen) when observed.

STUDY 1 and 3 (exposures and behavioral responses)	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**	**FY13**
Aerial surveys	Award monitoring contract, develop SOP, obtain permits	SEASWITI, shallow COMPTUEX, or ULT - 30 hours	SEASWITI, shallow COMPTUEX, or ULT - 30 hours	SEASWITI, shallow COMPTUEX, or ULT - 30 hours	SEASWITI, shallow COMPTUEX, or ULT - 30 hours	SEASWITI, shallow COMPTUEX, or ULT - 30 hours
Marine Mammal Observers	Opportunistic as staff and SOP developed	SEASWITI or ULT - 60 hours	SEASWITI or ULT - 60 hours	SEASWITI or ULT - 60 hours	SEASWITI or ULT - 60 hours	SEASWITI or ULT - 60 hours
Vessel surveys (study 3 only)	Award monitoring contract, develop SOP	SEASWITI, shallow COMPTUEX, or ULT- 100 hours	SEASWITI, shallow COMPTUEX, or ULT- 100 hours	SEASWITI, shallow COMPTUEX, or ULT- 100 hours	SEASWITI, shallow COMPTUEX, or ULT- 100 hours	SEASWITI, shallow COMPTUEX, or ULT - 100 hours
STUDY 2 (geographic redistribution)	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**	**FY13**
Aerial surveys before and after training events	SEASWITI, shallow COMPTUEX, or ULT- 24 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours
Onslow Bay and Jacksonville Aerial surveys	288 hours	288 hours	576 hours	576 hours	576 hours	576 hours
Onslow Bay and Jacksonville Shipboard surveys	288 hours	288 hours	576 hours	576 hours	576 hours	576 hours
Passive Acoustics	Award monitoring contract 1 HARP in place and use of pop-up buoys for exercise monitoring Begin recording	Installation of remaining 3 HARPS (4 total) and use of pop-up buoys for exercise monitoring Begin recording and data analysis	Continue recording and data analysis	Continue recording and data analysis	Continue recording and data analysis	Continue recording and data analysis
STUDY 4 (mitigation effectiveness)	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**	**FY13**
Marine mammal observers/lookout comparison	SEASWITI or ULT- 24 hours	SEASWITI or ULT- 40 hours	SEASWITI or ULT- 40 hours	SEASWITI or ULT- 40 hours	SEASWITI or ULT- 40 hours	SEASWITI or ULT- 40 hours
Aerial surveys before and after training events	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours

Table 7. Summary of monitoring effort proposed in draft Monitoring Plan for AFAST

In addition to the Monitoring Plan for AFAST, by the end of 2009, the Navy will have completed an Integrated Comprehensive Monitoring Program (ICMP). The ICMP will provide the overarching structure and coordination that will, over time, compile data from both range specific monitoring plans (such as AFAST, the Hawaii Range complex, and the Southern California Range Complex) as well as Navy funded research and development (R&D) studies. The primary objectives of the ICMP are:

- To monitor Navy training events, particularly those involving mid-frequency sonar and underwater detonations, for compliance with the terms and conditions of ESA Section 7 consultations or MMPA authorizations;
- To collect data to support estimating the number of individuals exposed to sound levels above current regulatory thresholds;
- To assess the efficacy of the Navy's current marine species mitigation;
- To add to the knowledge base on potential behavioral and physiological effects to marine species from mid-frequency active sonar and underwater detonations; and
- To assess the practicality and effectiveness of a number of mitigation tools and techniques (some not yet in use).

More information about the ICMP may be found in the draft Monitoring Plan for AFAST.

Past Monitoring in the AFAST Study Area

NMFS has received four total monitoring reports addressing MFAS use off the Atlantic Coast or in the Gulf of Mexico. The data contained in the After Action Reports (AAR) have been considered in developing mitigation and monitoring measures for the proposed activities contained in this rule. The Navy's AAR may be viewed at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*. NMFS has reviewed these reports and has summarized the results, as related to marine mammal observations, below.

ESG COMPTUEX 08–01

The USS Nassau Expeditionary Strike Group COMPTUEX 08–01 was conducted from November 28, 2007 through December 14, 2007. The ASW training conducted during the ESG COMPTUEX involved ships, submarines, aircraft, non-explosive exercise weapons, and other training related devices and occurred within portions of the Cherry Point and Charleston/Jacksonville Operating Areas (OPAREAS; see Figure A–1, Appendix A). MFA sonar equipped ships that participated in ESG COMPTUEX 08–01 included Ticonderoga-class guided missile cruisers (CG), Arleigh Burke-class guided missile destroyers (DDG), and Oliver Hazard Perry-class guided missile frigates (FFG). The surface combatants employed ANSQS–53C/ANSQS 56 sonar, and the associated aviation assets employed SH–60B/F/R with AN/AQS–13F or AQS–22 dipping sonar and AN/SSQ–62B1C/D/E Directional Command Activated Sonobuoy System (DICASS). The MFA sonar equipped submarines that participated were SSNs with AN/BQQ–5 sonar.

During ESG COMPTUEX 08–01, 141–161 hours of MFAS and 38–46 DICASS sonobuoy usage was reported.

Navy lookouts did not report any sightings of marine mammals during ESG COMPTUEX 08–01.

Combined CSG COMPTUEX/JTFEX 07–01

USS TRUMAN 07–1 CSG COMPTUEX/JTFEX was conducted from July 2–August 1, 2007 and involved a Carrier Strike Group. Ships assigned to this CSG included: two non-MFAS-equipped ships, and five MFAS-equipped ships and one submarine. Other participating U.S. Navy units representing support and opposition forces included one submarine and four MFAS-equipped ships. France participated with three MFAS-equipped ships. Allied nations participating in the exercise were also provided the mitigation measures in Appendix B and the MSAT. There were two ASW SH–60 helicopters and two ASW P–3 Maritime Patrol Aircraft also participating.

During USS Truman 07–1 CSG COMPTUEX/JTFEX MFAS was only used during carefully planned exercise events and for only a small subset of any given exercise time frame. During this exercise, 340–355 hours of hull-mounted MFAS, 50–65 hours of dipping sonar, and use of 170 DICASS sonobuoys were reported.

There were 49 total sighting events and three passive detections. An estimated 374–416 marine mammals and four sea turtles were observed during USS Truman 07–1 CSG COMPTUEX/JTFEX (See Table 8). There were two sighting events occurring during active sonar use. The first occurred with the observing ship observing five dolphins while using MFAS and a second ship was active within the vicinity of this sighting. The second occurred with the observing ship sighting two pilot whales while not active, but a second ship was active at a distance which could have had an influence on the sighted marine mammals. On four instances, vessels maneuvered to avoid the path of a marine mammal or increase the distance between the ship and animal.

None of the watchstanders reported any sort of ''observed effect'' on the marine mammals that were observed in the two instances when the sonar was on.

Data Quality	Date Time (Local)	Range (Yds) & Length of observation (Minutes)	Description of event	# of animals	MFAS Status
0	7/02-8/01	-- --	12 of sightings were of dolphins and porpoises which generally closed the ship to ride the bow wave. The size of each pod varied between 3 and 30. (Estimate of animal # is extremely tenuous)	140-160	Not Active
3	7/03 1600	-- 58 min	Clear day, 10 dolphins detected	10	Not Active
3	7/04 1225	-- 2 min	Clear Day, sea turtle passes alongside ship	1	Not Active
3	7/05 0827	-- 90 min	Clear Day, dolphins detected swimming and jumping	5	Not Active
3	7/05 1237	-- 150 min	Clear Day, 15 dolphins detected swimming and jumping	15	Not Active
3	7/06 1315	-- 10 min	Clear Day, sea turtle passes alongside ship	1	Not Active
3	7/07 0937	-- 210 min	Clear Day, 35 dolphins swimming and jumping	35	Not Active
3	7/07 1546	-- 30 min	Clear Day, 10 dolphins swimming, jumping and spyhopping	10	Not Active
3	7/08 0845	-- 45 min	Clear Day, 8 dolphins swimming	8	Not Active
2	7/09 1650	-- 20 min	Clear Day, 1 Shark (Unnecessary observation included for discussion purposes only)	1	Not Active
2	7/10 1245	-- 30 min	Clear Day, killer whale sighted	1	Not Active
2	7/14 1430	-- 10 min	Clear Day, 14 dolphins sighted	15	Not Active
3	7/15 1634	-- 15 min	Clear Day, 10 dolphins swimming, jumping and spyhopping	10	Not Active
3	7/18 1435	-- 20 min	Clear Day, 7 dolphins swimming and jumping	7	Not Active
2	7/20 0735	-- 3 min	Clear Day, sea turtle passes alongside ship	1	Not Active
0	7/23 0330	-- 38 min	Biologics heard on WQC-2, Under Water Telephone (UWT), no correlating visual	--	Not Active
1	7/23 1807	100 Yd --	Dolphins sighted within 100yds, ship maneuvered to open distance	--	Not Active
1	7/24 0912	200+Yd --	50+ dolphins over 200 yds, maintained course	50+	Not Active
1	7/24 1412	-- --	2 dolphins sighted	2	Not Active
1	7/25 0919	-- --	Possible submerged whale, only dark shades were visible on surface	1	Not Active
2	7/25 1237	100 Yd --	Dolphins 100yds off the bow, altered course to open distance	15+	Not Active
2	7/26 1538	-- 15 min	**Clear Day, 5 dolphins sighted, Sonar active, secured upon sighting. Additional ship concurrently active.**	5	**ACTIVE**

Table 8. Combined CSG COMPTUEX/JTFX 07-01 watchstander report

*Data Quality	Date-Time (Local)	Range (Yds) & Length of observation (Minutes)	Description of event	# of animals	MFAS Status
2	7/26 1700	1000 Yd --	2 pilot whales, ID through big eyes, approx 1,000yds. Additional ship concurrently active. Estimated received SPL, 110 dB re 1µPa.	2	ACTIVE
1	7/26 1918	-- --	Whale sighted	1	Not Active
1	7/26 1921	-- --	Whale sighted	1	Not Active
2	7/26 1935	500+Yd --	2 medium size whales approx 500+ yds from ship, maneuvered to avoid	2	Not Active
1	7/27 1400 & 1434	-- --	Twice on July 27th three Humpback Whales were sighted, each time they surfaced and showed flukes. (Likely the same animals on both sightings due to extremely close spatial and temporal proximity)	3	Not Active
2	7/28 0948	200+ Yd --	2-3 Pilot whales off port bow, 200yds+ and opening	2-3	Not Active
0	7/28 2221	-- 4 min	Biologics heard on WQC-2, UWT, no correlating visual	--	Not Active
2	7/29 0625	33 Yd --	Dolphins riding ship's bow wave, maintained course/speed	20+	Not Active
0	7/29 0632	-- 4 min	Biologics heard on WQC-2, UWT, no correlating visual	--	Not Active
3	7/29 1455	-- 10 min	Clear Day, 15 dolphins swimming, jumping and spyhopping	15	Not Active
2	7/30 0925	-- 3 min	Clear Day, sea turtle passes alongside ship	1	Not Active
1	7/30 1938	-- --	Whale sighted	1	Not Active
1	7/31 0732	-- --	Whale sighted	1	Not Active
2	7/31 0750	750+ Yd --	Pilot whale off port beam	1	Not Active
3	7/31 1735	-- 25 min	Clear Day, 5 dolphins swimming, jumping and spyhopping	5	Not Active
1	8/02 --	4000 Yd --	Ten Pilot whales surfaced about two miles from the ship and then dove deep. (Report is after the official end of the exercise)	10	Not Active
SUMMARY: 49 Total Sighting Events, 3 passive detections, 374-416 Mammals sighted, 4 sea turtles sighted					

***Data quality** is a relative assessment of the data provided by the participants, categorized as follows: 0 – Nominal level data, 1 – Data missing at least three critical components, 2 – Data missing two critical components, 3 – Data missing one critical component, 4 – Data has all needed components.*

Table 8 continued. Combined CSG COMPTUEX/JTFEX 07-01 watchstander report.

ESG COMPTUEX 07–01

This exercise was conducted in October 2006 in two large areas seaward of the shelf break off the coasts of North and South Carolina. The types of ASW training conducted during ESG COMPTUEX07–1 involved the use of ships, submarines, aircraft, non-explosive exercise weapons, and other training related devices. Exercise planning estimated use of 114 hours of MFA sonar and 118 DICASS sonobuoys. Actual use was 101.4 hours of MFA sonar and 35 DICASS sonobuoys.

There was one marine mammal sighting during the exercise. A surface ship sighted approximately 12 ''dolphins'' ''playing'' within 1,000 yds. The group was engaged in the combined battle problem, with ships intermittently active and passive. All units shut down MFAS for approximately 2 hours.

None of the watchstanders reported any sort of ''observed effect'' on the marine mammals that were observed, either with or without the operation of sonar.

JTFEX 06–02

This exercise was conducted from July 21–29, 2006, largely within the Cherry Point OPAREA, off the shelf break of North Carolina. The types of ASW training conducted during JTFEX 06–2 involved the use of ships, submarines, aircraft, non-explosive exercise weapons, and other training related devices. In addition to the JTFEX major exercise, a precursor event three days prior to the exercise was included in the analysis due to the temporal proximity of the exercise. The precursor event estimated sonar use was 22.5 hours of surface vessel MFAS and 36 DICASS sonobuoys. The planned exercise, exclusive of the precursor events, was estimated at 200–225 hours of SQS–53C MFAS, 100–125 hours of surface vessel SQS–56 MFAS and 50 DICASS sonobuoys used. In reality, 108 hours of MFA sonar and less than 50 sonobuoys were used for both the precursor events and the JTFEX 06–2 exercise.

During the exercise, all surface vessels and aircraft participating in ASW events were involved in the visual surveillance for marine mammals. There were 29 instances when marine mammals (individuals or pods) were detected, all by surface vessel exercise participants. MFAS was shut down seven times by exercise participants due to the detected marine mammals as detailed in Table 9.

These 29 marine mammal detections by exercise participants totaled 120 quantified marine mammals, and 10 sightings of multiple animals, or ''pods'' that could not be quantified. Assuming each pod consisted of at least four animals; the estimated total number of marine mammals detected was 160 animals. Of those detections when sonar was active (7 of the 29 in Table 9), 18 animals were quantified, and 4 reports were of multiple animals that could not be quantified. Using the described estimating procedure, approximately 34 marine mammals were in the vicinity of surface ships during MFAS use periods. In only one instance (see Table 9) were the animals present within a range requiring power reduction. In two instances described in Table 9, 12 dolphins (sighting 27 (8 animals) and sighting 29 (estimated 4 animals)) were sighted closing on the ship and later engaged in bow riding. In these instances, sonar was shutdown at a range of 3,000 yards.

None of the watchstanders reported any sort of ''observed effect'' on the marine mammals that were observed, either with or without the operation of MFAS.

	July Date-Time (Z)	Lost Hours	Description of Actions Taken
1	7/21-1445		Surface ship sighted 1 "unidentified gray whale" transiting the area at 600 yds. MFAS not active.
2	7/22-1812		Surface ship sighted 3 "dolphins playing" at 550 yds. MFAS not active.
3	7/23-2057		Surface ship sighted 6 "dolphins" transiting the area at 550 yds. MFAS not active.
4	7/23-2237		Surface ship sighted 3 "dolphins" at 20 yds, closing on ship to engage in "bow riding". MFAS not active.
5	7/23-2240		Surface ship sighted 22 "dolphins" engaged in "bow riding" at 25-100 yds. MFAS not active.
6	7/24-1245		Surface ship sighted an undetermined number of "dolphins playing" at 500 – 800 yds. MFAS not active.
7	7/24-1338		Surface ship sighted 3 "unknown gray whales with rounded spout pattern" at 200 yds. MFAS not active.
8	7/24-1425		Surface ship sighted an undetermined number of "dolphins playing" at an unspecified range. MFAS not active.
9	7/24-1646		Surface ship sighted an undetermined number of "dolphins playing" at an unspecified range. MFAS not active.
10	7/24-2136		Surface ship sighted 3 "pilot whales" at 500 yds. MFAS not active.
11	7/24-2324		Surface ship sighted 3 "dolphins" engaged in what was described as "swimming" at 40 yds. MFAS not active.
12	7/25-0200		Surface ship sighted an undetermined number of "dolphins playing" at an unspecified range. MFAS not active.
13	7/25-0245	1.0	Surface ship sighted undetermined number of "dolphins" engaged in what was described as "feeding". Range was not estimated. MFAS active at the time of sighting. SONAR was secured and continued to monitor.
14	7/25-0325	0.5	Surface ship sighted undetermined number of "dolphins" engaged in what was described as "playing". Range was not estimated. MFAS active at the time of sighting. SONAR was secured and continued to monitor.
15	7/25-1352		Surface ship sighted an undetermined number of "dolphins playing" at 200 yds. MFAS not active.
16	7/25-2200		Surface ship sighted 6 "dolphins playing", at 200 yds. MFAS not active.
17	7/26-1600		Surface ship sighted 20 "dolphins" playing and bow wave riding. MFAS not active.
18	7/26-1724		Surface ship sighted 15 "dolphins" at 700 yds. MFAS not active.
19	7/26-1817		Surface ship sighted 1 "dolphin" at 500 yds, transiting. MFAS not active.
20	7/26-1930		Surface ship sighted 1 "whale" at 1,500 yds, transiting in the opposite direction as the ship. MFAS not active.
21	7/26-2059		Surface ship sighted 7 "unknown whales" at 550 yds. MFAS not active.

Table 9. JTFX 06-02 watchstander report

22	7/26-2216	0.5	Surface ship sighted undetermined number of "dolphins" engaged in what was described as "playing". Range was not estimated. MFAS active at the time of sighting, SONAR was secured and continued to monitor.
23	7/27-0052		Surface ship sighted 6 "dolphins" bow riding at 40-60 yds. MFAS not active.
24	7/27-0325		Surface ship sighted 2 "dolphins playing" at an unspecified range. MFAS not active.
25	7/27-1043		Surface ship sighted undetermined number of "dolphins" engaged in what was described as "feeding" at 200 yds. MFAS not active.
26	7/27-1133	0.25	Surface ship sighted 8 "unidentified whales" engaged in what was described as "transiting or feeding". Range was estimated at 1,000 yds. MFAS active at the time of sighting. SONAR was secured until mammals clear of ship.
27	7/27-1402	0.3	Surface ship sighted 8 "dolphins" closing on ship to engage in "bow riding". Range was estimated at 3,000 yds. MFAS active at the time of sighting, SONAR was secured until mammals clear of ship. Also sighted was 1 "unidentified whale" engaged in what was described as "transiting". Range was estimated at 10,000 yds.
28	7/27-1425	0.25	Surface ship sighted 1 "unidentified whale" engaged in what was described as "transiting". Range was estimated at 4,000 yds. MFAS active at the time of sighting. SONAR was secured until mammals clear of ship.
29	7/27-1731	0.5	Surface ship sighted undetermined number of "dolphins" closing on ship to engage in "bow riding". Range was estimated at 3,000 yds. MFAS active at the time of sighting. SONAR was secured until mammals clear of ship.
	Participant Hours Lost	3.3	

Table 9 continued. JTFX 06-02 watchstander report

General Conclusions Drawn From Review of Monitoring Reports

Because NMFS has received relatively few monitoring reports from sonar training in the AFAST Study Area, and none that have utilized independent aerial or vessel-based observers (though they will be required by this LOA (see Monitoring)), it is difficult to draw biological conclusions. However, NMFS can draw some general conclusions from the content of the monitoring reports:

(a) Data from watchstanders is generally useful to indicate the presence or absence of marine mammals within the safety zones (and sometimes without) and to document the implementation of mitigation measures, but does not provide useful species specific information or behavioral data. Data gathered by independent observers can provide very valuable information at a level of detail not possible with watchstanders (such as data gathered by independent, biologist monitors in Hawaii and submitted to NMFS in a monitoring report, which indicated the presence of sub-adult sei whales in the Hawaiian Islands in fall, potentially indicating the use of the area for breeding).

(b) Though it is by no means conclusory, it is worth noting that no instances of obvious behavioral disturbance were observed by the Navy watchstanders. Though of course, these observations only cover the animals that were at the surface (or slightly below in the case of aerial surveys) and within the distance that the observers can see with the big-eye binoculars or from the aircraft.

(c) NMFS and the Navy need to more carefully designate what information should be gathered during monitoring, as some reports contain different information, making cross-report comparisons difficult.

Adaptive Management

Adaptive Management was addressed above in the context of the Stranding Response Plan because that Section will be a stand-alone document. More specifically, the final regulations governing the take of marine mammals incidental to Navy training exercises in the AFAST Study Area will contain an adaptive management component. Our understanding of the effects of MFAS/HFAS and explosives on marine mammals is still in its relative infancy, and yet the science in this field is evolving fairly quickly. These circumstances make the inclusion of an adaptive management component both valuable and necessary within the context of 5-year regulations for activities that have been associated with marine mammal mortality in certain circumstances and locations (though not the AFAST Study Area). The use of adaptive management will give NMFS the ability to consider new data from different sources to determine (in coordination with the Navy), on an annual basis if new or modified mitigation or monitoring measures are appropriate for subsequent annual LOAs. Following are some of the possible sources of applicable data:

- Results from the Navy's monitoring from the previous year (either from the AFAST Study Area or other locations)
- Results from specific stranding investigations (either from the AFAST Study Area or other locations, and involving coincident MFAS/HFAS of explosives training or not involving coincident use)
- Results from the Long Term Prospective Study described below
- Results from general marine mammal and sound research (funded by the Navy (described below) or otherwise)

Mitigation measures could be modified or added if new data suggests that such modifications would have a reasonable likelihood of reducing adverse effects to marine mammals and if the measures are practicable. NMFS could also coordinate with the Navy to modify or add to the existing monitoring requirements if the new data suggest that the addition of a particular measure would likely fill in a specifically important data gap.

Reporting

In order to issue an ITA for an activity, Section 101(a)(5)(A) of the MMPA states that NMFS must set forth ''requirements pertaining to the monitoring and reporting of such taking''. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring. Some of the reporting requirements are still in development and the final rule may contain additional details not contained in the proposed rule. Additionally, proposed reporting requirements may be modified, removed, or added based on information or comments received during the public comment period. Currently, there are several different reporting requirements pursuant to these proposed regulations:

General Notification of Injured or Dead Marine Mammals

Navy personnel will ensure that NMFS (regional stranding coordinator) is notified immediately (or as soon as clearance procedures allow) if an injured or dead marine mammal is found during or shortly after, and in the vicinity of, any Navy training exercise utilizing MFAS, HFAS, or underwater explosive detonations. The Navy will provide NMFS with species or description of the animal (s), the condition of the animal(s) (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available). The AFAST Stranding Response Plan contains more specific reporting requirements for specific circumstances.

IEER

A yearly report detailing the number of exercises along with the hours of associated marine mammal survey and associated marine mammal sightings, number of times employment was delayed by sightings, and the number of total detonated charges and self-scuttled charges will be submitted to NMFS.

MFAS/HFAS Mitigation/Navy Watchstanders

The Navy will submit an After Action Report to the Office of Protected Resources, NMFS, within 120 days of the completion of a Major Training Exercise (SEASWITI, COMPTUEX, JTFEX, but not Group Sails). For other ASW exercises the Navy will submit a yearly summary report. These reports will, at a minimum, include the following information:

- The estimated number of hours of sonar operation, broken down by source type.
- If possible, the total number of hours of observation effort (including observation time when sonar was not operating).
- A report of all marine mammal sightings (at any distance—not just within a particular distance) to include, when possible and to the best of their ability, and if not classified:
- Species or animal type.
- Number of animals sighted.
- Location of marine mammal sighting.
- Distance of animal from any operating sonar sources.
- Whether animal is fore, aft, port, starboard.
- Direction animal is moving in relation to source (away, towards, parallel).
- Any observed behaviors of marine mammals.
- The status of any sonar sources (what sources were in use) and whether or not they were powered down or shut down as a result of the marine mammal observation.
- The platform that the marine mammals were sighted from.

Monitoring Report

Although the draft Monitoring Plan for AFAST contains a general description of the monitoring that the Navy plans to conduct (and that NMFS has analyzed) in the AFAST Study Area, the detailed analysis and reporting protocols that will be used for the AFAST monitoring plan are still being refined at this time. The draft AFAST Monitoring plan may be viewed at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.* Standard marine species sighting forms will be used by Navy lookouts and biologists to standardize data collection and data collection methods will be standardized across ranges to allow for comparison in different geographic locations. Reports of the required monitoring will be submitted to NMFS on an annual basis as well as in the form of a multi-year report that compiles all five years worth of monitoring data (reported at end of fourth year of rule—in future rules will include the last year of the prior rule).

AFAST Comprehensive Report

The Navy will submit to NMFS a draft report that analyzes and summarizes all of the multi-year marine mammal information gathered during ASW and IEER exercises for which individual reports are required in § 216.175(d)–(f). This report will be submitted at the end of the fourth year of the rule (December 2012), covering activities that have occurred through June 1, 2012. The Navy will respond to NMFS comments on the draft comprehensive report if submitted within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or three months after the submittal of the draft if NMFS does not comment by then.

Comprehensive National ASW Report

The Navy will submit a draft Comprehensive National ASW Report that analyzes, compares, and summarizes the data gathered from the watchstanders and pursuant to the implementation of the Monitoring Plans for AFAST, the Hawaii Range Complex, the Southern California (SOCAL) Range Complex, and the Marianas range Complex. The Navy will respond to NMFS comments on the draft comprehensive report if submitted within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or three months after the submittal of the draft if NMFS does not comment by then.

Estimated Take of Marine Mammals

As mentioned previously, for the purposes of MMPA authorizations, NMFS' effects assessments have two primary purposes (in the context of the AFAST LOA, where subsistence communities are not present): (1) To put forth the permissible methods of taking within the context of MMPA Level B Harassment (behavioral harassment), Level A Harassment (injury), and mortality (i.e., identify the number and types of take that will occur); and (2) to determine whether the specified activity will have a negligible impact on the affected species or stocks of marine mammals (based on the likelihood that the activity will adversely affect the species or stock through effects on annual rates of recruitment or survival).

In the Potential Effects of Exposure of Marine Mammal to MFAS/HFAS and Underwater Detonations section, NMFS' analysis identified the lethal responses, physical trauma, sensory impairment (permanent and temporary threshold shifts and acoustic masking), physiological responses (particular stress responses), and behavioral responses that could potentially result from exposure to MFAS/HFAS or underwater explosive detonations. In this section, we will relate the potential effects to marine mammals from MFAS/HFAS and underwater detonation of explosives to the MMPA regulatory definitions of Level A and Level B Harassment and attempt to quantify the effects that might occur from the specific training activities that the Navy is proposing in the AFAST Study Area.

Definition of Harassment

As mentioned previously, with respect to military readiness activities, Section 3(18)(B) of the MMPA defines ''harassment'' as: (i) Any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment].

Level B Harassment

Of the potential effects that were described in the Potential Effects of Exposure of Marine Mammal to MFAS/HFAS and Underwater Detonations Section, the following are the types of effects that fall into the Level B Harassment category:

Behavioral Harassment—Behavioral disturbance that rises to the level described in the definition above, when resulting from exposures to MFAS/HFAS or underwater detonations, is considered Level B Harassment. Some of the lower level physiological stress responses discussed in the Potential Effects of Exposure of Marine Mammal to MFAS/HFAS and Underwater Detonations Section: Stress Section will also likely co-occur with the predicted harassments, although these responses are more difficult to detect and fewer data exist relating these responses to specific received levels of sound. When Level B Harassment is predicted based on estimated behavioral responses, those takes may have a stress-related physiological component as well.

In the effects section above, we described the Southall *et al.* (2007) severity scaling system and listed some examples of the three broad categories of behaviors: (0–3: Minor and/or brief behaviors); 4–6 (Behaviors with higher potential to affect foraging, reproduction, or survival); 7–9 (Behaviors considered likely to affect the aforementioned vital rates). Generally speaking, MMPA Level B Harassment, as defined in this document, would include the behaviors described in the 7–9 category, and a subset, dependent on context and other considerations, of the behaviors described in the 4–6 categories. Behavioral harassment does not generally include behaviors ranked 0–3 in Southall *et al.* (2007).

Acoustic Masking and Communication Impairment—Acoustic masking is considered Level B Harassment as it can disrupt natural behavioral patterns by interrupting or limiting the marine mammal's receipt or transmittal of important information or environmental cues.

TTS—As discussed previously, TTS can effect how an animal behaves in response to the environment, including conspecifics, predators, and prey. The following physiological mechanisms are thought to play a role in inducing auditory fatigue: effects to sensory hair cells in the inner ear that reduce their sensitivity, modification of the chemical environment within the sensory cells, residual muscular activity in the middle ear, displacement of certain inner ear membranes, increased blood flow, and post-stimulatory reduction in both efferent and sensory neural output. Ward (1997) suggested that when these effects result in TTS rather than PTS, they are within the normal bounds of physiological variability and tolerance and do not represent a physical injury. Additionally, Southall *et al.* (2007) indicate that although PTS is a tissue injury, TTS is not, because the reduced hearing sensitivity following exposure to intense sound results primarily from fatigue, not loss, of cochlear hair cells and supporting structures and is reversible. Accordingly, NMFS classifies TTS (when resulting from exposure to either MFAS/HFAS or underwater detonations) as Level B Harassment, not Level A Harassment (injury).

Level A Harassment

Of the potential effects that were described in the Potential Effects of Exposure of Marine Mammals to MFAS/HFAS and Underwater Detonations Section, following are the types of effects that fall into the Level A Harassment category:

PTS—PTS (resulting either from exposure to MFAS/HFAS or explosive detonations) is irreversible and considered an injury. PTS results from exposure to intense sounds that cause a permanent loss of inner or outer cochlear hair cells or exceed the elastic limits of certain tissues and membranes in the middle and inner ears and result in changes in the chemical composition of the inner ear fluids.

Tissue Damage due to Acoustically Mediated Bubble Growth—A few theories suggest ways in which gas bubbles become enlarged through exposure to intense sounds (MFAS/HFAS) to the point where tissue damage results. In rectified diffusion, exposure to a sound field would cause bubbles to increase in size. A short duration of sonar pings (such as that which an animal exposed to MFAS would be most likely to encounter) would not likely be long enough to drive bubble growth to any substantial size. Alternately, bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. The degree of supersaturation and exposure levels observed to cause microbubble destabilization are unlikely to occur, either alone or in concert because of how close an animal would need to be to the sound source to be exposed to high enough levels, especially considering the likely avoidance of the sound source and the required mitigation. Still, possible tissue damage from either of these processes would be considered an injury.

Tissue Damage due to Behaviorally Mediated Bubble Growth—Several authors suggest mechanisms in which marine mammals could behaviorally respond to exposure to MFAS/HFAS by altering their dive patterns in a manner (unusually rapid ascent, unusually long series of surface dives, etc.) that might result in unusual bubble formation or growth ultimately resulting in tissue damage (emboli, etc.) In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. There is considerable disagreement among scientists as to the likelihood of this phenomenon (Piantadosi and Thalmann, 2004; Evans and Miller, 2003). Although it has been argued that traumas from recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson *et al.*, 2003; Fernandez *et al.*, 2005), nitrogen bubble formation as the cause of the traumas has not been verified. If tissue damage does occur by this phenomenon, it would be considered an injury.

Physical Disruption of Tissues Resulting from Explosive Shock Wave—Physical damage of tissues resulting from a shock wave (from an explosive detonation) is classified as an injury. Blast effects are greatest at the gas-liquid interface (Landsberg, 2000) and gas-containing organs, particularly the lungs and gastrointestinal tract, are especially susceptible (Goertner, 1982; Hill 1978; Yelverton *et al.*, 1973). Nasal sacs, larynx, pharynx, trachea, and lungs may be damaged by compression/expansion caused by the oscillations of the blast gas bubble (Reidenberg and Laitman, 2003). Severe damage (from the shock wave) to the ears can include tympanic membrane rupture, fracture of the ossicles, damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear.

Acoustic Take Criteria

For the purposes of an MMPA incidental take authorization, three types of take are identified: Level B Harassment; Level A Harassment; and mortality (or serious injury leading to mortality). The categories of marine mammal responses (physiological and behavioral) that fall into the two harassment categories were described in the previous section.

Because the physiological and behavioral responses of the majority of the marine mammals exposed to MFAS/HFAS and underwater detonations cannot be detected or measured (not all responses visible external to animal, portion of exposed animals underwater (so not visible), many animals located many miles from observers and covering very large area, etc.) and because NMFS must authorize take prior to the impacts to marine mammals, a method is needed to estimate the number of individuals that will be taken, pursuant to the MMPA, based on the proposed action. To this end, NMFS developed acoustic criteria that estimate at what received level (when exposed to MFAS/HFAS or explosive detonations) Level B Harassment, Level A Harassment, and mortality (for explosives) of marine mammals would occur. The acoustic criteria for MFAS/HFAS and Underwater Detonations (IEER) are discussed below.

MFAS/HFAS Acoustic Criteria

Because relatively few applicable data exist to support acoustic criteria specifically for HFAS and because such a small percentage of the sonar pings that marine mammals will likely be exposed to incidental to this activity come from a HFAS source (the vast majority come from MFAS sources), NMFS will apply the criteria developed for the MFAS to the HFAS as well.

NMFS utilizes three acoustic criteria for MFAS/HFAS: PTS (injury—Level A Harassment), TTS (Level B Harassment), and behavioral harassment (Level B Harassment). Because the TTS and PTS criteria are derived similarly and the PTS criteria was extrapolated from the TTS data, the TTS and PTS acoustic criteria will be presented first, before the behavioral criteria.

For more information regarding these criteria, please see the Navy's FEIS for AFAST.

Level B Harassment Threshold (TTS)

As mentioned above, behavioral disturbance, acoustic masking, and TTS are all considered Level B Harassment. Marine mammals would usually be behaviorally disturbed at lower received levels than those at which they would likely sustain TTS, so the levels at which behavioral disturbance are likely to occur is considered the onset of Level B Harassment. The behavioral responses of marine mammals to sound are variable, context specific, and, therefore, difficult to quantify (see Risk Function section, below). Alternately, TTS is a physiological effect that has been studied and quantified in laboratory conditions. Because data exist to support an estimate of at what received levels marine mammals will incur TTS, NMFS uses an acoustic criteria to estimate the number of marine mammals that might sustain TTS. TTS is a subset of Level B Harassment (along with sub-TTS behavioral harassment) and we are not specifically required to estimate those numbers; however, the more specifically we can estimate the affected marine mammal responses, the better the analysis.

A number of investigators have measured TTS in marine mammals. These studies measured hearing thresholds in trained marine mammals before and after exposure to intense sounds. The existing cetacean TTS data are summarized in the following bullets.

- Schlundt *et al.* (2000) reported the results of TTS experiments conducted with 5 bottlenose dolphins and 2 belugas exposed to 1-second tones. This paper also includes a reanalysis of preliminary TTS data released in a technical report by Ridgway *et al.* (1997). At frequencies of 3, 10, and 20 kHz, sound pressure levels (SPLs) necessary to induce measurable amounts (6 dB or more) of TTS were between 192 and 201 dB re 1 μPa (EL = 192 to 201 dB re 1 $\mu Pa^2 - s$). The mean exposure SPL and EL for onset-TTS were 195 dB re 1 μPa and 195 dB re 1 $\mu Pa^2 - s$, respectively.
- Finneran *et al.* (2001, 2003, 2005) described TTS experiments conducted with bottlenose dolphins exposed to 3-kHz tones with durations of 1, 2, 4, and 8 seconds. Small amounts of TTS (3 to 6 dB) were observed in one dolphin after exposure to ELs between 190 and 204 dB re 1 $\mu Pa^2 - s$. These results were consistent with the data of Schlundt *et al.* (2000) and showed that the Schlundt *et al.* (2000) data were not significantly affected by the masking sound used. These results also confirmed that, for tones with different durations, the amount of TTS is best correlated with the exposure EL rather than the exposure SPL.
- Nachtigall *et al.* (2003) measured TTS in a bottlenose dolphin exposed to octave-band sound centered at 7.5 kHz. Nachtigall *et al.* (2003a) reported TTSs of about 11 dB measured 10 to 15 minutes after exposure to 30 to 50 minutes of sound with SPL 179 dB re 1 μPa (EL about 213 dB re $\mu Pa^2 - s$). No TTS was observed after exposure to the same sound at 165 and 171 dB re 1 μPa. Nachtigall *et al.* (2004) reported TTSs of around 4 to 8 dB 5 minutes after exposure to 30 to 50 minutes of sound with SPL 160 dB re 1 μPa (EL about 193 to 195 dB re 1 $\mu Pa^2 - s$). The difference in results was attributed to faster post-exposure threshold measurement—TTS may have recovered before being detected by Nachtigall *et al.* (2003). These studies showed that, for long-duration exposures, lower sound pressures are required to induce TTS than are required for short-duration tones.
- Finneran *et al.* (2000, 2002) conducted TTS experiments with dolphins and belugas exposed to impulsive sounds similar to those produced by distant underwater explosions and seismic waterguns. These studies showed that, for very short-duration impulsive sounds, higher sound pressures were required to induce TTS than for longer-duration tones.
- Finneran *et al.* (2007) conducted TTS experiments with bottlenose dolphins exposed to intense 20 kHz fatiguing tone. Behavioral and auditory evoked potentials (using sinusoidal amplitude modulated tones creating auditory steady state response [AASR]) were used to measure TTS. The fatiguing tone was either 16 (mean = 193 re 1μPa, SD = 0.8) or 64 seconds (185–186 re 1μPa) in duration. TTS ranged from 19–33db from behavioral measurements and 40–45dB from ASSR measurements.
- Kastak *et al.* (1999a, 2005) conducted TTS experiments with three species of pinnipeds, California sea lion, northern elephant seal and a Pacific harbor seal, exposed to continuous underwater sounds at levels of 80 and 95 dB sensation level at 2.5 and 3.5 kHz for up to 50 minutes. Mean TTS shifts

of up to 12.2 dB occurred with the harbor seals showing the largest shift of 28.1 dB. Increasing the sound duration had a greater effect on TTS than increasing the sound level from 80 to 95 dB.

Some of the more important data obtained from these studies are onset-TTS levels (exposure levels sufficient to cause a just-measurable amount of TTS) often defined as 6 dB of TTS (for example, Schlundt *et al.*, 2000) and the fact that energy metrics (sound exposure levels (SEL), which include a duration component) better predict when an animal will sustain TTS than pressure (SPL) alone. NMFS' TTS criteria (which indicate the received level at which onset TTS (>6dB) is induced) for MFAS/HFAS are as follows:

• Cetaceans—195 dB re 1 $\mu Pa^2 - s$ (based on mid-frequency cetaceans—no published data exist on auditory effects of noise in low- or high-frequency cetaceans (Southall *et al.* (2007))

• Pinnipeds—183 dB re 1 $\mu Pa^2 - s$

A detailed description of how TTS criteria were derived from the results of the above studies may be found in Chapter 3 of Southall *et al.* (2007), as well as the Navy's AFAST LOA application.

Level A Harassment Threshold (PTS)

For acoustic effects, because the tissues of the ear appear to be the most susceptible to the physiological effects of sound, and because threshold shifts tend to occur at lower exposures than other more serious auditory effects, NMFS has determined that PTS is the best indicator for the smallest degree of injury that can be measured. Therefore, the acoustic exposure associated with onset-PTS is used to define the lower limit of the Level A harassment.

PTS data do not currently exist for marine mammals and are unlikely to be obtained due to ethical concerns. However, PTS levels for these animals may be estimated using TTS data from marine mammals and relationships between TTS and PTS that have been discovered through study of terrestrial mammals. NMFS uses the following acoustic criteria for injury:

• Cetaceans—215 dB re 1 $\mu Pa^2 - s$ (based on mid-frequency cetaceans—no published data exist on auditory effects of noise in low- or high-frequency cetaceans (Southall *et al.* (2007))

• Pinnipeds—203 dB re 1 $\mu Pa^2 - s$)

These criteria are based on a 20 dB increase in SEL over that required for onset-TTS. Extrapolations from terrestrial mammal data indicate that PTS occurs at 40 dB or more of TS, and that TS growth occurs at a rate of approximately 1.6 dB TS per dB increase in EL. There is a 34-dB TS difference between onset-TTS (6 dB) and onset-PTS (40 dB). Therefore, an animal would require approximately 20 dB of additional exposure (34 dB divided by 1.6 dB) above onset-TTS to reach PTS. A detailed description of how TTS criteria were derived from the results of the above studies may be found in Chapter 3 of Southall *et al.* (2007), as well as the Navy's AFAST LOA application. Southall *et al.* (2007) recommend a precautionary dual criteria for TTS (230 dB re 1 μPa (SPL peak pressure) in addition to 215 dB re 1 $\mu Pa^2 - s$ (SEL)) to account for the potentially damaging transients embedded within non-pulse exposures. However, in the case of MFAS/HFAS, the distance at which an animal would receive 215 dB (SEL) is farther from the source (i.e., more conservative) than the distance at which they would receive 230 dB (SPL peak pressure) and therefore, it is not necessary to consider 230 dB peak.

We note here that behaviorally mediated injuries (such as those that have been hypothesized as the cause of some beaked whale strandings) could potentially occur in response to received levels lower than those believed to directly result in tissue damage. As mentioned previously, data to support a quantitative estimate of these potential effects (for which the exact mechanism is not known and in which factors other than received level may play a significant role) do not exist. However, based on the number of years (more than 40) and number of hours of MFAS per year that the U.S. (and other countries) has operated compared to the reported (and verified) cases of associated marine mammal strandings, NMFS believes that the probability of these types of injuries is very low.

Level B Harassment Risk Function (Behavioral Harassment)

In 2006, NMFS issued the only MMPA authorization that has, as yet, authorized the take of marine mammals incidental to MFAS. For that authorization, NMFS used 173 dB SEL as the criterion for the onset of behavioral harassment (Level B Harassment). This type of single number criterion is referred to as a step function, in which (in this example) all animals estimated to be exposed to received levels above 173 db SEL would be predicted to be taken by Level B Harassment and all animals exposed to less than 173 dB SEL would not be taken by Level B Harassment. As mentioned previously, marine mammal behavioral responses to sound are highly variable and context specific (affected by differences in acoustic conditions; differences between species and populations; differences in gender, age, reproductive status, or social behavior; or the prior experience of the individuals), which does not support the use of a step function to estimate behavioral harassment.

Unlike step functions, acoustic risk continuum functions (which are also called ''exposure-response functions,'' ''dose-response functions,'' or ''stress-response functions'' in other risk assessment contexts) allow for probability of a response that NMFS would classify as harassment to occur over a range of possible received levels (instead of one number) and assume that the probability of a response depends first on the ''dose'' (in this case, the received level of sound) and that the probability of a response increases as the ''dose'' increases (see Figure 3a). The Navy and NMFS have previously used acoustic risk functions to estimate the probable responses of marine mammals to acoustic exposures for other training and research programs. Examples of previous application include the Navy FEISs on the SURTASS LFA sonar (U.S. Department of the Navy, 2001c); the North Pacific Acoustic Laboratory experiments conducted off the Island of Kauai (Office of Naval Research, 2001), the Supplemental EIS for SURTASS LFA sonar (U.S. Department of the Navy, 2007d) and the FEIS for the Navy's Hawaii Range Complex (U.S. Department of the Navy, 2008). As discussed in the Effects section, factors other than received level (such as distance from or bearing to the sound source) can affect the way that marine mammals respond; however, data to support a quantitative analysis of those (and other factors) do not currently exist. NMFS will continue to modify these criteria as new data become available.

The particular acoustic risk functions developed by NMFS and the Navy (see Figures 3a and b) estimate the probability of behavioral responses to MFAS/HFAS (interpreted as the percentage of the exposed population) that NMFS would classify as harassment for the purposes of the MMPA given exposure to specific received levels of MFAS/HFAS. The mathematical function (below) underlying this curve is a cumulative probability distribution adapted from a solution in Feller (1968) and was also used in predicting risk for the Navy's SURTASS LFA MMPA authorization as well.

$$R = \frac{1 - \left(\frac{L - B}{K}\right)^{-A}}{1 - \left(\frac{L - B}{K}\right)^{-2A}}$$

Where:
R = Risk (0–1.0)
L = Received level (dB re: 1 μPa)
B = Basement received level = 120 dB re: 1 μPa
K = Received level increment above B where 50 percent risk = 45 dB re: 1 μPa
A = Risk transition sharpness parameter = 10 (odontocetes and pinnipeds) or 8 (mysticetes)

In order to use this function to estimate the percentage of an exposed population that would respond in a manner that NMFS classifies as Level B Harassment, based on a given received level, the values for B, K and A need to be identified.

B Parameter (Basement)—The B parameter is the estimated received level below which the probability of disruption of natural behavioral patterns, such as migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered approaches zero for the MFAS/HFAS risk assessment. At this received level, the curve would predict that the percentage of the exposed population that would be taken by Level B Harassment approaches zero. For MFAS/HFAS, NMFS has determined that B = 120 dB. This level is based on a broad overview of the levels at which many species have been reported responding to a variety of sound sources.

K Parameter (representing the 50 percent Risk Point)—The K parameter is based on the received level that corresponds to 50 percent risk, or the received level at which we believe 50 percent of the animals exposed to the designated received level will respond in a manner that NMFS classifies as Level B Harassment. The K parameter (K = 45 dB) is based on three datasets in which marine mammals exposed to mid-frequency sound sources were reported to respond in a manner that NMFS would classify as Level B Harassment. There is widespread consensus that marine mammal responses to MFA sound signals need to be better defined using controlled exposure experiments (Cox *et al.*, 2006; Southall *et al.*, 2007). The Navy is contributing to an ongoing behavioral response study in the Bahamas that is expected to provide some initial information on beaked whales, the species identified as the most sensitive to MFAS. NMFS is leading this international effort with scientists from various academic institutions and research organizations to conduct studies on how marine mammals respond to underwater sound exposures. Additionally, the Navy plans to tag whales in conjunction with the 2008 RIMPAC exercises. Until additional data are available, however, NMFS and the Navy have determined that the following three data sets are most applicable for the direct use in establishing the K parameter for the MFAS/HFAS risk function. These data sets, summarized below, represent the only known data that specifically relate altered behavioral responses (that NMFS would consider Level B Harassment) to exposure—at specific received levels—to MFA sonar and sources within or having components within the range of MFAS (1–10 kHz).

Even though these data are considered the most representative of the proposed specified activities, and therefore the most appropriate on which to base the K parameter (which basically determines the midpoint) of the risk function, these data have limitations, which are discussed in Appendix J of the Navy's FEIS for AFAST.

1. Controlled Laboratory Experiments with Odontocetes (SSC Dataset)—Most of the observations of the behavioral responses of toothed whales resulted from a series of controlled experiments on bottlenose dolphins and beluga whales conducted by researchers at SSC's facility in San Diego, California (Finneran *et al.*, 2001, 2003, 2005; Finneran and Schlundt, 2004; Schlundt *et al.*, 2000). In experimental trials (designed to measure TTS) with marine mammals trained to perform tasks when prompted, scientists evaluated whether the marine mammals still performed these tasks when exposed to mid-frequency tones. Altered behavior during experimental trials usually involved refusal of animals to return to the site of the sound stimulus, but also included attempts to avoid an exposure in progress, aggressive behavior, or refusal to further participate in tests.

Finneran and Schlundt (2004) examined behavioral observations recorded by the trainers or test coordinators during the Schlundt *et al.* (2000) and Finneran *et al.* (2001, 2003, 2005) experiments. These included observations from 193 exposure sessions (fatiguing stimulus level > 141 dB re 1 μPa) conducted by Schlundt *et al.* (2000) and 21 exposure sessions conducted by Finneran *et al.* (2001, 2003, 2005). The TTS experiments that supported Finneran and Schlundt (2004) are further explained below:

- Schlundt *et al.* (2000) provided a detailed summary of the behavioral responses of trained marine mammals during TTS tests conducted at SSC San Diego with 1-sec tones and exposure frequencies of 0.4 kHz, 3 kHz, 10 kHz, 20 kHz and 75 kHz. Schlundt *et al.* (2000) reported eight individual TTS experiments. The experiments were conducted in San Diego Bay. Because of the variable ambient noise in the bay, low-level broadband masking noise was used to keep hearing thresholds consistent despite fluctuations in the ambient noise. Schlundt *et al.* (2000) reported that ''behavioral alterations,'' or deviations from the behaviors the animals being tested had been trained to exhibit, occurred as the animals were exposed to increasing fatiguing stimulus levels.
- Finneran *et al.* (2001, 2003, 2005) conducted 2 separate TTS experiments using 1-sec tones at 3 kHz. The test methods were similar to that of Schlundt *et al.* (2000) except the tests were conducted in a pool with very low ambient noise level (below 50 dB re 1 μPa^2/hertz [Hz]), and no masking noise was used. In the first, fatiguing sound levels were increased from 160 to 201 dB SPL. In the second experiment, fatiguing sound levels between 180 and 200 dB SPL were randomly presented.

Bottlenose dolphins exposed to 1-second (sec) intense tones exhibited short-term changes in behavior above received sound levels of 178 to 193 dB re 1 μPa (rms), and beluga whales did so at received levels of 180 to 196 dB and above.

2. Mysticete Field Study (Nowacek *et al.*, 2004)—The only available and applicable data relating mysticete responses to exposure to mid-frequency sound sources is from Nowacek *et al.* (2004). Nowacek *et al.* (2004) documented observations of the behavioral response of North Atlantic right whales exposed to alert stimuli containing mid-frequency components in the Bay of Fundy. Investigators used archival digital acoustic recording tags (DTAG) to record the behavior (by measuring pitch, roll, heading, and depth) of right whales in the presence of an alert signal, and to calibrate received sound levels. The alert signal was 18 minutes of exposure consisting of three 2-minute signals played sequentially three times over. The three signals had a 60 percent duty cycle and consisted of: (1) Alternating 1-sec pure tones at 500 Hz and 850 Hz; (2) a 2-sec logarithmic down-sweep from 4,500 Hz to 500 Hz; and (3) a pair of low (1,500 Hz)-high (2,000 Hz) sine wave tones amplitude modulated at 120 Hz and each 1-sec long. The purposes of the

alert signal were (a) to pique the mammalian auditory system with disharmonic signals that cover the whales' estimated hearing range; (b) to maximize the signal to noise ratio (obtain the largest difference between background noise) and (c) to provide localization cues for the whale. The maximum source level used was 173 dB SPL.

Nowacek *et al.* (2004) reported that five out of six whales exposed to the alert signal with maximum received levels ranging from 133 to 148 dB re 1 μPa significantly altered their regular behavior and did so in identical fashion. Each of these five whales: (i) Abandoned their current foraging dive prematurely as evidenced by curtailing their ''bottom time''; (ii) executed a shallow-angled, high power (i.e., significantly increased fluke stroke rate) ascent; (iii) remained at or near the surface for the duration of the exposure, an abnormally long surface interval; and (iv) spent significantly more time at subsurface depths (1–10 m) compared with normal surfacing periods when whales normally stay within 1 m (1.1 yd) of the surface.

3. Odontocete Field Data (Haro Strait—USS SHOUP)—In May 2003, killer whales (Orcinus orca) were observed exhibiting behavioral responses generally described as avoidance behavior while the U.S. Ship (USS) SHOUP was engaged in MFAS in the Haro Strait in the vicinity of Puget Sound, Washington. Those observations have been documented in three reports developed by Navy and NMFS (NMFS, 2005; Fromm, 2004a, 2004b; DON, 2003). Although these observations were made in an uncontrolled environment, the sound field that may have been associated with the sonar operations was estimated using standard acoustic propagation models that were verified (for some but not all signals) based on calibrated in situ measurements from an independent researcher who recorded the sounds during the event. Behavioral observations were reported for the group of whales during the event by an experienced marine mammal biologist who happened to be on the water studying them at the time. The observations associated with the USS SHOUP provide the only data set available of the behavioral responses of wild, non-captive animal upon actual exposure to AN/SQS–53 sonar.

U.S. Department of Commerce (National Marine Fisheries, 2005a); U.S. Department of the Navy (2004b); Fromm (2004a, 2004b) documented reconstruction of sound fields produced by USS SHOUP associated with the behavioral response of killer whales observed in Haro Strait. Observations from this reconstruction included an approximate closest approach time which was correlated to a reconstructed estimate of received level. Observations from this reconstruction included an estimate of 169.3 dB SPL which represents the mean level at a point of closest approach within a 500 m wide area which the animals were exposed. Within that area, the estimated received levels varied from approximately 150 to 180 dB SPL.

Calculation of K Parameter—NMFS and the Navy used the mean of the following values to define the midpoint of the function: (1) The mean of the lowest received levels (185.3 dB) at which individuals responded with altered behavior to 3 kHz tones in the SSC data set; (2) the estimated mean received level value of 169.3 dB produced by the reconstruction of the USS SHOUP incident in which killer whales exposed to MFA sonar (range modeled possible received levels: 150 to 180 dB); and (3) the mean of the 5 maximum received levels at which Nowacek *et al.* (2004) observed significantly altered responses of right whales to the alert stimuli than to the control (no input signal) is 139.2 dB SPL. The arithmetic mean of these three mean values is 165 dB SPL. The value of K is the difference between the value of B (120 dB SPL) and the 50 percent value of 165 dB SPL; therefore, K = 45.

A Parameter (Steepness)—NMFS determined that a steepness parameter (A) = 10 is appropriate for odontocetes and pinnipeds and A = 8 is appropriate for mysticetes.

The use of a steepness parameter of A = 10 for odontocetes for the MFAS/HFAS risk function was based on the use of the same value for the SURTASS LFA risk continuum, which was supported by a sensitivity analysis of the parameter presented in Appendix D of the SURTASS/LFA FEIS (U.S. Department of the Navy, 2001c). As concluded in the SURTASS FEIS/EIS, the value of A = 10 produces a curve that has a more gradual transition than the curves developed by the analyses of migratory gray whale studies (Malme *et al.*, 1984; Buck and Tyack, 2000; and SURTASS LFA Sonar EIS, Subchapters 1.43, 4.2.4.3 and Appendix D, and National Marine Fisheries Service, 2008).

NMFS determined that a lower steepness parameter (A = 8), resulting in a shallower curve, was appropriate for use with mysticetes and MFAS/HFAS. The Nowacek *et al.* (2004) dataset contains the only data illustrating mysticete behavioral responses to a sound source that encompasses frequencies in the mid-frequency sound spectrum. A shallower curve (achieved by using A = 8) better reflects the risk of behavioral response at the relatively low received levels at which behavioral responses of right whales were reported in the Nowacek *et al.* (2004) data. Compared to the odontocete curve, this adjustment results in an increase in the proportion of the exposed population of mysticetes being classified as behaviorally harassed at lower RLs, such as those reported in and is supported by the only dataset currently available.

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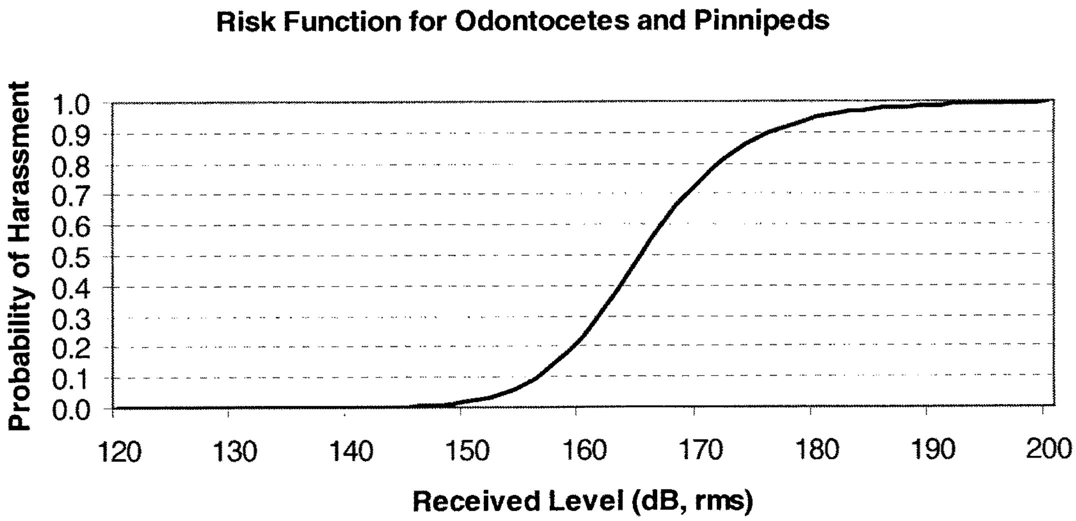

Figure 3a. Risk function for odontocetes and pinnipeds. B=120 dB, K=45 dB, A=10

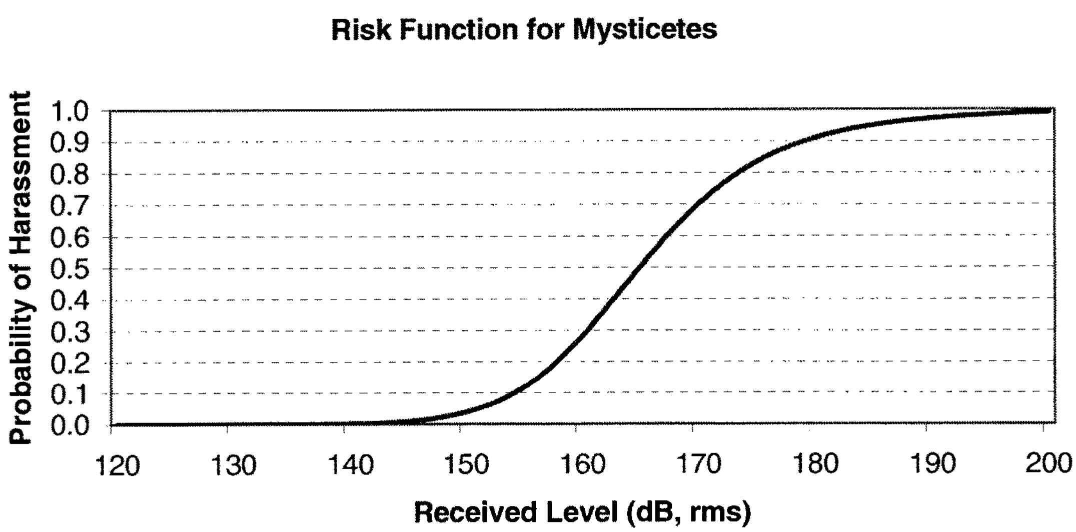

Figure 3b. Risk function for mysticetes. B=120 dB, K=45 dB, A=8.

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Basic Application of the Risk Function—The risk function is used to estimate the percentage of an exposed population that is likely to exhibit behaviors that would qualify as harassment (as that term is defined by the MMPA applicable to military readiness activities, such as the Navy's testing and training with MFA sonar) at a given received level of sound. For example, at 165 dB SPL (dB re: 1μPa rms), the risk (or probability) of harassment is defined according to this function as 50 percent, and Navy/NMFS applies that by estimating that 50 percent of the individuals exposed at that received level are likely to respond by exhibiting behavior that NMFS would classify as behavioral harassment. The risk function is not applied to individual animals, only to exposed populations.

The data primarily used to produce the risk function (the K parameter) were compiled from four species that had been exposed to sound sources in a variety of different circumstances. As a result, the risk function represents a general relationship between acoustic exposures and behavioral responses that is then applied to specific circumstances. That is, the risk function represents a relationship that is deemed to be generally true, based on the limited, best-available science, but may not be true in specific circumstances. In particular, the risk function, as currently derived, treats the received level as the only variable that is relevant to a marine mammal's behavioral response. However, we know that many other variables—the marine mammal's gender, age, and prior experience; the activity it is engaged in during an exposure event, its distance from a sound source, the number of sound sources, and whether the sound sources are approaching or moving away from the animal—can be critically important in determining whether and how a marine mammal will respond to a sound source (Southall *et al.*, 2007). The data that are currently available do not allow for incorporation of these other variables in the current risk functions; however, the risk function represents the best use of the data that are available.

As more specific and applicable data become available for MFAS/HFAS sources, NMFS can use these data to modify the outputs generated by the risk function to make them more realistic. Ultimately, data may exist to justify the use of additional, alternate, or multi-variate functions. For example, as mentioned previously, the distance from the sound source and whether it is perceived as approaching or moving away can affect the way an animal responds to a sound (Wartzok *et al.*, 2003). In the AFAST example, animals exposed to received levels between 120 and 130 dB may be more than 65 nautical miles (131,651 yards (120381 m)) from a sound source; those distances could influence whether those animals perceive the sound source as a potential threat, and their behavioral responses to that threat. Though there are data showing marine mammal responses to sound sources at that received level, NMFS does not currently have any data that describe the response of marine mammals to sounds at that distance, much less data that compare responses to similar sound levels at varying distances (much less for MFAS/HFAS). However, if data were to become available, NMFS would re-evaluate the risk function and incorporate any additional variables into the ''take'' estimates.

Harbor Porpoise Behavioral Harassment Criteria

The information currently available regarding these inshore species that inhabit shallow and coastal waters suggests a very low threshold level of response for both captive and wild animals. Threshold levels at which both captive (*e.g.* Kastelein *et al.*, 2000; Kastelein *et al.*, 2005; Kastelein *et al.*, 2006, Kastelein *et al.*, 2008) and wild harbor porpoises (*e.g.* Johnston, 2002) responded to sound (*e.g.* acoustic harassment devices (ADHs), acoustic deterrent devices (ADDs), or other non-pulsed sound sources) is very low (*e.g.* ~120 dB SPL), although the biological significance of the disturbance is uncertain. Therefore, a step function threshold of 120 dB SPL was used to estimate take of harbor porpoises instead of the risk functions used for other species (i.e., we assume for the purpose of estimating take that all harbor porpoises exposed to 120 dB or higher MFAS/HFAS will be taken by Level B behavioral harassment).

Explosive Detonation Criteria (for IEER)

The criteria for mortality, Level A Harassment, and Level B Harassment resulting from explosive detonations were initially developed for the Navy's Sea Wolf and Churchill ship-shock trials and have not changed since other MMPA authorizations issued for explosive detonations. The criteria, which are applied to cetaceans and pinnipeds, are summarized in Table 10. Additional information regarding the derivation of these criteria is available in the Navy's FEIS for the AFAST and in the Navy's CHURCHILL FEIS (U.S. Department of the Navy, 2001c).

Criterion	Criterion Definition	Threshold
Mortality	onset of severe lung injury (1% probability of mortality)	31 psi-ms (positive impulse)
Level A Harassment (Injury)	Slight lung injury; or	13 psi-ms (positive impulse)
	50% of animals exposed would experience ear drum rupture; and 30% exposed sustain PTS	205 dB re 1 microPa^2-s (full spectrum energy)
Level B Harassment	TTS (dual criteria); or	23 psi (peak pressure) (explosives < 2,000 lbs.); or
		182 dB re 1 microPa^2-s (peak 1/3 octve band)

Table 10. Summary of Criteria for Explosive Detonations applicable to IEER

Although NMFS does consider behavioral harassment that could potentially result from successive explosive detonations, such as those that would occur in gunnery exercises, because of the spatio-temporal separation (10–12 charges are detonated over the course of 2–8 hours in an area of up to 60 by 60 nm) of the charges detonated in an IEER exercises, behavioral harassment is considered unlikely. Also, the pressure wave (23 psi) explosive TTS threshold radius is very close to the size of the acoustic energy threshold for sub-TTS harassment—so many of the takes that might have been counted as behavioral harassments would already have been captured as TTS takes anyway. Additionally, a 1,000-yd exclusion zone is utilized for the IEER exercises and the distance from the source at which animals would be exposed to the behavioral harassment threshold is less than 1,000 yds (approximately 500 yd).

Estimates of Potential Marine Mammal Exposures and Takes

Information regarding the models used, the assumptions used in the models, and the process of estimating take is available in the Navy's EIS/OEIS for AFAST. Estimating the take that will result from the proposed activities entails the following general steps:

(1) In order to quantify the types of take described in previous sections that are predicted to result from the Navy's specified activities, the Navy first uses a sound propagation model that predicts the volume of water that will be ensonified to a range of levels of pressure and energy (of the metrics used in the criteria) from MFAS/HFAS and explosive detonations based on several important pieces of information, including:

- Characteristics of the sound sources
  - Sonar source characteristics include: Source level (with horizontal and vertical directivity corrections), source depth, center frequency, source directivity (horizontal/vertical beam width and horizontal/vertical steer direction), and ping spacing
  - Explosive source characteristics include: The weight of an explosive, the type of explosive, and the detonation depth
- Transmission loss (in 36 representative environmental provinces) based on: Seasonal sound speed profiles; seabed geoacoustics; wind speed; and acoustics

(2) The accumulated energy and maximum received sound pressure level within the waters in which the sonar is operating is sampled over a two dimensional grid. The zone of influence (ZOI) for a given threshold is estimated by summing the areas represented by each grid point for which the threshold is exceeded. For behavioral response, the percentage of animals likely to respond corresponding to the maximum received level is found, and the area of the grid point is multiplied by that percentage to find the adjusted area. Those adjusted areas are summed across all grid points to find the overall ZOI for a particular source.

(3) The densities of each marine mammal species, which are specific to certain geographic areas and seasons if data are available, are applied to the summed zones of influence for a particular training event to determine how many times individuals of each species are exposed to levels that exceed the applicable criteria for injury or harassment.

(4) Next, the criteria discussed in the previous section are applied to the estimated exposures to predict the number of exposures that exceed the criteria, i.e., the number of takes by Level B Harassment, Level A Harassment, and mortality.

(5) Last, NMFS and the Navy consider the mitigation measures and model-calculated estimates may be adjusted based a post-model assessment. For example, in some cases the raw modeled numbers of exposures to levels predicted to result in Level A Harassment from exposure to sonar might indicate that 1 fin whale would be exposed to levels of sonar anticipated to result in PTS—however, a fin whale would need to be within approximately 10 m of the source vessel in order to be exposed to these levels. Because of the mitigation measures (watchstanders and shutdown zone), size of fin whales, and nature of fin whale behavior, it is highly unlikely that a fin whale would be exposed to those levels, and therefore the Navy would not request authorization for Level A Harassment of 1 fin whale. Table 11 contains the Navy's estimated take estimates. The ''takes'' reported in the take table and proposed to be authorized are based on estimates of marine mammal exposures to levels above those indicated in the criteria. Every separate take does not necessarily represent a different individual because some individual marine mammals may be exposed more than once, either within one day and one exercise, or on different days from different exercise types.

(6) Last, the Navy's specified activities have been described based on best estimates of the number of MFAS/HFAS

hours that the Navy will conduct. The exact number of hours may vary from year to year, but will not exceed the 5-year total indicated in Table 1 (by multiplying the yearly estimate by 5) by more than 10-percent. NMFS estimates that a 10-percent increase in sonar hours would result in approximately a 10-percent increase in the number of takes, and we have considered this possibility and the effect of this additional sonar use in our analysis.

NMFS notes here that the Navy revised its request for incidental harassment (since the application was initially submitted and posted on NMFS' Web site) based on corrections to the acoustic analysis that resulted in changes in the exposure estimates. During intensive quality assurance of the acoustic analysis calculations, the following errors were corrected:

- Acoustic footprints for several of the sound sources were not summing correctly, leading to an underestimate of exposures.
- Nearshore densities of several species of marine mammals in the northeast were improperly used to estimate offshore densities resulting in an overestimate of exposures.
- Modeling of maintenance of the AN/BQQ–5/10 (submarine sonar) improperly summed footprints that were modeled for operations, leading to a significant overestimate of the number of marine mammal exposures. During operations submarines are predicted to ping infrequently, therefore each ping is added independently with no overlap between ping footprints. During maintenance the BQQ–5/10 is predicted to ping frequently, which leads to significant overlap of the ping footprints.

The analysis contained in this proposed rule incorporates the revised take estimates and, thereby, the above-mentioned corrections.

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Species	NAVY MODELED EXPOSURE ESTIMATES: Atlantic Ocean, Offshore of the Southeastern United States: VACAPES OPAREA PTS	VACAPES OPAREA TTS	VACAPES OPAREA Dose-Function	Cherry Pt OPAREA PTS	Cherry Pt OPAREA TTS	Cherry Pt OPAREA Dose-Function	Jax/CHASN OPAR PTS	Jax/CHASN OPAR TTS	Jax/CHASN OPAR Dose-Function	Northeast: Northeast OPAREA PTS	Northeast OPAREA TTS	Northeast OPAREA Dose-Function	Gulf of Mexico: GOMEX PTS	GOMEX TTS	GOMEX Dose-Function	TOTAL PTS	TOTAL TTS	TOTAL Dose-Function	NMFS' Proposed Annual Take Authorization: Mortality	Level A Harassment	Level B Harassment
North Atlantic right whale*	0	1	45	0	0	30	0	3	363	0	0	224	X	X	X	0	4	662	0	0	666 (0)
Humpback whale*	0	4	402	0	6	685	0	19	2370	0	0	701	0†	1†	10†	0	30	4168	0	0	4198 (0)
Minke whale	0	0	21	0	0	36	0	1	129	0	0	227	X	X	X	0	1	413	0	0	414 (1)
Bryde's whale	X	X	X	X	X	X	0†	1†	10†	X	X	X	0	0	23	0	1	33	0	0	34 (0)
Sei whale*	0†	1†	10†	0†	1†	10†	X	X	X	0	0	1032	X	X	X	0	2	1052	0	0	1054 (0)
Fin whale*	0	1	68	0†	1†	10†	X	X	X	0	0	801	X	X	X	0	2	879	0	0	881 (0)
Blue whale*	X	X	X	X	X	X	X	X	X	0	0	801	X	X	X	0	0	801	0	0	801 (0)
Sperm whale*	0	36	3084	0	4	317	0	17	1517	0	1	4403	0	5	357	0	63	9678	0	0	9741 (0-32)
Kogia spp.	0	5	408	0	8	703	0	26	2476	0	0	423	0	5	330	0	44	4340	0	0	4384 (22 to 44)
Beaked whale	0	8	486	0	5	323	0	19	1318	0	0	351	0	2	153	0	34	2631	10 over 5 yrs		2665 (17 to 34)
Rough-toothed dolphin	0	2	194	0	4	334	0	13	1177	X	X	X	0	10	971	0	29	2676	0	0	2705 (0-15)
Bottlenose dolphin	3	405	32627	7	738	66299	35	4722	461520	0	2	16102	2	210	22905	47	6077	599453	0	0	605530 (0-3039)
Pantropical spotted dolp.	1	108	8992	2	183	15484	5	580	54546	0	1	9243	5	683	48574	13	1555	136839	0	0	138394 (0-778)
Atlantic spotted dolphin	10	1287	97820	3	551	41880	11	2176	202703	0	4	15135	3	124	14390	27	4142	371928	0	0	376070 (0-2071)
Spinner dolphin	0†	1†	10†	0†	10†	100†	0†	10†	100†	0†	1†	10†	2	289	20616	2	311	20836	0	0	21147 (0-156)
Clymene dolphin	0	51	4296	1	87	7397	2	277	26060	0	0	0	1	106	7549	4	521	45302	0	0	45823 (0-261)
Striped dolphin	8	839	75343	0	1	61	X	X	X	2	10	94140	0	58	4131	10	908	173675	0	0	174583 (0-454)
Common dolphin	4	850	47477	0	1	111	X	X	X	1	10	47960	X	X	X	5	861	95548	0	0	96409 (0-431)
Fraser's dolphin	X	X	X	X	X	X	X	X	X	X	X	X	0	4	316	0	4	316	0	0	320 (0-2)
Risso's dolphin	1	92	7270	1	100	8635	5	585	57157	0	2	18716	0	20	1424	7	799	93202	0	0	94001 (0-400)
Atlantic white-sided dolp.	0†	1†	10†	X	X	X	X	X	X	0	1	20635	X	X	X	0	2	20645	0	0	20647 (0-1)
White-beaked dolphin	X	X	X	X	X	X	X	X	X	0	2	26421	X	X	X	0	2	26421	0	0	26243 (1)
Melon-headed whale	X	X	X	X	X	X	0†	1†	10†	X	X	X	0	21	1501	0	22	1511	0	0	1533 (0)
Pygmy killer whale	0†	1†	10†	0†	1†	10†	0†	1†	10†	0†	1†	10†	0	3	216	0	7	256	0	0	263 (0)
False killer whale	0†	1†	10†	0†	1†	10†	0†	1†	10†	0†	1†	10†	0	6	452	0	10	492	0	0	502 (0)
Killer whale	0†	10†	100†	0†	10†	100†	0†	10†	100†	0†	10†	100†	0	1	58	0	41	458	0	0	499 (0)
Pilot whales	1	159	13208	1	134	12241	7	796	77065	0	12	22597	0	15	1039	9	1116	126150	0	0	127266 (0)
Harbor porpoise	0†	10†	1000†	0†	1†	100†	X	X	X	0	0	152370	X	X	X	0	11	153470	0	0	153481 (0)
Gray Seal	X	X	X	X	X	X	X	X	X	0	31	7828	X	X	X	0	31	7828	0	0	7859 (16-31)
Harbor Seal	X	X	X	X	X	X	X	X	X	0	29	12630	X	X	X	0	29	12630	0	0	12659 (15-29)
Hooded Seal	X	X	X	X	X	X	X	X	X	0	62	15656	X	X	X	0	62	15656	0	0	15718 (31-62)
Harp Seal	X	X	X	X	X	X	X	X	X	0	43	10959	X	X	X	0	43	10959	0	0	11002 (22-43)

Table 11. Navy's estimated exposures to indicated criteria and NMFS proposed take authorization. Though exposures are predicted by the model, NMFS does not anticipate any injury/PTS to occur because of the mitigation measures (as related to certain characteristics of animals, such as size, gregariousness, or group size) and likely avoidance behavior of marine mammals. As discussed in the Estimated Take of Marine Mammals Section, NMFS also anticipates fewer takes by TTS will actually occur than were modeled.

Anticipated TTS occurences are indicated in parentheses in the last column (and are already counted within the broad Level B harassment number that NMFS proposes to authorize)

X - Species is not present or extremely rare in this region, therefore Navy is not requesting takes of this species in this region.

† - Species may be present in small numbers but insufficient data exists to generate density and therefore exposures could not be modeled. In this case the Navy estimated a number of takes to request based on qualitative assessment.

‡ - In the Atlantic pilot whales are often grouped in sighting records due to difficulty of distinguishing between the species. Therefore, in the Atlantic long-finned and short-finned pilot whale takes are combined. There are no confirmed sightings of long-finned pilot whales in the Gulf of Mexico, therefore take numbers are only for short finned pilot whales.

Blue whale: Used fin whale densities to predict exposures in the Northeast.

White-beaked dolphin: Used fall bottlenose estimates in the Northeast as a year-round white-beaked dolphin estimate.

Hooded seal: Used 0.2x gray seal estimate based on ratio of hooded seal vs. gray seal stranding records throughout their range.

Harp seal: Used 1.4x gray seal estimate based on ratio of harp seal vs. gray seal stranding records throughout their range.

Mortality

Evidence from five beaked whale strandings, all of which have taken place outside the AFAST Study Area, and have occurred over approximately a decade, suggests that the exposure of beaked whales to MFAS in the presence of certain conditions (e.g., multiple units using tactical sonar, steep bathymetry, constricted channels, strong surface ducts, etc.) may result in strandings, potentially leading to mortality. Although these physical factors believed to contribute to the likelihood of beaked whale strandings are not present, in their aggregate, in the AFAST Study Area, scientific uncertainty exists regarding what other factors, or combination of factors, may contribute to beaked whale strandings. Accordingly, to allow for scientific uncertainty regarding contributing causes of beaked whale strandings and the exact behavioral or physiological mechanisms that can lead to the ultimate physical effects (stranding and/or death), the Navy has requested authorization for take, by serious injury or mortality, of 10 beaked whales over the course of the 5-yr regulations. Neither NMFS nor the Navy anticipates that marine mammal strandings or mortality will result from the operation of mid-frequency sonar during Navy exercises within the AFAST Study Area.

Effects on Marine Mammal Habitat

Unless the source is stationary and/or continuous over a long duration in one area, the effects of the introduction of sound into the environment are generally considered to have a less severe impact on marine mammal habitat than the physical alteration of the habitat. AFAST activities primarily include the operation of active sonar sources at various locations and times along the Atlantic and Gulf of Mexico Coasts throughout the year, although IEER exercises (169 2–8 hour exercises per year) may also include the detonation of several explosive sonobuoys, which utilize a 4.1-lb charge. In addition to the physical alteration of habitat, NMFS considers the effects of the action on prey species when analyzing the effects of the action on marine mammal habitat. Based on the information below and the supporting information included in the Navy's DEIS, NMFS has preliminarily determined that the AFAST activities will not have significant or long term impacts on marine mammal habitat. However, the determination of whether an activity will adversely modify designated critical habitat is reached through a separate process, which would be completed before an MMPA authorization would be issued.

Right Whale Critical Habitat

Please see the Negligible Impact Determination Section for a discussion of the nature and extent of effects proposed to occur in designated right whale critical habitat. The NMFS Endangered Species Division will make a determination pursuant to the ESA regarding whether the Navy's actions are likely to result in the destruction or adverse modification of right whale critical habitat prior to the issuance (if appropriate) of an LOA.

Effects on Fish

Mid-Frequency and High-Frequency Active Sonar

The Navy's DEIS (Section 4.7) includes a detailed discussion of the effects of sonar on marine fish. In summary, studies have indicated that acoustic communication and orientation of fish may be restricted by anthropogenic sound in their environment. However, most marine fish species are not expected to be able to detect sounds in the mid-frequency range of the operational sonars used in the Proposed Action, and therefore, the sound sources are not likely to mask key environmental sounds. The few fish species that have been shown to be able to detect mid-frequencies do not have their best sensitivities in the range of the operational sonars. Additionally, vocal marine fish largely communicate below the range of mid-frequency levels used in the Proposed Action.

Though mortality has been shown to occur in one species, a hearing specialist, as a result of exposure to non-impulsive sources, the available evidence does not suggest that exposures such as those anticipated from MFAS/HFAS would result in significant fish mortality on a population level. The mortality that was observed was considered insignificant in light of natural daily mortality rates. Experiments have shown that exposure to loud sound can result in significant threshold shifts in certain fish that are classified as hearing specialists (but not those classified as hearing generalists). Threshold shifts are temporary, and considering the best available data, no data exist that demonstrate any long-term negative effects on marine fish from underwater sound associated with sonar activities. Further, while fish may respond behaviorally to mid-frequency sources, this behavioral modification is only expected to be brief and not biologically significant. Based on the evaluation presented in the Navy's DEIS and summarized here, the likelihood of significant effects to individual fish from active sonar is low.

Explosive Detonations (IEER)

There are currently no well-established thresholds for estimating effects to fish from explosives other than mortality models. Fish that are located in the water column, in proximity to the source of detonation could be injured, killed, or disturbed by the impulsive sound and possibly temporarily leave the area. Continental Shelf Inc. (2004) summarized a few studies conducted to determine effects associated with removal of offshore structures (e.g., oil rigs) in the Gulf of Mexico. Their findings revealed that at very close range, underwater explosions are lethal to most fish species regardless of size, shape, or internal anatomy. For most situations, cause of death in fishes has been massive organ and tissue damage and internal bleeding. At longer range, species with gas-filled swimbladders (e.g., snapper, cod, and striped bass) are more susceptible than those without swimbladders (e.g., flounders, eels). Studies also suggest that larger fishes are generally less susceptible to death or injury than small fishes. Moreover, elongated forms that are round in cross section are less at risk than deep-bodied forms; and orientation of fish relative to the shock wave may affect the extent of injury. Open water pelagic fish (e.g., mackerel) also seem to be less affected than reef fishes. The results of most studies are dependent upon specific biological, environmental, explosive, and data recording factors. The Navy's explosive sonobuoys that are proposed for use in IEER exercises are relatively small (4.1 lb) compared to charges used in many other activities, both military and construction-based.

The huge variations in the fish population, including numbers, species, sizes, and orientation and range from the detonation point, make it very difficult to accurately predict mortalities at any specific site of detonation. 872 explosive sonobuoys, deployed in 169 2–8 hour exercises spread approximately evenly across all OPAREAs, are proposed to be detonated per year in the AFAST Study Area. Most fish species experience large numbers of natural mortalities, especially during early life-stages, and any small level of mortality caused by the AFAST activities involving the explosive source sonobuoy (AN/SSQ–110A) will likely be insignificant to the population as a whole.

Analysis and Negligible Impact Determination

Pursuant to NMFS regulations implementing the MMPA, an applicant is required to estimate the number of animals that will be ''taken'' by the specified activities (i.e., takes by harassment only, or takes by harassment, injury, and/or death). This estimate informs the analysis that NMFS must perform to determine whether the activity will have a ''negligible impact'' on the affected species or stock. Level B (behavioral) harassment occurs at the level of the individual(s) and does not assume any resulting population-level consequences, though there are known avenues through which behavioral disturbance of individuals can result in population-level effects (for example: pink-footed geese (Anser brachyrhynchus) in undisturbed habitat gained body mass and had about a 46 percent reproductive success compared with geese in disturbed habitat (being consistently scared off the fields on which they were foraging) which did not gain mass and has a 17 percent reproductive success). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (i.e., population-level effects). An estimate of the number of Level B harassment takes, alone, is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' through behavioral harassment, NMFS must consider other factors, such as the likely nature of any responses (their intensity, duration, etc.), the context of any responses (critical reproductive time or location, migration, etc.), or any of the other variables mentioned in the first paragraph (if known), as well as the number and nature of estimated Level A takes, the number of estimated mortalities, and effects on habitat. Generally speaking, and especially with other factors being equal, the Navy and NMFS anticipate more severe effects from takes resulting from exposure to higher received levels (though this is in no way a strictly linear relationship throughout species, individuals, or circumstances) and less severe effects from takes resulting from exposure to lower received levels.

The Navy's specified activities have been described based on best estimates of the number of MFAS/HFAS hours that the Navy will conduct. The exact number of hours (or torpedoes, or pings, whatever unit the source is estimated in) may vary from year to year, but will not exceed the 5-year total indicated in Table 1 (by multiplying the yearly estimate by 5) by more than 10 percent. NMFS estimates that a 10 percent increase in sonar hours (torpedoes, pings, etc.) would result in approximately a 10 percent increase in the number of takes, and we have considered this possibility and the effect of the additional sonar use in our analysis.

Taking the above into account, considering the sections discussed below, and dependent upon the implementation of the proposed mitigation measures, NMFS has preliminarily determined that Navy training exercises utilizing MFAS/HFAS and underwater detonations (IEER) will have a negligible impact on the marine mammal species and stocks present in the AFAST.

Behavioral Harassment

As discussed in the Potential Effects of Exposure of Marine Mammals to MFAS/HFAS and illustrated in the conceptual framework, marine mammals can respond to MFAS/HFAS in many different ways, a subset of which qualifies as harassment (see Behavioral Harassment Section). One thing that the take estimates do not take into account is the fact that most marine mammals will likely avoid strong sound sources to one extent or another. Although an animal that avoids the sound source will likely still be taken in some instances (such as if the avoidance results in a missed opportunity to feed, interruption of reproductive behaviors, etc.) in other cases avoidance may result in fewer instances of take than were estimated or in the takes resulting from exposure to a lower received level than was estimated, which could result in a less severe response. For MFAS/HFAS, the Navy provided information (Table 12) estimating what percentage of the total takes that will occur within the 10–dB bins (without considering mitigation or avoidance) that are within the received levels considered in the risk continuum and for TTS and PTS. This table applies specifically to 53C sonar (the most powerful source), with less powerful sources the percentages would increase slightly in the lower received levels and correspondingly decrease in the higher received levels. As mentioned above, an animal's exposure to a higher received level is more likely to result in a behavioral response that is more likely to adversely affect the health of the animals.

As mentioned previously, the Navy developed planning awareness areas (PAAs) based on important bathymetric and consistent oceanographic features (see Mitigation). The incorporation of the Navy's proposed PAAs into their planning process along with the plan not to conduct more than 4 major exercises within these areas should ultimately result in a reduction in the number of marine mammals exposed to MFAS/HFAS (because these PAAs are anticipated to have higher densities of animals), a reduction in the number of animals exposed while engaged in feeding behaviors (because these areas are particularly productive), and an increased awareness of their potential presence when conducting activities in those important areas. Additionally, the Navy's plan to minimize both the helicopter dipping and object detection activities within the NARW critical habitat during the time when the most calves and mothers are present should result in the minimization of exposure of cow/calf pairs to MFAS/HFAS.

Received Level (SPL)	Percent of Total Harassment Takes Estimated to Occur at Indicated Level
Below 140 dB	<1%
140 < Level < 150 dB	2%
150 < Level < 160 dB	20%
160 < Level < 170 dB	40%
170 < Level < 180 dB	24%
180 < Level < 190 dB	9%
Above 190 dB	2%
TTS (195 dB EFDL)	2%
PTS (215 dB EFDL)	<1%

Table 12. Approximate percent of estimated takes that occur in the indicated 10-dB bins for AN/SQS-53 (the most powerful source). For smaller sources, a higher % of the takes occur at lower levels, and a lower % at higher levels.

Because the Navy has only been monitoring specifically to discern the effects of MFAS/HFAS on marine mammals since approximately 2006, and because of the overall datagap regarding the effects MFAS/HFAS on marine mammals, not a lot is known regarding, specifically, how marine mammals in the AFAST Study Area will respond to MFAS/HFAS. For the four MTEs for which NMFS has received a monitoring report, no instances of obvious behavioral disturbance were observed by the Navy watchstanders in the 700+ hours of effort in which 79 sightings of marine mammals were made (10 during active sonar operation). One cannot conclude from these results that marine mammals were not harassed from MFAS/HFAS, as a portion of animals within the area of concern were not seen (especially those more cryptic, deep-diving species, such as beaked whales or Kogia sp.) and some of the non-biologist watchstanders might not be well-qualified to characterize behaviors. However, one can say that the animals that were observed did not respond in any of the obviously more severe ways, such as panic, aggression, or anti-predator response.

In addition to the monitoring that will be required pursuant to this LOA, which is specifically designed to help us better understand how marine mammals respond to sound, the Navy and NMFS have developed, funded, and begun conducting a controlled exposure experiment with beaked whales in the Bahamas. Separately, the Navy plans to conduct an opportunistic tagging experiment with beaked whales in the area of the 2008 Rim of the Pacific training exercises in the HRC.

Diel Cycle

As noted previously, many animals perform vital functions, such as feeding, resting, traveling, and socializing on a diel cycle (24-hr cycle). Substantive behavioral reactions to noise exposure (such as disruption of critical life functions, displacement, or avoidance of important habitat) are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007).

In the previous section, we discussed the fact that potential behavioral responses to MFAS/HFAS that fall into the category of harassment could range in severity. By definition, the takes by behavioral harassment involve the disturbance of a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns (such as migration, surfacing, nursing, breeding, feeding, or sheltering) to a point where such behavioral patterns are abandoned or significantly altered. These reactions would, however, be more of a concern if they were expected to last over 24 hours or be repeated in subsequent days. For hull-mounted sonar (the highest power source), approximately 60% of the hours of source use are comprised of Independent Unit Level Training or maintenance activities that occur in events of 6 hours or less. Coordinated Unit Level Training or Strike Group Training events typically last more than one day, however, sonar use is not continuous and the exercises take place over very large areas, between 30 nm x 30 nm areas and 180 nm x 180 nm areas (900–32,400 nm^2). Additionally, during ASW exercises (times of continuous sonar use) vessels with hull-mounted sonar are typically moving at speeds of 10–12 knots. When this is combined with the fact that the majority of the cetaceans in the AFAST study area would not likely remain in the same area for successive days (especially an area in waters beyond 22 km from shore or greater than 600 ft deep, which is where the majority of the exercises take place), it is unlikely that animals would be exposed to MFAS/HFAS at levels or for a duration likely to result in a substantive response that would then be carried on for more than one day or on successive days.

TTS

NMFS and the Navy have estimated that some individuals of some species of marine mammals may sustain some level of TTS from MFAS/HFAS. As mentioned previously, TTS can last from a few minutes to days, be of varying degree, and occur across various frequency bandwidths. Table 11 indicates the estimated number of animals that might sustain TTS from exposure to MFAS/HFAS. The TTS sustained by an animal is primarily classified by three characteristics:

• Frequency—Available data (of mid-frequency hearing specialists exposed to mid to high frequency sounds—Southall *et al.,* 2007) suggest that most TTS occurs in the frequency range of the source up to one octave higher than the source (with the maximum TTS at ½ octave above). The two hull-mounted MFAS sources, the DICASS sonobuoys, and the helicopter dipping sonar have center frequencies between 3.5 and 8 kHz and the other unidentified MF sources are, by definition, less than 10 kHz, which suggests that TTS induced by any of these MF sources would be in a frequency band somewhere between approximately 2 and 20 kHz. There are far fewer hours of HF source use and the sounds would attenuate more quickly, but if an animal were to incur TTS from these sources, it would cover a higher frequency range (don't know exactly because center frequencies of HF sources are classified). TTS from explosives would be broadband. Tables 13a and b summarize the vocalization data for each species.

• Degree of the shift (i.e., how many dB is the sensitivity of the hearing reduced by)—generally, both the degree of TTS and the duration of TTS will be greater if the marine mammal is exposed to a higher level of energy (which would occur when the peak dB level is higher or the duration is longer). The threshold for the onset of TTS (> 6 dB) is 195 dB (SEL), which might be received at distances of up to 275–500 m from the most powerful MFAS source, the AN/SQS–53 (the maximum ranges to TTS from other sources would be less). An animal would have to approach closer to the source or remain in the vicinity of the sound source appreciably longer to increase the received SEL, which would be difficult considering the watchstanders and the nominal speed of a sonar vessel (10–12 knots). Of all TTS studies, some using exposures of almost an hour in duration or up to 217 SEL, most of the TTS induced was 15 dB or less, though Finneran *et al.* (2007) induced 43 dB of TTS with a 64-sec exposure to a 20 kHz source (MFAS emits a 1-s ping 2 times/minute).

• Duration of TTS (Recovery time)—see above. Of all TTS laboratory studies, some using exposures of almost an hour in duration or up to 217 SEL, almost all recovered within 1 day (or less, often in minutes), though in one study (Finneran *et al.* (2007)), recovery took 4 days.

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	Signal Type	Frequency Range (kHz)	Frequency Near Max energy (kHz)	Source Level (dB re 1 µPa)	Duration / Other
North Atlantic Right Whale	call	< 0.4 0.02 - 15*	< 0.2	137 - 192*	0.01 to multiple s
	moans	< 0.4			
Humpback Whale	songs	0.03 - 8	0.1 - 4	144-186	
	social	0.05 - 10	< 3		
	shrieks		0.75 - 1.8	179-181	
	horn blasts		0.41 - 0.42	181-185	
	moans	0.02 - 1.8	0.035 - 0.36	175	
	grunts	0.025 - 1.9		190	
	pulse trains	0.025 - 1.25	0.025 - 0.080	179-181	
	slap	0.03 - 1.2		183-192	
	feeding calls	0.02 - 2	0.5	162 -192	< 1 s
Humpback Whale, Calf	simple vocalization	0.14 - 4	0.22 (mean)		
Minke Whale	sweeps, moans	0.06 - 0.14		151-175	
	down sweeps	0.06 - 0.13		165	
	moans, grunts	0.06 - 0.14	0.06 - 0.14	151-175	
	ratchet	0.85 - 6	0.85		
	thump trains	0.1 - 2	0.1 - 0.2		
	speed up pulse train	0.2 - 0.4			40 to 60 ms
	slow down pulse train	0.25 - 0.35			70 to 140 ms
	Star Wars vocalization	0.05 - 9.4		150-165	
	Breeding Boings (pulse then amp-mod. call)	1.3 - 1.4			2.5 s with slight frequency modulation
Bryde's Whale	moans	0.07 - 0.245	0.124 - 0.132	152-174	0.25 to several s
	pulsed moans	0.1 - 0.93	0.165 - 0.9		
	discrete pulses	0.7 - 0.95	0.7 - 0.9		
Sei whale	FM sweeps	1.5 - 3.5			10 to 20 sweeps lasting 4 ms
	growls, whooshes, tonal calls	0.433		156	.45 s
Fin whale	moans	0.016 - 0.75	0.02	160-190	
	pulses	0.04 - 0.075 / 0.018 - 0.025	- / 0.02		
	ragged pulse	< 0.03			
	rumbles	- / 0.01 - 0.03	< 0.03 / -		
	moans, downsweeps	0.014 - 0.118	0.02	160-186	
	constant call	0.02 - 0.04			
	moans, tones, upsweeps	0.03 - 0.75		155-165	
	whistles, chirps	1.5 - 5	1.5 - 2.5		
	clicks	16 - 28			
	vocal sequence , ? only	0.015 - 0.03			
	FM sweeps	0.018 - .23		184 - 186	1 s
Blue Whale	moans, long duration songs	0.012 - .4	.012 - .025	188	up to 36 s, repeated every 1 - 2 min
	FM sweeps	0.858 ± 0.148			< 5 s

Table 13a. Summary of mysticete vocalization information compiled from The Biology of Marine Mammals (Reynolds and Rommel (eds), 1999) and the Navy's AFAST and HRC EISs - see those documents for specific information.

	Signal Type	Frequency Range (kHz)	Frequency Near Max energy (kHz)	Source Level (dB re 1 μPa)	Duration / Other
Sperm Whale	clicks	0.1 - 30	2 - 4, 10 - 16	160 - 180	< 30 ms
	short clicks			236	< 1 μs, highly directional
	trumpets			172	
Sperm Whale, Neonate	clicks		0.5	140 - 162	< 2 to 12 ms, low directionality
Pygmy sperm whale	clicks	60 - 200	120 - 130		
	narrowband pulses		129	175	119 μs, interclk intervals 40-70 ms
	echolocation clicks	60 - 200	120 - 130		
Dwarf sperm whale	clicks	13-33			0.3 - 0.5 s
Beaked Whales					
Blainville's beaked	whistles, chirps	< 1 - 6			
	whistles	2.6 - 10.7			
	echolocation clicks	20 - 40		200 - 220	< 175 μs, depths > 200 m
Cuvier's beaked	echolocation clicks	20 - 40		214	< 200 to 250 μs, depths > 200 m
	whistles	8 - 12			upsweep lasts 1 s
	pulses	13 - 17			15 to 44 s
Rough-toothed Dolphin	whistles	0.3 - 24			< 1 s
	whistles		4 - 7		
	clicks	0.1 - 200			< 250 μsec
	clicks		5 - 32		
Bottlenose Dolphin	whistles	0.8 - 24	3.5 - 14.5	125-173	
	whistle	4 - 20			
	click	0.2 - 150	30 - 60		
	click		110 - 130	218-228	
	bark	0.2 - 16			
Pantropical Spotted Dolpin	whistles	3.1 - 21.4	6.7 - 17.8		
	pulse	up to 150			
	clicks	40 -140		up to 220	
Atlantic Spotted Dolphin	whistles		7.1 - 14.5		
	burst pulses		40		
	squawks, barks growls	0.1 - 8			
	echolocation clicks	40 - 130		210	
	squawks	0.2 - 12			
	barks, ? only	0.2 - 20			
	synchronized squawks, ? only in a group	0.1 - 15			
Spinner Dolphin	pulse	1 - 160	5 - 60		
	whistles	1 - 20	8 - 12		
	echolocation clicks		up to 65		
	click	1 - 160	60	195 - 222	
Clymene Dolphin	whistles	6.3 - 19.2			
Striped dolphin	whistles	1 - 22.5	6.8 - 16.9	109-125	
	whistles	6 - 24	8 - 125		
	pulse bursts		5 - 60	108-115	

Table 13b. Summary of odontocete vocalization information compiled from The Biology of Marine Mammals (Reynolds and Rommel (eds), 1999) and the Navy's AFAST and HRC EISs - see those documents for specific information.

	Signal Type	Frequency Range (kHz)	Frequency Near Max energy (kHz)	Source Level (dB re 1 μPa)	Duration / Other
Sperm Whale	clicks	0.1 - 30	2 - 4, 10 - 16	160 - 180	< 30 ms
	short clicks			236	< 1 μs, highly directional
	trumpets			172	
Sperm Whale, Neonate	clicks		0.5	140 - 162	< 2 to 12 ms, low directionality
Pygmy sperm whale	clicks	60 - 200	120 - 130		
	narrowband pulses		129	175	119 μs, interclk intervals 40-70 ms
	echolocation clicks	60 - 200	120 - 130		
Dwarf sperm whale	clicks	13-33			0.3 - 0.5 s
Beaked Whales					
Blainville's beaked	whistles, chirps	< 1 - 6			
	whistles	2.6 - 10.7			
	echolocation clicks	20 - 40		200 - 220	< 175 μs, depths > 200 m
Cuvier's beaked	echolocation clicks	20 - 40		214	< 200 to 250 μs, depths > 200 m
	whistles	8 - 12			upsweep lasts 1 s
	pulses	13 - 17			15 to 44 s
Rough-toothed Dolphin	whistles	0.3 - 24			< 1 s
	whistles		4 - 7		
	clicks	0.1 - 200			< 250 μsec
	clicks		5 - 32		
Bottlenose Dolphin	whistles	0.8 - 24	3.5 - 14.5	125-173	
	whistle	4 - 20			
	click	0.2 - 150	30 - 60		
	click		110 - 130	218-228	
	bark	0.2 - 16			
Pantropical Spotted Dolpin	whistles	3.1 - 21.4	6.7 - 17.8		
	pulse	up to 150			
	clicks	40 -140		up to 220	
Atlantic Spotted Dolphin	whistles		7.1 - 14.5		
	burst pulses		40		
	squawks, barks growls	0.1 - 8			
	echolocation clicks	40 - 130		210	
	squawks	0.2 - 12			
	barks, ? only	0.2 - 20			
	synchronized squawks, ? only in a group	0.1 - 15			
Spinner Dolphin	pulse	1 - 160	5 - 60		
	whistles	1 - 20	8 - 12		
	echolocation clicks		up to 65		
	click	1 - 160	60	195 - 222	
Clymene Dolphin	whistles	6.3 - 19.2			
Striped dolphin	whistles	1 - 22.5	6.8 - 16.9	109-125	
	whistles	6 - 24	8 - 125		
	pulse bursts		5 - 60	108-115	

Table 13b. Summary of odontocete vocalization information compiled from The Biology of Marine Mammals (Reynolds and Rommel (eds), 1999) and the Navy's AFAST and HRC EISs - see those documents for specific information.

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Based on the range of degree and duration of TTS reportedly induced by exposures to non-pulse sounds of energy higher than that to which free-swimming marine mammals in the field are likely to be exposed during MFAS/HFAS training exercises, it is unlikely that marine mammals would sustain a TTS from MFAS that alters their sensitivity by more than 20 dB for more than a few days (and the majority would be far less severe). Also, for the same reasons discussed in the Diel Cycle section, and because of the short distance within which animals would need to approach the sound source, it is unlikely that animals would be exposed to the levels necessary to induce TTS in subsequent time periods such that their recovery were impeded. Additionally (see Tables 13a and 13b), though the frequency range of TTS that marine mammals might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from MFAS (the source from which TTS would more likely be sustained because the higher source level and slower attenuation make it more likely that an animal would be exposed to a higher level) would not usually span the entire frequency range of one vocalization type, much less span all types of vocalizations. It is worth noting that TTS from MFAS could potentially result in reduced sensitivity to the vocalizations of killer whales (potential predators). If impaired, marine mammals would typically be aware of their impairment and implement behaviors to compensate for it (see Communication Impairment Section), though these compensations may incur energetic costs.

Acoustic Masking or Communication Impairment

Table 13 is also informative regarding the nature of the masking or communication impairment that could potentially occur from MFAS (again, center frequencies are 3.5 and 7.5 kHz for the two types of hull-mounted sonar). However, masking only occurs during the time of the signal (and potential secondary arrivals of indirect rays), versus TTS, which occurs continuously for its duration. Standard MFAS sonar pings last on average one second and occur about once every 24–30 seconds for hull-mounted sources. When hull-mounted sonar is used in the Kingfisher mode, pulse length is shorter, but pings are much closer together (both in time and space, since the vessel goes slower when operating in this mode). For the sources for which we know the pulse length, most are significantly shorter than hull-mounted sonar, on the order of several microseconds to 10s of microseconds. For hull-mounted sonar, though some of the vocalizations that marine mammals make are less than one second long, there is only a 1 in 24 chance that they would occur exactly when the ping was received, and when vocalizations are longer than one second, only parts of them are masked. Alternately, when the pulses are only several microseconds long, the majority of most animals' vocalizations would not be masked. Masking effects from MFAS/HFAS are expected to be minimal. If masking or communication impairment were to occur briefly, it would be in the frequency range of MFAS, which overlaps with some marine mammal vocalizations; however, it would likely not mask the entirety of any particular vocalization or communication series because the pulse length, frequency, and duty cycle of the MFAS/HFAS signal does not perfectly mimic the characteristics of any marine mammal's vocalizations.

PTS, Injury, or Mortality

The Navy's model estimated that the following numbers of individuals of the indicated species would be exposed to levels of MFAS/HFAS associated with the likelihood of resulting in PTS: bottlenose dolphin-47; pantropical spotted dolphin-13; Atlantic spotted dolphin-27; spinner dolphin-2; Clymene dolphin-4; striped dolphin-10; common dolphin-5; Risso's dolphin-7; and pilot whales (long-finned and short-finned)—9. However, these estimates do not take into consideration either the mitigation measures or the likely avoidance behaviors of some of the animals exposed. NMFS believes that many marine mammals would deliberately avoid exposing themselves to the received levels necessary to induce injury (i.e., approaching to within approximately 10 m (10.9 yd) of the source) by moving away from or at least modifying their path to avoid a close approach. Additionally, in the unlikely event that an animal approaches the sonar vessel at a close distance, NMFS believes that the mitigation measures (i.e., shutdown/powerdown zones for MFAS/HFAS) further ensure that animals would not be exposed to injurious levels of sound. As discussed previously, the Navy utilizes both aerial (when available) and passive acoustic monitoring (during all ASW exercises) in addition to watchstanders on vessels to detect marine mammals for mitigation implementation and indicated that they are capable of effectively monitoring a 1000-meter (1,093-yd) safety zone at night using night vision goggles, infrared cameras, and passive acoustic monitoring. When these two points are considered, NMFS does not believe that any marine mammals will incur PTS from exposure to MFAS/HFAS.

The Navy's model estimated that 12 total animals (dolphins) would be exposed to explosive detonations (from IEER) at levels that could result in injury—however, those estimates do not consider mitigation measures. Surveillance during the exercises for which injury was estimated (which includes aerial and passive acoustic detection methods, when available, to ensure clearance) begins half an hour before the exercise and extends to 1000 yds (914 m) from the source. Because of the behavior and visibility of dolphins and the half hour of monitoring that occurs prior to detonation, NMFS does not think that any animals will be exposed to levels of sound or pressure that will result in injury from explosive detonations.

As discussed previously, marine mammals could potentially respond to MFAS at a received level lower than the injury threshold in a manner that indirectly results in the animals stranding. The exact mechanisms of this potential response, behavioral or physiological, are not known. However, based on the number of occurrences where strandings have been definitively associated with military sonar versus the number of hours of sonar that have been conducted, we suggest that the probability is small that this will occur. Additionally, a sonar shutdown protocol for strandings involving live animals milling in the water minimizes the chances that these types of events turn into mortalities.

Though NMFS does not expect it to occur, because of the uncertainty surrounding the mechanisms that link exposure to MFAS to stranding (especially in beaked whales), NMFS is proposing to authorize the injury or mortality of 10 beaked whales over the course of the 5-yr regulations. The Navy's incorporation of the PAAs (some of which include steep bathymetry, certain variations of which have been implicated as contributing factors in marine mammal strandings) into exercise planning and their plan to not conduct major exercises in them could potentially further reduce the likelihood of strandings in association with MFAS operation.

40 Years of Navy Training Exercises Using MFAS/HFAS in the AFAST Study Area

The Navy has been conducting MFAS/HFAS training exercises in the AFAST Study Area for over 40 years, and the proposed action is the ‘‘No Action’’ alternative in the Navy's DEIS, i.e., continuing sonar operation in the manner and at the levels used in recent years. Although monitoring specifically in conjunction with training exercises to determine the effects of sonar on marine mammals was not being conducted by the Navy prior to 2006 and the symptoms indicative of potential acoustic trauma were not as well recognized prior to the mid-nineties, people have been collecting stranding data in the AFAST Study Area for approximately 30 years. Though not all dead or injured animals are expected to end up on the shore (some may be eaten or float out to sea), one might expect that if marine mammals were being harmed by sonar with any regularity, more evidence would have been detected over the 40-yr period.

Model Overestimation

When analyzing the results of the acoustic effects modeling to provide an estimate of effects, it is important to understand that there are limitations to the ecological data and to the acoustic model that likely result in an overestimation of the total exposures to marine mammals. NMFS considers these limitations qualitatively when analyzing effects. Specifically, the modeling results are likely overestimates for the following reasons:

- Acoustic footprints for sonar sources near land are not reduced to account for the land mass, where marine mammals would not be exposed to underwater sound.
- The acoustic footprint for each sonar source is modeled independently and, therefore, does not account for overlap it would have with other sonar systems used during the same active sonar activity (especially applicable during coordinated unit level training or strike group training). As a consequence, the calculated acoustic footprint is larger than the actual acoustic footprint, which can be significant when considering the range over which a behavioral effect may occur.
- Acoustic exposures do not reflect implementation of mitigation measures, such as reducing sonar source levels when marine mammals are present.
- In this analysis, the acoustic footprint is assumed to extend from the water surface to the ocean bottom. In reality, the acoustic footprint radiates from the source like a bubble, and a marine animal may be outside this region.
- Marine mammal densities were averaged across specific active sonar activity areas and, therefore, are evenly distributed without consideration for animal grouping or patchiness.
- The model also does not consider the likely avoidance behaviors of marine mammals in the proximity of an intense sound source.

Species-Specific Analysis

In the discussions below, the ‘‘acoustic analysis’’ refers to the Navy's analysis, which includes the use of several models and other applicable calculations as described in the Estimates of Potential Marine Mammal Exposure section. The numbers predicted by the ‘‘acoustic analysis’’ are based on a uniform and stationary distribution of marine mammals and do not take into consideration the implementation of mitigation measures or potential avoidance behaviors of marine mammals, and therefore, are likely overestimates of potential exposures to the indicated thresholds (PTS, TTS, behavioral harassments). Consequently, NMFS has factored in the mitigation measures and avoidance to make both quantitative and qualitative adjustments to the take estimates predicted by the Navy's ‘‘acoustic analysis’’. The revised take estimates (and proposed take authorization) depict a more realistic scenario than those adopted directly from the Navy's acoustic analysis.

Although NMFS is not required to identify the number of animals that will be taken specifically by TTS versus behavioral harassment (Level B Harassment takes include both), we have attempted to make more realistic estimates by quantitatively refining the Navy's TTS estimates by modifying the estimate produced by the acoustic analysis by a specific amount if certain circumstances are present as described below:

For MFAS/HFAS, some animals are likely to avoid the source to some degree (which could decrease the number exposed to TTS levels). Adding to that, in the following circumstances (discussed in more detail in the individual sections below) the indicated multipliers were applied to the TTS estimates predicted by the acoustic analysis:

- When animals are highly visible (such as melon-headed whales, humpback whales), we assume that lookouts will see them in time to cease sonar operation before the animals are exposed to levels associated with TTS, which reach to about 140 m from the sonar source. In this case we estimate 0 animals will incur TTS.
- When animals are deep divers and very cryptic at the surface (such as beaked whales), though some may avoid the source, we assume that most will not be sighted, and therefore we estimated that 50–100% of the number predicted by the Navy's acoustic analysis might actually incur TTS.
- When animals are more likely to be visually detected than beaked whales, but less likely than the highly visible species, we estimate that 0–100% of the number of these species (sperm whales, some pinnipeds) predicted by the Navy's acoustic analysis might actually incur TTS.
- Though dolphins are highly visible, because the mitigation includes a provision to allow bow-riding, not all TTS take of dolphins will necessarily be avoided. Therefore, we estimated that 0–50% of the number of dolphins predicted by the Navy's acoustic analysis might actually incur TTS.

North Atlantic Right Whale

Acoustic analysis (here and below, ‘‘acoustic analysis’’ refers to the Navy's process, including primarily the Navy's model, that results in the take estimates submitted to NMFS—further analysis by NMFS may result in minor adjustments of some of the numbers) indicates that up to 666 exposures of North Atlantic right whales to sound levels likely to result in Level B harassment may occur. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year (additionally, as mentioned above, the number may be an overestimate). Although 4 of the modeled Level B Harassment takes were predicted to be in the form of TTS, NMFS believes it is unlikely that any right whales will incur TTS because of the distance within which they would have to approach the sonar source (depending on conditions, within a range of 275–500 m for the most powerful source), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect these animals prior to an approach within this distance and implement sonar powerdown or shutdown. Navy lookouts will likely detect a group of North Atlantic right whales out to 914 m (1,000 yd) given their large size (Leatherwood and Reeves, 1982), surface behavior, pronounced blow, and mean group size of approximately three animals. The probability of trackline detection in Beaufort Sea States of 6 or less is 0.90 or 90 percent (Barlow, 2003).

A small number (30: 20 in the SE and 10 in the NE) of the predicted takes of North Atlantic right whales would likely occur within critical habitat for the North Atlantic Right Whale, which has been designated in three areas: (1) Coastal Florida and Georgia (Sebastian Inlet, Florida, to the Altamaha River, Georgia)—calving grounds; (2) The Great South Channel, east of Cape Cod—feeding and nursery grounds; and (3) Cape Cod and Massachusetts Bays—feeding and nursery grounds.

In the Northeast, the Navy has proposed to largely avoid conducting any training or sonar use in the critical habitat, with one exception. Torpedo exercises (a maximum of 32 MK–48 torpedo runs at 15 minutes each or up to 24 lightweight MK–46 or MK–54 torpedoes) would occur in August–December (when right whales are less likely to be present), as worked out during a previous section 7 consultation. The Navy has included special mitigation measures for TORPEXs conducted in the Northeast.

In the Southeast critical habitat, the Navy has also proposed to largely avoid conducting any training or sonar use in critical habitat, with two exceptions. Maintenance of helicopter dipping sonars occasionally occurs (approximately 30 events at 2–4 hours each) in the portion of the helicopter dipping sonar training area that overlaps with NARW critical habitat. In addition, the Navy would conduct approximately 40 ship object detection/navigational sonar training exercises (1–2 hours each) annually while entering/exiting port (within approximately 1 mile of the shore). This activity could occur year-round (i.e., not all of them would occur during the time that right whales are concentrated in the critical habitat, December–April). All ASW training, except shore-based helicopter dipping sonar, occurs more than 12 nm from shore and usually in greater than 600 ft of water.

Due to the importance of right whale critical habitat for reproductive activities and feeding, takes that occur in those areas would be considered more likely to have more potentially severe effects than takes that occur while whales are just moving through and not involved in reproductive or feeding behaviors. However, the estimated takes in these areas are low (30 total, 20 in the SE, 10 in the NE). Additionally, NMFS and the Navy have included mitigation measures to minimize impacts (both number and severity) both in the northeast and Southeast designated right whale critical habitat (see Mitigation section).

Acoustic analysis indicates that no right whales will be exposed to sound levels likely to result in Level A harassment. Modeling of the explosive sonobuoys predicts no potential for injury or mortality to right whales. As noted previously, regardless of what the model predicts, NMFS believes that the Navy watchstanders would detect a right whale and implement sonar powerdown or shutdown well before an animal was able to approach within the distance necessary to be injured (approximately 10 m from a hull-mounted sonar).

Fleet Area Control and Surveillance Facility Jacksonville coordinates Navy ship and aircraft clearance into the Northern Right Whale Critical Habitat and the surrounding Operating Area (OPAREA) based on season, water temperature, weather conditions, and frequency of whale sightings, and provides Northern Right Whale sighting reports to ships, submarines and aircraft. Through coordination with the Florida Fish and Wildlife Conservation Commission (FWCC), Georgia Department of Natural Resources (GDNR), New England Aquarium Early Warning System (EWS) and others, Fleet Area Control and Surveillance Facility Jacksonville organized a communications network and reporting system that ensures the widest possible exchange and dissemination of Northern Right Whale sighting information to Department of Defense (DoD) and civilian shipping.

Approximately 350 right whales, including about 70 mature females, are thought to occur in the western North Atlantic (Kraus *et al*., 2005). The most recent stock assessment report states that in a review of the photo-ID recapture database for October 2005, 306 individually recognized whales were known to be alive during 2001 (Waring *et al.,* 2007). This number represents a minimum population size, and no abundance estimate with an associated coefficient of variation has been calculated for this population (Waring *et al.,* 2007). Right whales are not normally expected to occur in the Gulf of Mexico.

Based on the Navy's modeled take estimates, it is possible that nearly every North Atlantic right whale in the stock might be harassed (Level B) one or two times during the course of one year, or alternately, fewer animals might be harassed more than one or two times per year. However, as discussed above, Coordinated Unit Level Exercises and Strike Group Exercises utilizing surface vessels (i.e., the exercises that utilize multiple surface vessels and last for multiple days) occur farther than 12 nm from shore and do not occur in the NE OPAREA at all, which means that they do not occur in or directly adjacent to the right whale critical habitat. Therefore, any takes that occur in the critical habitat would likely be short term and at a lower received level (hull-mounted source on surface vessel is highest power) and would likely not affect annual rates of recruitment or survival.

Last, in the unanticipated event that an injured or entangled North Atlantic right whale is encountered by the Navy at sea during training exercises, the Navy will cease sonar operation within 14 nm (Atlantic) or 17 nm (Gulf of Mexico) of the animal in order to ensure that Navy activities do not add to the stress of an already at risk and weakened (regardless of the original cause) animal. These are the respective estimated distances at which a marine mammal would receive approximately 145 dB SPL, the level at which the risk function predicts 1% of the animals exposed would respond in a manner that NMFS considers Level B harassment. Navy training will not resume in the area until the animal dies or swims away of its own volition.

Humpback Whale

Acoustic analysis indicates that up to 4,198 exposures of humpback whales to sound levels likely to result in Level B harassment may occur. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. Although 30 of the modeled Level B Harassment takes were predicted to be in the form of TTS, NMFS believes it is unlikely that any humpback whales will incur TTS because of the distance within which they would have to approach the sonar source (depending on conditions, within a range of 275–500 m for the most powerful source), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect these animals prior to an approach within this distance and implement sonar powerdown or shutdown. Navy lookouts will likely detect a group of humpback whales out to 914 m (1,000 yd) given their large size (Leatherwood and Reeves, 1982), surface behavior, and pronounced blow.

In the North Atlantic Ocean, humpbacks are found from spring through fall on feeding grounds that are located from south of New England to northern Norway (NMFS, 1991). The Gulf of Maine is one of the principal summer feeding grounds for humpback whales in the North Atlantic. The largest numbers of humpback whales are present from mid-April to mid-November. Feeding locations off the northeastern United States include

Stellwagen Bank, Jeffreys Ledge, the Great South Channel, the edges and shoals of Georges Bank, Cashes Ledge, Grand Manan Banks, the banks on the Scotian Shelf, the Gulf of St. Lawrence, and the Newfoundland Grand Banks (CETAP, 1982; Whitehead, 1982; Kenney and Winn, 1986; Weinrich *et al.*, 1997). Feeding most often occurs in relatively shallow waters over the inner continental shelf and sometimes in deeper waters. Large multi-species feeding aggregations (including humpback whales) have been observed over the shelf break on the southern edge of Georges Bank (CETAP, 1982; Kenney and Winn, 1987) and in shelf break waters off the U.S. mid-Atlantic coast (Smith *et al.*, 1996).

Acoustic analysis indicates that no humpback whales will be exposed to sound levels likely to result in Level A harassment. Modeling of the explosive sonobuoys predicts no potential injury or mortality to humpback whales.

Humpback whales in the North Atlantic are thought to belong to five different feeding stocks: Gulf of Maine, Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, and Iceland. The current best estimate of population size for humpback whales in the North Atlantic, including the Gulf of Maine Stock, is 11,570 individuals (Waring *et al.*, 2007). The best abundance estimate for the Gulf of Maine humpback stock is 902 individuals (Waring *et al.*, 2007). During the winter, most of the North Atlantic population of humpback whales is believed to migrate south to calving grounds in the West Indies region (Whitehead and Moore, 1982; Smith *et al.*, 1999; Stevick *et al.*, 2003). During this time individuals from the various feeding stocks mix through migration routes as well as on the feeding grounds. Although the population composition of the mid-Atlantic is apparently dominated by Gulf of Maine whales, the mixing of multiple stocks through the migratory season suggests that exposures in the Mid-Atlantic and Southeast are likely spread across all of the North Atlantic populations. Sufficient data to estimate the percentage of exposures to each stock is currently not available, however, the estimated takes are spread across the different OPAREAs and time such that focused and harmful impacts to one particular stock are not anticipated.

As mentioned previously, important feeding areas for humpbacks are located in the Northeast. Stellwagen Banks Sanctuary contains some of this important area and the Navy does not currently plan to conduct any activities in this area. Additionally, the Navy has designated PAAs in the Northeast that include some of these important feeding areas and these areas will be considered in the planning of exercises.

Sei Whale

Acoustic analysis indicates that up to 1,054 exposures of sei whales to sound levels likely to result in Level B harassment may occur. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. Although 2 of the modeled Level B Harassment takes were predicted to be in the form of TTS, NMFS believes it is unlikely that any sei whales will incur TTS because of the distance within which they would have to approach the sonar source (depending on conditions, within a range of 275–500 m for the most powerful source), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect these animals prior to an approach within this distance and implement sonar powerdown or shutdown. Navy lookouts will likely detect a group of sei whales out to 914 m (1,000 yd) given their large size (Leatherwood and Reeves, 1982), group size (3 or more), and pronounced blow. No areas of specific importance for reproduction or feeding for sei whales have been identified in the AFAST Study Area. Modeling of the explosive sonobuoys also predicts no potential for injury or mortality to sei whales.

Sei whales in the North Atlantic belong to three stocks: Nova Scotia, Iceland-Denmark Strait, and Northeast Atlantic (Perry *et al.*, 1999). The Nova Scotia Stock occurs in U.S. Atlantic waters (Waring *et al.*, 2007). There are no recent abundance estimates for the Nova Scotia stock (Waring *et al.*, 2007).

Fin and Blue Whales

There are no population estimates for blue whales for the Western North Atlantic except for the Gulf of Saint Lawrence (Waring *et al.*, 2002), for which the estimate is 308. Blue whales are known to occur throughout the deeper waters of the Atlantic, beyond the U.S. EEZ (Clark 1995, Clark and Gagnon 2004). Comparisons can be made between blue and fin whales based on behavior, areas where they are typically found, and feeding habits. The fin whale abundance estimate is the most analogous representation for blue whale abundance within the study area. Therefore, the number of takes estimated for blue whales, as well as overall conclusions, should be similar to those estimated for fin whales.

Acoustic analysis indicates that up to 881 fin whales and 801 blue whales may be exposed to sound levels likely to result in Level B harassment. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. Although 2 of the modeled Level B Harassment takes (for fin whales) were predicted to be in the form of TTS, NMFS believes it is unlikely that any fin (or blue) whales will incur TTS because of the distance within which they would have to approach the sonar source (depending on conditions, within a range of 275–500 m for the most powerful source), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect these animals prior to an approach within this distance and implement sonar powerdown or shutdown. Navy lookouts will likely detect a group of fin (or blue) whales out to 914 m (1,000 yd) given their large size and pronounced blow (Barlow 2003 estimated a high rate of detection for fin whales: 0.90 in Beaufort sea states of 6 or less). No areas of specific importance for reproduction or feeding for fin (or blue) whales have been identified in the AFAST Study Area. Also, acoustic analysis predicts that no fin whales will be exposed to sound or explosive levels likely to result either in Level A harassment or mortality.

Fin whales are currently considered as a single stock in the western North Atlantic. The best abundance estimate for the Western North Atlantic stock of fin whales is 2,814 (Waring *et al.*, 2007).

Minke Whales

Acoustic analysis indicates that up to 414 exposures of minke whales to sound levels likely to result in Level B harassment may occur. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. Acoustic analysis indicates that 1 of the modeled Level B Harassment takes would be in the form of TTS. Though minke whales would have to approach the sonar source within a range of 275–500 m (for the most powerful source) to incur TTS and many animals will likely avoid sonar sources to some degree, these animals have relatively cryptic behavior and profile at the surface and therefore could potentially be missed by the lookouts at this distance. Therefore, NMFS thinks that one minke whale may incur TTS. No areas of specific importance for reproduction or feeding for minke whales have been identified in the AFAST Study Area. Also, acoustic analysis predicts that no minke whales will be exposed to sound or explosive levels likely to result either in Level A harassment or mortality. The best available abundance estimate for minke whales from the Canadian East Coast stock is 2,998 animals (Waring *et al.*, 2007). The minke whale is not expected in the Gulf of Mexico.

Bryde's Whale

Acoustic analysis indicates that up to 34 exposures of Bryde's whales to sound levels likely to result in Level B harassment may occur. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. Although acoustic modeling estimated that one of the Level B Harassment takes would be in the form of TTS, NMFS believes it is unlikely that any Bryde's whales would incur TTS or be injured because of the distance within which they would have to approach the sonar source (depending on conditions, within a range of 275–500 m for the most powerful source for TTS, 10 m for injury), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect these animals prior to an approach within this distance and implement sonar powerdown or shutdown. Navy lookouts will likely detect a group of Bryde's whales out to 914 m (1,000 yd) given their large size and pronounced blow. Acoustic analysis predicts that no Bryde's whales will be exposed to sound levels or explosive detonations likely to result either in TTS, Level A harassment, or mortality. No areas of specific importance for reproduction or feeding for Bryde's whales have been identified in the AFAST Study Area. The best abundance estimate for Bryde's whales within the northern Gulf of Mexico is 40.

Sperm Whales

Acoustic analysis indicates that up to 9741 (estimated 342 in GOM) exposures of sperm whales to sound levels likely to result in Level B harassment may occur. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. Although 63 of the modeled Level B Harassment takes were predicted to be in the form of TTS, NMFS believes it is unlikely that all of the estimated sperm whales will incur TTS because of the distance within which they would have to approach the sonar source (depending on conditions, within a range of 275–500 m for the most powerful source), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect these animals prior to an approach within this given their large size, pronounced blow, and average group size (7). However, because of their long, deep diving behavior (up to 2-hour dives), NMFS believes that some animals may approach undetected within the distance in which TTS would likely be incurred. Therefore, NMFS estimates that 0–32 sperm whales may incur some degree of TTS from exposure to MFAS/HFAS.

The region of the Mississippi River Delta (Desoto Canyon) has been recognized for high densities of sperm whales and appears to represent an important calving and nursery area for these animals (Townsend, 1935; Collum and Fritts, 1985; Mullin *et al.*, 1994a; Würsig *et al.*, 2000; Baumgartner *et al.*, 2001; Davis *et al.*, 2002; Mullin *et al.*, 2004; Jochens *et al.*, 2006). Sperm whales typically exhibit a strong affinity for deep waters beyond the continental shelf, though in the area of the Mississippi Delta they also occur on the outer continental shelf break. However, there is a PAA designated immediately seaward of the continental shelf associated with the Mississippi Delta, in which the Navy plans to conduct no more than 1 major exercise and which they plan to take into consideration in the planning of unit-level exercises, and therefore NMFS does not expect that impacts will be focused, extensive, or severe in the sperm whale calving area.

Acoustic analysis predicts that no sperm whales will be exposed to sound or explosive levels likely to result either in Level A harassment or mortality. The best abundance estimate for sperm whales for the western North Atlantic is 4,804 and in the northern GOMEX is 1,349 individuals (Mullin and Fulling, 2004).

Pygmy and Dwarf Sperm Whales

Due to the difficulty in differentiating these two species at sea, an estimate of the effects on the two species have been combined (as have abundance estimates in NMFS' stock assessment reports). Acoustic analysis indicates that up to 4384 exposures of Kogia spp. to sound levels likely to result in Level B harassment may occur. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. 44 of the modeled Level B Harassment takes were predicted to be in the form of TTS. NMFS believes it is unlikely that all 44 whales will incur TTS because of the distance within which they would have to approach the sonar source (depending on conditions, within a range of 275–500 m for the most powerful source), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect some of these animals prior to an approach within this distance and implement sonar powerdown or shutdown. However, because of their deep diving behavior (longer time below the surface) and relatively cryptic behavior/profile at the surface, NMFS estimates that 22–44 animals may approach undetected within the distance in which TTS would likely be incurred. As mentioned above, some Kogia sp. vocalizations might overlap with the MFAS/HFAS TTS frequency range (2–20 kHz), but the limited information for Kogia sp. indicates that their clicks are at a much higher frequency and that their maximum hearing sensitivity is between 90 and 150 kHz. It is worth noting that TTS in the range induced by MFAS would reduce sensitivity in the band that killer whales click and echolocate in. However, as noted previously, NMFS does not anticipate TTS of a long duration or severe degree to occur as a result of exposure to MFA/HFAS.

No areas of specific importance for reproduction or feeding for Kogia spp. have been identified in the AFAST Study Area. Also, acoustic analysis predicts that no pygmy or dwarf sperm whales will be exposed to sound or explosive levels likely to result either in Level A harassment or mortality. The best abundance estimate for both species combined in the western North Atlantic is 395 individuals, and combined in the Northern Gulf of Mexico, the best abundance estimate is 742.

Beaked Whales

Due to the difficulty in differentiating Mesoplodon species from each other, as well as from Ziphius at sea, and because of the lack of a population estimate for bottlenose whales, estimates of the effects on the six species of beaked whales listed in Table 4 have been combined (as have abundance estimates in NMFS's stock assessment reports). Acoustic analysis indicates that up to 2,665 exposures of beaked whales to sound levels likely to result in Level B harassment may occur. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year: 34 of the modeled Level B Harassment takes were predicted to be in the form of TTS. NMFS believes it is unlikely that all 34 whales will incur TTS because of the distance within which they would have to approach the sonar source (depending on conditions, within a range of 275–500 m for the most powerful source), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect a few of these animals prior to an approach within this distance and implement sonar powerdown or shutdown. However, because of their deep diving behavior (longer time below the surface) and cryptic behavior/profile at the surface, NMFS believes that some animals (estimate 17–34) may approach undetected within the distance in which TTS would likely be incurred. As mentioned above and indicated in Table 13, some beaked whale vocalizations might overlap with the MFAS/HFAS TTS frequency range (2–20 kHz); however, as noted previously, NMFS does not anticipate TTS of a long duration or severe degree to occur as a result of exposure to MFA/HFAS. It is worth noting that TTS in the range induced by MFAS could reduce sensitivity in the band that killer whales click and echolocate in.

No areas of specific importance for reproduction or feeding for beaked whales have been identified in the AFAST Study Area. Also, acoustic analysis predicts that no beaked whales will be exposed to sound or explosive levels likely to result either in Level A harassment or mortality. The best abundance estimate for Mesoplodon species and Cuvier's beaked whales in the northern Gulf of Mexico are 106 and 95 animals, respectively. The best abundance estimate for undifferentiated beaked whales (Ziphius and Mesoplodon species) in the Western North Atlantic is 3,513.

Although NMFS does not expect mortality of any of these six species to occur as a result of the MFAS/HFAS training exercises (see Mortality paragraph above), because we intend to authorize mortality, we consider the 10 potential mortalities from across the six species potentially effected over the course of 5 years in our negligible impact determination (NMFS only intends to authorize a total of 10 beaked whale mortality takes, but since they could be of any of the species, we consider the effects of 10 mortalities of any of the six species).

Social Pelagic Species (Except Pilot Whales)

Acoustic analysis predicts that the following numbers of behavioral harassments of the associated species will occur: 502 (false killer whales), 499 (killer whales), 263 (Pygmy killer whales), and 1,533 (melon-headed whales), including the following numbers of TTS, respectively: 10, 41, 7, 22. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. Although 80 (total) of the modeled Level B Harassment takes for these four species were predicted to be in the form of TTS, NMFS believes it is unlikely that any individuals of these species will incur TTS because of the distance within which they would have to approach the sonar source (depending on conditions, within a range of 275–500 m for the most powerful source), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect these animals prior to an approach within this distance and implement sonar powerdown or shutdown. Navy lookouts will likely detect a group of any of these four social pelagic species out to 914 m (1,000 yd) given their large size, gregarious behavior, and large average group size. No areas of specific importance for reproduction or feeding for these whales have been identified in the AFAST Study Area.

Acoustic analysis predicts that no individuals of these 4 species will be exposed to sound or explosive levels likely to result either in Level A harassment or mortality. These species are rare or extralimital in the Northwest Atlantic Ocean and estimated takes for these species are anticipated to occur in the GOM. Following are the best estimates of abundance for these species in the GOM: false killer whales—1,038; killer whales—133; pygmy killer whales—408; melon-headed whales—3,451.

Pilot Whales

An estimate of the effects on these two species has been combined (as have abundance estimates in NMFS's stock assessment reports). Acoustic analysis indicates that up to 127,266 exposures of pilot whales to sound levels likely to result in Level B harassment may occur. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. Although 1,104 of the modeled Level B Harassment takes for pilot whales were predicted to be in the form of TTS, NMFS believes it is unlikely that any individuals of these species will incur TTS because of the distance within which they would have to approach the sonar source (275–500 m for the most powerful source), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect these animals prior to an approach within this distance and implement sonar powerdown or shutdown. Navy lookouts will likely detect a group of pilot whales out to 914 m (1,000 yd) given their large size, gregarious behavior, and large average group size. Although the model predicted that 1 animal would be exposed to sound levels that would result in Level A Harassment (PTS—injury), NMFS does not believe that any animals would be exposed to these levels for the same reasons listed in the previous sentence (and animals would need to approach within 10 m of the sonar dome). No areas of specific importance for reproduction or feeding for pilot whales have been identified in the AFAST Study Area.

Acoustic analysis predicts that no pilot whales will be exposed to sound or explosive levels likely to result in mortality. The best estimate of abundance for pilot whales (combined short-finned and long-finned) in the western North Atlantic is 31,139 individuals, with a minimum population estimate of 24,866 (Waring *et al.,* 2007). The best estimate of abundance for the short-finned pilot whale in the northern Gulf of Mexico is 2,388 individuals, with a minimum population estimate of 1,628 (Mullin and Fulling, 2004; Waring *et al.,* 2006).

Dolphins

The acoustic analysis predicts that the following numbers of behavioral harassments of the associated species will occur: 2705 (rough-toothed dolphin), 605530 (bottlenose dolphins), 138394 (pantropical spotted dolphin), 376070 (Atlantic spotted dolphin), 21147 (spinner dolphin), 45302 (Clymene dolphin), 173675 (striped dolphin), 95548 (common dolphin), 320 (Fraser's dolphin), 94001 (Risso's dolphins), 20647 (Atlantic white-sided dolphins), and 26243 (white-beaked dolphin). This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year.

Although a portion (see table 11) of the modeled Level B Harassment takes for all of these species were predicted to be in the form of TTS, NMFS believes it is unlikely that all of the individuals estimated will incur TTS because of the distance within which they would have to approach the sonar source (depending on conditions, within a range of 275–500 m for the most powerful source), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect these animals prior to an approach within this distance and implement sonar powerdown or shutdown. Navy lookouts will likely detect a group of dolphins out to 914 m (1,000 yd) given their relatively short dives and large average group size. However, the Navy's proposed mitigation has a provision that allows the Navy to continue operation of MFAS if the animals are clearly bow-riding even after the Navy has initially maneuvered to try and avoid closing with the animals. Since these animals sometimes bow-ride and could potentially be exposed to levels associated with TTS as they approach or depart from bow-riding, we estimate that half or less of the number of animals modeled for MFAS/HFAS TTS might actually sustain TTS (see table 11). As mentioned above and indicated in Table 13, some dolphin vocalizations might overlap with the MFAS/HFAS TTS frequency range (2–20 kHz), however, as noted previously, NMFS does not anticipate TTS of a long duration or severe degree to occur as a result of exposure to MFA/HFAS.

No areas of specific importance for reproduction or feeding for dolphins have been identified in the AFAST Study Area.

Although acoustic analysis predicted that a small number of several dolphin species would be exposed to levels of sound or explosive detonations likely to result in Level A harassment, for the same reasons stated above (mitigation, avoidance, dolphin behavior), NMFS believes it is unlikely any animals would actually approach within the necessary distance undetected (10 m for sonar, 79–180 m for IEER) to be exposed to injurious levels. Of note, the directionality of the sonar dome is such that dolphins would not likely be exposed to injurious levels of sound while bow-riding. No mortalities from MFAS/HFAS or IEER were predicted.

Table 14 summarizes the best abundance estimates for the different dolphin stocks, except for the bottlenose dolphin, which is addressed below.

	Best Abundance Estimate	
	W. North Atlantic	**N. Gulf of Mexico**
Rough-toothed dolphin	no estimate available	2223
Pantropical spotted dolphin	4439	91321
Atlantic spotted dolphin	50978	30947
Spinner dolphin	no estimate available	11971
Clymene dolphin	6086	17355
Striped dolphin	94462	6505
Common dolphin	120743	no estimate available
Fraser's dolphin	N/A	726
Risso's dolphin	20479	2169
Atlantic white-sided dolphin	51640	N/A
White-beaked dolphin	no estimate available	no estimate available

Table 14. Best abundance estimates for dolphins (except bottlenose, which are addressed separately in narrative.)

The western North Atlantic includes both coastal and offshore bottlenose dolphin stocks. The best estimate for the western North Atlantic coastal stock of bottlenose dolphins is 15,620 and the best estimate for the western North Atlantic offshore stock of bottlenose dolphins is 81,588 (Waring *et al.*, 2007). Torres *et al.* (2003) found that the offshore morphotype was found exclusively seaward of 34 km (18 NM) and in waters deeper than 34 m, though more recent studies have sampled offshore animals as close as 7.3 km (4 NM) from shore in water depths of 13 m (43 ft) (Garrison *et al.*, 2003). Due to the apparent mixing of the coastal and offshore stocks of bottlenose dolphins along the Atlantic coast it is impossible to estimate the percentage of each stock potentially exposed to sonar from AFAST. The general distribution of AFAST training activities suggests that the majority of estimated exposures to bottlenose dolphins will be to the offshore stock, however some small proportion of exposures will likely apply to the coastal stock as well.

In the northern GOMEX, the stocks of concern include the continental shelf and oceanic stocks. The continental shelf stock is thought to overlap with both the oceanic stock as well as coastal stocks in some areas (Waring *et al.*, 2007); however, the coastal stock is generally limited to less than 20 m (66 ft) water depths and therefore is not expected to be exposed to sonar from AFAST. The best abundance estimate for the continental shelf stock is 25,320 (Waring *et al.*, 2007), The estimated abundance for bottlenose dolphins in oceanic waters, pooled from 1996 to 2001, is 2,239 (Mullin and Fulling, 2004). The oceanic stock is provisionally defined for bottlenose dolphins inhabiting waters greater than 200 m (656 ft) (Waring *et al.*, 2007). While the two stocks may overlap to some degree the Navy estimates, based on the distribution of AFAST activities, that most of the predicted exposures will occur to the oceanic stock with the few remaining exposures applying to the continental stock.

Harbor Porpoises

Acoustic analysis indicates that up to 153,481 exposures of harbor porpoises to sound levels likely to result in Level B harassment may occur. This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. Of note, the Level B harassment threshold for harbor porpoises is 120 dB rms, i.e. any animal exposed above that level is considered to be taken, which means that the vast majority of the estimated takes will occur at relatively low levels (120–140 dB). Although 11 of the modeled Level B Harassment takes for all of these species were predicted to be in the form of TTS, NMFS believes it is unlikely that any of the individuals estimated will incur TTS because of the distance within which they would have to approach the sonar source (depending on conditions, within a range of 275–500 m for the most powerful source), the fact that many animals will likely avoid sonar sources to some degree, and the likelihood that Navy monitors would detect these animals prior to an approach within this distance and implement sonar powerdown or shutdown. Navy lookouts will likely detect a group of harbor porpoises out to 914 m (1,000 yd) given their relatively short dives and large average group size.

Acoustic analysis predicts that no harbor porpoises will be exposed to sound levels or explosive detonations likely to result either in Level A harassment or mortality. No areas of specific importance for reproduction or feeding for harbor porpoises have been identified in the AFAST Study Area. The best abundance estimate for the Gulf of Maine/Bay of Fundy stock of harbor porpoises is 89,700 individuals.

Pinnipeds

The acoustic analysis predicts that the following numbers of behavioral harassments of the associated species will occur: 7,859 (gray seal), 12,659 (harbor seal), 15,718 (hooded seal), and 11,002 (harp seal). This estimate represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. A small number (31, 29, 62, and 43, respectively) of the modeled Level B Harassment takes for these species were predicted to be in the form of TTS. Because the TTS threshold for these species is lower than for cetaceans (i.e., the distance from the source at which they might incur TTS is larger) and because they are typically more difficult to detect, NMFS concurs with the Navy that up to the indicated number of pinnipeds could be exposed to levels of sonar associated with TTS. As mentioned above and indicated in Table 13, some pinniped vocalizations might overlap with the MFAS/HFAS TTS frequency range (2–20 kHz); however, as noted previously, NMFS does not anticipate TTS of a long duration or severe degree to occur as a result of exposure to MFA/HFAS.

No areas of specific importance for reproduction or feeding for pinnipeds have been identified in the AFAST Study Area. Acoustic analysis predicts that no pinnipeds will be exposed to sound levels or explosive detonations likely to result in Level A harassment or mortality. Best estimates for the north Atlantic for the hooded and harp seals are, respectively, 592,100 and 5.9 million. The best estimate for the western north Atlantic stock of the harbor seal is 99,340. There is no current best estimate for gray seals in the north Atlantic, though Canada's DFO estimated 99,340 in 1995.

Preliminary Determination

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat and dependent upon the implementation of the mitigation and monitoring measures, NMFS preliminarily finds that the total taking from Navy training exercises utilizing MFAS/HFAS and underwater explosives (IEER) in the AFAST Study Area will have a negligible impact on the affected species or stocks. NMFS has proposed regulations for these exercises that prescribe the means of affecting the least practicable adverse impact on marine mammals and their habitat and set forth requirements pertaining to the monitoring and reporting of that taking.

Subsistence Harvest of Marine Mammals

NMFS has preliminarily determined that the issuance of 5-yr regulations and subsequent LOAs for Navy training exercises in the AFAST Study Area would not have an unmitigable adverse impact on the availability of the affected species or stocks for subsistence use, since there are no such uses in the specified area.

ESA

There are six marine mammal species and six sea turtle species that are listed as endangered under the ESA with confirmed or possible occurrence in the study area: humpback whale, North Atlantic right whale, sei whale, fin whale, blue whale, sperm whale, loggerhead sea turtle, the green sea turtle, hawksbill sea turtle, leatherback sea turtle, the Kemp's ridley sea turtle, and the olive ridley sea turtle. The Navy has begun consultation with NMFS pursuant to section 7 of the ESA, and NMFS will also consult internally on the issuance of an LOA under section 101(a)(5)(A) of the MMPA for AFAST activities. Consultation will be concluded prior to a determination on the issuance of the final rule and an LOA.

NEPA

NMFS has participated as a cooperating agency on the Navy's Draft Environmental Impact Statement (DEIS) for AFAST, which was published on February 15, 2008. The Navy's DEIS is posted on NMFS's website: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*. NMFS intends to adopt the Navy's Final EIS (FEIS), if adequate and appropriate. Currently, we believe that the adoption of the Navy's FEIS will allow NMFS to meet its responsibilities under NEPA for the issuance of an LOA for AFAST. If the Navy's FEIS is deemed not to be adequate, NMFS would supplement the existing analysis and document to ensure that we comply with NEPA prior to the issuance of the final rule or LOA.

Classification

This action does not contain a collection of information requirement for purposes of the Paperwork Reduction Act.

Pursuant to the procedures established to implement section 6 of Executive Order 12866, the Office of Management and Budget has determined that this proposed rule is significant.

Pursuant to the Regulatory Flexibility Act, the Chief Counsel for Regulation of the Department of Commerce has certified to the Chief Counsel for Advocacy of the Small Business Administration that this rule, if adopted, would not have a significant economic impact on a substantial number of small entities. The Regulatory Flexibility Act requires Federal agencies to prepare an analysis of a rule's impact on small entities whenever the agency is required to publish a notice of proposed rulemaking. However, a Federal agency may certify, pursuant to 5 U.S.C. section 605(b), that the action will not have a significant economic impact on a substantial number of small entities. The Navy is the entity that will be affected by this rulemaking, not a small governmental jurisdiction, small organization or small business, as defined by the Regulatory Flexibility Act. Any requirements imposed by a

Letter of Authorization issued pursuant to these regulations, and any monitoring or reporting requirements imposed by these regulations, will be applicable only to the Navy. Because this action, if adopted, would directly affect the Navy and not a small entity, NMFS concludes the action would not result in a significant economic impact on a substantial number of small entities.

Dated: September 25, 2008.

James Balsiger,

Acting Assistant Administrator for Fisheries, National Marine Fisheries Service.

For reasons set forth in the preamble, 50 CFR part 216 is proposed to be amended as follows:

PART 216—REGULATIONS GOVERNING THE TAKING AND IMPORTING OF MARINE MAMMALS

1. The authority citation for part 216 continues to read as follows:

Authority: 16 U.S.C. 1361 *et seq.*

2. Subpart V is added to part 216 to read as follows:

Subpart V—Taking Marine Mammals Incidental to U.S. Navy's Atlantic Fleet Active Sonar Training (AFAST)

Subpart V—Taking Marine Mammals Incidental to U.S. Navy's Atlantic Fleet Active Sonar Training (AFAST)

§ 216.240 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to the U.S. Navy for the taking of marine mammals that occurs in the area outlined in paragraph (b) of this section and that occur incidental to the activities described in paragraph (c) of this section.

(b) The taking of marine mammals by the Navy is only authorized if it occurs within the AFAST Study Area, which extends east from the Atlantic Coast of the U.S. to 45 degrees W. long. and south from the Atlantic and Gulf of Mexico Coasts to approximately 23 degrees N. lat., excluding the Bahamas (see Figure 1–1 in the Navy's Application).

(c) The taking of marine mammals by the Navy is only authorized if it occurs incidental to the use of the following mid-frequency active sonar (MFAS) sources, high frequency active sonar (HFAS) sources, or explosive sonobuoys for U.S. Navy anti-submarine warfare (ASW), mine warfare (MIW) training, maintenance, or research, development, testing, and evaluation (RDT&E) in the amounts indicated below (+/−10 percent):

(1) AN/SQS–53 (hull-mounted sonar)—up to 16,070 hours over the course of 5 years (an average of 3,214 hours per year).

(2) AN/SQS–56 (hull-mounted sonar)—up to 8,420 hours over the course of 5 years (an average of 1,684 hours per year).

(3) AN/SQS–56 or 53 (hull mounted sonar in object detection mode)—up to 1,080 hours over the course of 5 years (an average of 216 hours per year).

(4) AN/BQQ–10 or 5 (submarine sonar)—up to 49,880 pings over the course of 5 years (an average of 9,976 pings per year)(an average of 1 ping per two hours during training events, 60 pings per hour for maintenance).

(5) AN/AQS–22 or 13 (helicopter dipping sonar)—up to 14,760 dips over the course of 5 years (an average of 2,952 dips per year—10 pings per five-minute dip).

(6) SSQ–62 (Directional Command Activated Sonobuoy System (DICASS) sonobuoys)—up to 29,265 sonobuoys over the course of 5 years (an average of 5,853 sonobuoys per year).

(7) MK–48 (heavyweight torpedoes)—up to 160 torpedoes over the course of 5 years (an average of 32 torpedoes per year).

(8) MK–46 or 54 (lightweight torpedoes)—up to 120 torpedoes over the course of 5 years (an average of 24 torpedoes per year).

(9) AN/SSQ–110A (IEER explosive sonobuoy)—up to 4,360 sonobuoys over the course of 5 years (an average of 872 buoys per year).

(10) AN/SQQ–32 (over the side mine-hunting sonar)—up to 22,370 hours over the course of 5 years (an average of 4,474 hours per year).

(11) AN/SLQ–25 (NIXIE—towed countermeasure)—up to 1,660 hours over the course of 5 years (an average of 332 hours per year).

(12) AN/BQS–15 (submarine navigation)—up to 2,250 hours over the course of 5 years (an average of 450 hours per year)

(13) MK–1 or 2 or 3 or 4 (Submarine-fired Acoustic Device Countermeasure (ADC))—up to 1,125 ADCs over the course of 5 years (an average of 225 ADCs per year)

(14) Noise Acoustic Emitters (NAE—Sub-fired countermeasure)—up to 635 NAEs over the course of 5 years (an average of 127 NAEs per year)

§ 216.241 Definitions.

The following definitions are utilized in these regulations:

(a) *Uncommon Stranding Event (USE)*—A stranding event that takes place during a major training exercise (MTE) and involves any one of the following:

(1) Two or more individuals of any cetacean species (not including mother/calf pairs, unless of species of concern listed in next bullet) found dead or live on shore within a two-day period and occurring within 30 miles of one another.

(2) A single individual or mother/calf pair of any of the following marine mammals of concern: beaked whale of any species, dwarf or pygmy sperm whales, melon-headed whales, pilot whales, right whales, humpback whales, sperm whales, blue whales, fin whales, or sei whales.

(3) A group of 2 or more cetaceans of any species exhibiting indicators of distress.

(b) *Shutdown*—The cessation of MFAS/HFAS operation or detonation of explosives within 14 nm (Atlantic Ocean) or 17 nm (Gulf of Mexico) of any live, in the water, animal involved in a USE.

(c) *Exhibiting Indicators of Distress*—Animals exhibiting an uncommon combination of behavioral and physiological indicators typically associated with distressed or stranded animals. This situation would be identified by a qualified individual and typically includes, but is not limited to, some combination of the following characteristics:

(1) Marine mammals continually circling or moving haphazardly in a tightly packed group—with or without a member occasionally breaking away and swimming towards the beach.

(2) Abnormal respirations including increased or decreased rate or volume of breathing, abnormal content or odor.

(3) Presence of an individual or group of a species that has not historically been seen in a particular habitat, for example a pelagic species in a shallow bay when historic records indicate that it is a rare event.

(4) Abnormal behavior for that species, such as abnormal surfacing or

swimming pattern, listing, and abnormal appearance.

(d) *Major Training Exercise*—MTEs, within the context of the AFAST Stranding Plan, include:

(1) Southeastern Integrated Training Initiative (SEASWITI)—4 events annually, 5 to 7 days per entire event.

(2) Integrated ASW Course (IAC)—5 events annually, 2 to 5 days per entire event.

(3) Group Sails—20 events annually, 2 to 3 days per entire event.

(4) Composite Training Unit Exercise (COMPTUEX)—5 events annually, 21 days per entire event.

(5) Joint Task Force Exercise (JTFEX)—2 events annually, 10 days per entire event.

It should be noted that sonar is typically not in use throughout an entire event.

§ 216.242 Permissible methods of taking.

(a) Under Letters of Authorization issued pursuant to §§ 216.106 and 216.247, the Holder of the Letter of Authorization (hereinafter ''Navy'') may incidentally, but not intentionally, take marine mammals within the area described in § 216.240(b), provided the activity is in compliance with all terms, conditions, and requirements of these regulations and the appropriate Letter of Authorization.

(b) The activities identified in § 216.240(c) must be conducted in a manner that minimizes, to the greatest extent practicable, any adverse impacts on marine mammals and their habitat.

(c) The incidental take of marine mammals under the activities identified in § 216.240(c) is limited to the following species, by the indicated method of take and the indicated number of times (estimated based on the authorized amounts of sound source operation):

(1) Level B Harassment (+/−10 percent of the take estimate indicated below):

(i) Mysticetes:

(A) North Atlantic right whale (*Eubalaena glacialis*)—666.

(B) Humpback whale (*Megaptera novaeangliae*)—4,198.

(C) Minke whale (*Balaenoptera acutorostrata*)—414.

(D) Sei whale (*Balaenoptera borealis*)—1,054.

(E) Fin whale (*Balaenoptera physalus*)—881.

(F) Blue whale (*Balaenoptera musculus*)—801.

(F) Bryde's whale (*Balaenoptera edeni*)—34.

(ii) Odontocetes:

(A) Sperm whales (*Physeter macrocephalus*)—9,741.

(B) Pygmy or dwarf sperm whales (*Kogia breviceps* or *Kogia sima*)—4,384.

(C) Beaked Whales (Cuvier's, True's, Gervais', Sowerby's, Blainville's, Northern bottlenose whale) (*Ziphius cavirostris, Mesoplodon mirus, M. europaeus, M. bidens, M. densirostris*, Hyperoodon ampullatus)—2665.

(D) Rough-toothed dolphin (*Steno bredanensis*)—2705.

(E) Bottlenose dolphin (*Tursiops truncatus*)—605530.

(F) Pan-tropical dolphin (*Stenella attenuata*)—138394.

(G) Atlantic spotted dolphin (*Stenella frontalis*)—376070.

(H) Spinner dolphin (*Stenella longirostris*)—21147.

(I) Clymene dolphin (*Stenella clymene*)—45823.

(J) Striped dolphin (*Stenella coeruleoalba*)—174583.

(K) Common dolphin (*Delphinus spp.*)—96409.

(L) Fraser's dolphin (*Lagenodelphis hosei*)—320.

(M) Risso's dolphin (*Grampus griseus*)—94001.

(N) Atlantic white-sided dolphin (*Lagenorhynchus acutus*)—20647.

(O) White-beaked dolphin (*Lagenorhynchus albirostris*)—26243.

(P) Melon-headed whale (*Peponocephala electra*)—1533.

(Q) Pygmy killer whale (*Feresa attenuata*)—263.

(R) False killer whale (*Pseudorca crassidens*)—502.

(S) Killer whale (*Orcinus orca*)—499.

(T) Pilot whales (Short-finned pilot or long-finned) (*Globicephala macrorynchus* or *G. melas*)—127266.

(U) Harbor porpoise (*Phocoena phocoena*)—153481.

(iii) Pinnipeds:

(A) Gray seal (*Halichoerus grypus*)—7859.

(B) Harbor seal (*Phoca vitulina*)—12659.

(C) Hooded seal (*Cystophora cristata*)—15718.

(D) Harp seal (*Pagophilus groenlandica*)—11002.

(2) Level A Harassment and/or mortality of no more than 10 beaked whales (total), of any of the species listed in § 216.242(c)(1)(ii)(C) over the course of the 5-year regulations.

§ 216.243 Prohibitions.

No person in connection with the activities described in § 216.240 may:

(a) Take any marine mammal not specified in § 216.242(c);

(b) Take any marine mammal specified in § 216.242(c) other than by incidental take as specified in § 216.242(c)(1) and (2);

(c) Take a marine mammal specified in § 216.242(c) if such taking results in more than a negligible impact on the species or stocks of such marine mammal; or

(d) Violate, or fail to comply with, the terms, conditions, and requirements of these regulations or a Letter of Authorization issued under §§ 216.106 and 216.247.

§ 216.244 Mitigation.

(a) The activity identified in § 216.240(a) must be conducted in a manner that minimizes, to the greatest extent practicable, adverse impacts on marine mammals and their habitats.

(b) When conducting training, maintenance, or RDT&E activities and operating the sound sources identified in § 216.240(a), the mitigation measures contained in the Letter of Authorization issued under §§ 216.106 and 216.247 must be implemented. These mitigation measures include (but are not limited to):

(1) Mitigation Measures for ASW and MIW training:

(i) All lookouts onboard platforms involved in ASW training events shall review the NMFS-approved Marine Species Awareness Training (MSAT) material prior to use of midfrequency active sonar.

(ii) All Commanding Officers, Executive Officers, and officers standing watch on the Bridge shall review the MSAT material prior to a training event employing the use of mid- or high frequency active sonar.

(iii) Navy lookouts shall undertake extensive training in order to qualify as a watchstander in accordance with the Lookout Training Handbook (NAVEDTRA, 12968–B).

(iv) Lookout training shall include on-the-job instruction under the supervision of a qualified, experienced watchstander. Following successful completion of this supervised training period, Lookouts shall complete the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects).

(v) Lookouts shall be trained in the most effective means to ensure quick and effective communication within the command structure in order to facilitate implementation of mitigation measures if marine mammals are spotted.

(vi) On the bridge of surface ships, there shall always be at least three people on watch whose duties include observing the water surface around the vessel.

(vii) All surface ships participating in ASW exercises shall, in addition to the three personnel on watch noted previously, have at all times during the exercise at least two additional personnel on watch as lookouts.

(viii) Personnel on lookout and officers on watch on the bridge shall have at least one set of binoculars available for each person to aid in the detection of marine mammals.

(ix) On surface vessels equipped with mid-frequency active sonar, pedestal mounted ''Big Eye'' (20x110) binoculars shall be present and in good working order.

(x) Personnel on lookout shall employ visual search procedures employing a scanning methodology in accordance with the Lookout Training Handbook (NAVEDTRA 12968–B). Surface lookouts would scan the water from the ship to the horizon and be responsible for all contacts in their sector. In searching the assigned sector, the lookout would always start at the forward part of the sector and search aft (toward the back). To search and scan, the lookout would hold the binoculars steady so the horizon is in the top third of the field of vision and direct the eyes just below the horizon. The lookout would scan for approximately five seconds in as many small steps as possible across the field seen through the binoculars. They would search the entire sector in approximately five-degree steps, pausing between steps for approximately five seconds to scan the field of view. At the end of the sector search, the glasses should be lowered to allow the eyes to rest for a few seconds, and then the lookout would search back across the sector with the naked eye.

(xi) After sunset and prior to sunrise, lookouts shall employ Night Lookouts Techniques in accordance with the Lookout Training Handbook. At night, lookouts would not sweep the horizon with their eyes because this method is not effective when vessel is moving. Lookouts would scan the horizon in a series of movements that should allow their eyes to come to periodic rests as they scan the sector. When visually searching at night, they should look a little to one side and out of the corners of their eyes, paying attention to the things on the outer edges of their field of vision.

(xii) Personnel on lookout shall be responsible for reporting all objects or anomalies sighted in the water (regardless of the distance from the vessel) to the Officer of the Deck, since any object or disturbance (e.g., trash, periscope, surface disturbance, discoloration) in the water may be indicative of a threat to the vessel and its crew or indicative of a marine species that may need to be avoided as warranted.

(xiii) Commanding Officers shall make use of marine mammal detection cues and information to limit interaction with marine mammals to the maximum extent possible consistent with safety of the ship.

(xiv) All personnel engaged in passive acoustic sonar operation (including aircraft, surface ships, or submarines) shall monitor for marine mammal vocalizations and report the detection of any marine mammal to the appropriate watch station for dissemination and appropriate action.

(xv) Units shall use training lookouts to survey for marine mammals prior to commencement and during the use of active sonar.

(xvi) During operations involving sonar, personnel shall utilize all available sensor and optical systems (such as Night Vision Goggles) to aid in the detection of marine mammals.

(xvii) Navy aircraft participating in exercises at sea shall conduct and maintain, when operationally feasible and safe, surveillance for marine mammals as long as it does not violate safety constraints or interfere with the accomplishment of primary operational duties.

(xviii) Aircraft with deployed sonobuoys shall use only the passive capability of sonobuoys when marine mammals are detected within 200 yards (182 m) of the sonobuoy.

(xix) Marine mammal detections shall be reported immediately to assigned Aircraft Control Unit (if participating) for further dissemination to ships in the vicinity of the marine mammals. This action would occur when it is reasonable to conclude that the course of the ship will likely close the distance between the ship and the detected marine mammal.

(xx) Safety Zones—When marine mammals are detected by any means (aircraft, shipboard lookout, or acoustically) the Navy shall ensure that sonar transmission levels are limited to at least 6 dB below normal operating levels if any detected marine mammals are within 1000 yards (914 m) of the sonar dome (the bow).

(A) Ships and submarines shall continue to limit maximum transmission levels by this 6-dB factor until the marine mammal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards (1828 m) beyond the location of the last detection.

(B) Should a marine mammal be detected within or closing to inside 457 m (500 yd) of the sonar dome, active sonar transmissions would be limited to at least 10 dB below the equipment's normal operating level. Ships and submarines shall continue to limit maximum ping levels by this 10-dB factor until the marine mammal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2000 yards (1828 m) beyond the location of the last detection.

(C) Should the marine mammal be detected within or closing to inside 183 m (200 yd) of the sonar dome, active sonar transmissions would cease. Sonar shall not resume until the marine mammal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards (1828 m) beyond the location of the last detection.

(D) If the need for power-down should arise as detailed in ''Safety Zones'' above, Navy shall follow the requirements as though they were operating at 235 dB—the normal operating level (i.e., the first power-down shall be to 229 dB, regardless of at what level above 235 sonar was being operated).

(xxi) Prior to start up or restart of active sonar, operators shall check that the Safety Zone radius around the sound source is clear of marine mammals.

(xxii) Sonar levels (generally)—The Navy shall operate sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives.

(xxiii) Helicopters shall observe/survey the vicinity of an ASW Operation for 10 minutes before the first deployment of active (dipping) sonar in the water.

(xxiv) Helicopters shall not dip their sonar within 200 yards (183 m) of a marine mammal and shall cease pinging if a marine mammal closes within 200 yards (183 m) after pinging has begun.

(xxv) Submarine sonar operators shall review detection indicators of close-aboard marine mammals prior to the commencement of ASW training activities involving active sonar.

(xxvi) Dolphin bowriding—If, after conducting an initial maneuver to avoid close quarters with dolphins, the ship concludes that dolphins are deliberately closing in on the ship to ride the vessel's bow wave, no further mitigation actions would be necessary because dolphins are out of the main transmission axis of the active sonar while in the shallow-wave area of the vessel bow.

(xxvii) TORPEXs conducted in the northeast North Atlantic right whale critical habitat (as designated in 50 CFR Part 226) shall implement the below measures.

(A) All torpedo-firing operations shall take place during daylight hours.

(B) During the conduct of each test, visual surveys of the test area shall be conducted by all vessels and aircraft involved in the exercise to detect the presence of marine mammals. Additionally, trained observers shall be placed on the submarine, spotter aircraft, and the surface support vessel. All participants shall report sightings of any marine mammals, including negative reports, prior to torpedo firings. Reporting requirements shall be outlined in the test plans and procedures written for each individual exercise, and shall be emphasized as part of pre-exercise briefings conducted with all participants.

(C) Observers shall receive NMFS-approved training in field identification, distribution, and relevant behaviors of marine mammals of the western north Atlantic. Observers shall fill out Standard Sighting Forms and the data shall be housed at the Naval Undersea Warfare Center Division Newport (NUWCDIVNPT). Any sightings of North Atlantic right whales shall be immediately communicated to the Sighting Advisory System (SAS). All platforms shall have onboard a copy of:

(*1*) The Guide to Marine Mammals and Turtles of the US Atlantic and Gulf of Mexico (Wynne and Schwartz 1999).

(*2*) The NMFS Critical Sightings Program placard.

(*3*) Right Whales, Guidelines to Mariners placard.

(D) In addition to the visual surveillance discussed above, dedicated aerial surveys shall be conducted utilizing a fixed-wing aircraft. An aircraft with an overhead wing (i.e., Cessna Skymaster or similar) shall be used to facilitate a clear view of the test area. Two trained observers, in addition to the pilot, shall be embarked on the aircraft. Surveys shall be conducted at an approximate altitude of 1000 ft (305 m) flying parallel track lines at a separation of 1 nmi (1.85 km), or as necessary to facilitate good visual coverage of the sea surface. While conducting surveillance, the aircraft shall maintain an approximate speed of 100 knots (185 km/hr). Since factors that affect visibility are highly dependent on the specific time of day of the survey, the flight operator will have the flexibility to adjust the flight pattern to reduce glare and improve visibility. The entire test site shall be surveyed initially, but once preparations are being made for an actual test launch, survey effort shall be concentrated over the vicinity of the individual test location. Further, for approximately ten minutes immediately prior to launch, the aircraft shall racetrack back and forth between the launch vessel and the target vessel.

(E) Commencement of an individual torpedo test scenario shall not occur until observers from all vessels and aircraft involved in the exercise have reported to the Officer in Tactical Command (OTC) and the OTC has declared that the range is clear of marine mammals. Should marine mammals be present within or seen moving toward the test area, the test shall be either delayed or moved as required to avoid interference with the animals.

(F) The TORPEX shall be suspended if the Beaufort Sea State exceeds 3 or if visibility precludes safe operations.

(G) Vessel speeds:

(*1*) During transit through the northeastern North Atlantic right whale critical habitat, surface vessels and submarines shall maintain a speed of no more than 10 knots (19 km/hr) while not actively engaged in the exercise procedures.

(*2*) During TORPEX operations, a firing vessel should, where feasible, not exceed 10 knots. When a submarine is used as a target, vessel speeds should, where feasible, not exceed 18 knots. However, on occasion, when surface vessels are used as targets, the vessel may exceed 18 kts in order to fully test the functionality of the torpedoes. This increased speed would occur for a short period of time (e.g., 10–15 minutes) to evade the torpedo when fired upon.

(H) In the event of an animal strike, or if an animal is discovered that appears to be in distress, the Navy shall immediately report the discovery through the appropriate Navy chain of Command.

(xxviii) The Navy shall abide by the following additional measures:

(A) The Navy shall avoid planning major exercises in the specified planning awareness areas (PAAs—see Figure 2 of this Subpart) where feasible. Should national security require the conduct of more than four major exercises (C2X, JTFEX, SEASWITI, or similar scale event) in these areas (meaning all or a portion of the exercise) per year the Navy shall provide NMFS with prior notification and include the information in any associated after-action or monitoring reports.

(B) The Navy shall conduct no more than one of the four above-mentioned major exercises (COMPTUEX, JTFEX, SEASWITI or similar scale event) per year in the Gulf of Mexico to the extent operationally feasible. If national security needs require more than one major exercise to be conducted in the Gulf of Mexico PAAs, the Navy shall provide NMFS with prior notification and include the information in any associated after-action or monitoring reports.

(C) The Navy shall include the PAAs in the Navy's Protective Measures Assessment Protocol (PMAP) (implemented by the Navy for use in the protection of the marine environment) for unit level situational awareness (i.e., exercises other than COMPTUEX, JTFEX, SEASWITI) and planning purposes.

(D) Helicopter Dipping Sonar—Unless otherwise dictated by national security needs, the Navy shall minimize helicopter dipping sonar activities within the southeastern areas of North Atlantic right whale critical habitat (as designated in 50 CFR Part 226) from November 15–April 15.

(E) Object Detection Exercises—The Navy shall implement the following measures regarding object detection activities in the southeastern areas of the North Atlantic right whale critical habitat:

(*1*) The Navy shall reduce the time spent conducting object detection exercises in the NARW critical habitat;

(*2*) Prior to conducting surface ship object detection exercises in the southeastern areas of the North Atlantic right whale critical habitat during the time of November 15—April 15, ships shall contact FACSFACJAX to obtain the latest right whale sighting information. FACSFACJAX shall advise ships of all reported whale sightings in the vicinity of the critical habitat and associated areas of concern (which extend 9 km (5 NM) seaward of the designated critical habitat boundaries). To the extent operationally feasible, ships shall avoid conducting training in the vicinity of recently sighted right whales. Ships shall maneuver to maintain at least 500 yards separation from any observed whale, consistent with the safety of the ship.

(xxix) The Navy shall abide by the letter of the ''Stranding Response Plan for Major Navy Training Exercises in the AFAST Study Area'' (available at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*), to include the following measures:

(A) Shutdown Procedures—When an Uncommon Stranding Event (USE—defined in § 216.241) occurs during a Major Training Exercise (MTE, including SEASWITI, IAC, Group Sails, JTFEX, or COMPTUEX) in the AFAST Study Area, the Navy shall implement the procedures described below.

(*1*) The Navy shall implement a Shutdown (as defined § 216.241) when advised by a NMFS Office of Protected Resources Headquarters Senior Official designated in the AFAST Stranding

Communication Protocol that a USE involving live animals has been identified and that at least one live animal is located in the water. NMFS and Navy shall communicate, as needed, regarding the identification of the USE and the potential need to implement shutdown procedures.

(*2*) Any shutdown in a given area shall remain in effect in that area until NMFS advises the Navy that the subject(s) of the USE at that area die or are euthanized, or that all live animals involved in the USE at that area have left the area (either of their own volition or herded).

(*3*) If the Navy finds an injured or dead animal of any species other than North Atlantic right whale floating at sea during an MTE, the Navy shall notify NMFS immediately or as soon as operational security considerations allow. The Navy shall provide NMFS with species or description of the animal (s), the condition of the animal (s) including carcass condition if the animal(s) is/are dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available). Based on the information provided, NMFS shall determine if, and advise the Navy whether a modified shutdown is appropriate on a case-by-case basis.

(*4*) If the Navy finds an injured (or entangled) right whale floating at sea during an MTE, the Navy shall implement shutdown procedures (14 or 17 nm, as defined below) around the animal immediately (without waiting for notification from NMFS). The Navy shall then notify NMFS (pursuant to the AFAST Communication Protocol, which is still in development) immediately or as soon as operational security considerations allow. The Navy shall provide NMFS with species or description of the animal (s), the condition of the animal (s) including carcass condition if the animal(s) is/are dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available). Subsequent to the discovery of the injured whale, any Navy platforms in the area shall report any right whale sightings to NMFS (or to a contact that can alert NMFS as soon as possible). Based on the information provided, NMFS may initiate/organize an aerial survey (by requesting the Navy's assistance pursuant to the MOA (see (xxix)(C) below) or by other available means) to see if other right whales are in the vicinity. Based on the information provided by the Navy and, if necessary, the outcome of the aerial surveys, NMFS shall determine whether a continued shutdown is appropriate on a case-by-case basis. Though it will be determined on a case-by-case basis after Navy/NMFS discussion of the situation, NMFS anticipates that the shutdown will continue within 14 or 17 nm of a live, injured/entangled right whale until the animal dies or has not been seen for at least 3 hours (either by NMFS staff attending the injured animal or Navy personnel monitoring the area around where the animal was last sighted).

(*5*) If the Navy finds a dead right whale floating at sea during an MTE, the Navy shall notify NMFS (pursuant to AFAST Stranding Communication Protocol, which is still in development) immediately or as soon as operational security considerations allow. The Navy shall provide NMFS with species or description of the animal (s), the condition of the animal (s) including carcass condition if the animal(s) is/are dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available). Subsequent to the discovery of the dead whale, if the Navy is operating sonar in the area they shall use increased vigilance (in looking for right whales) and all platforms in the area shall report sightings of right whales to NMFS as soon as possible. Based on the information provided, NMFS may initiate/organize an aerial survey (by requesting the Navy's assistance pursuant to the memorandum of agreement (see (xxix)(C) below) or by other available means) to see if other right whales are in the vicinity. Based on the information provided by the Navy and, if necessary, the outcome of the aerial surveys, NMFS will determine whether any additional protective measures are necessary on a case-by-case basis.

(*6*) In the event, following a USE, that: (a) Qualified individuals are attempting to herd animals back out to the open ocean and animals are not willing to leave, or (b) animals are seen repeatedly heading for the open ocean but turning back to shore, NMFS and the Navy should coordinate (including an investigation of other potential anthropogenic stressors in the area) to determine if the proximity of MFAS/HFAS training activities or explosive detonations, though farther than 14 or 17 nm from the distressed animal(s), is likely decreasing the likelihood that the animals return to the open water. If so, NMFS and the Navy shall further coordinate to determine what measures are necessary to further minimize that likelihood and implement those measures as appropriate.

(B) Within 72 hours of NMFS notifying the Navy of the presence of a USE, the Navy shall provide available information to NMFS (per the AFAST Communication Protocol) regarding the location, number and types of acoustic/explosive sources, direction and speed of units using MFAS/HFAS, and marine mammal sightings information associated with training activities occurring within 80 nm (148 km) and 72 hours prior to the USE event. Information not initially available regarding the 80 nm (148 km), 72 hours, period prior to the event shall be provided as soon as it becomes available. The Navy shall provide NMFS investigative teams with additional relevant unclassified information as requested, if available.

(C) Memorandum of Agreement (MOA)—The Navy and NMFS shall develop an MOA, or other mechanism consistent with federal fiscal law requirements (and all other applicable laws), that allows the Navy to assist NMFS with the Phase 1 and 2 Investigations of USEs through the provision of in-kind services, such as (but not limited to) the use of plane/boat/truck for transport of personnel involved in the stranding response or investigation or animals, use of Navy property for necropsies or burial, or assistance with aerial surveys to discern the extent of a USE. The Navy may assist NMFS with the Investigations by providing one or more of the in-kind services outlined in the MOA, when available and logistically feasible and when the assistance does not negatively affect Fleet operational commitments.

(2) Mitigation for IEER—The following are protective measures for use with Extended Echo Ranging/Improved Extended Echo Ranging (EER/IEER) given an explosive source generates the acoustic wave used in this sonobuoy.

(i) Navy crews shall conduct visual reconnaissance of the drop area prior to laying their intended sonobuoy pattern. This search should be conducted below 500 yards (457 m) at a slow speed, if operationally feasible and weather conditions permit. In dual aircraft training activities, crews are allowed to conduct coordinated area clearances.

(ii) Navy crews shall conduct a minimum of 30 minutes of visual and acoustic monitoring of the search area prior to commanding the first post detonation. This 30-minute observation period may include pattern deployment time.

(iii) For any part of the briefed pattern where a post (source/receiver sonobuoy pair) will be deployed within 1,000 yards (914 m) of observed marine mammal activity, deploy the receiver ONLY and monitor while conducting a visual search. When marine mammals are no longer detected within 1,000 yards (914 m) of the intended post position, co-locate the explosive source sonobuoy (AN/SSQ–110A) (source) with the receiver.

(iv) When able, Navy crews shall conduct continuous visual and aural monitoring of marine mammal activity. This is to include monitoring of own-aircraft sensors from first sensor placement to checking off station and out of communication range of these sensors.

(v) Aural Detection: If the presence of marine mammals is detected aurally, then that should cue the aircrew to increase the diligence of their visual surveillance. Subsequently, if no marine mammals are visually detected, then the Navy crew may continue multi-static active search.

(vi) Visual Detection:

(A) If marine mammals are visually detected within 1,000 yards (914 m) of the explosive source sonobuoy (AN/SSQ–110A) intended for use, then that payload shall not be detonated.

(B) Navy Aircrews may utilize this post once the marine mammals have not been re-sighted for 30 minutes, or are observed to have moved outside the 1,000 yards (914 m) safety buffer.

(C) Navy Aircrews may shift their multi-static active search to another post, where marine mammals are outside the 1,000 yards (914 m) safety buffer.

(vii) Navy Aircrews shall make every attempt to manually detonate the unexploded charges at each post in the pattern prior to departing the operations area by using the ''Payload 1 Release'' command followed by the ''Payload 2 Release'' command. Aircrews shall refrain from using the ''Scuttle'' command when two payloads remain at a given post. Aircrews shall ensure that a 1,000 yard (914 m) safety buffer, visually clear of marine mammals, is maintained around each post as is done during active search operations.

(viii) Navy Aircrews shall only leave posts with unexploded charges in the event of a sonobuoy malfunction, an aircraft system malfunction, or when an aircraft must immediately depart the area due to issues such as fuel constraints, inclement weather, and in-flight emergencies. In these cases, the sonobuoy will self-scuttle using the secondary or tertiary method.

(ix) The navy shall ensure all payloads are accounted for. Explosive source sonobuoys (AN/SSQ–110A) that cannot be scuttled shall be reported as unexploded ordnance via voice communications while airborne, then upon landing via naval message.

(x) Mammal monitoring shall continue until out of own-aircraft sensor range.

(3) Protective Measures related to Vessel Transit and North Atlantic Right Whales.

(i) Mid-Atlantic, Offshore of the Eastern United States.

(A) All Navy vessels are required to use extreme caution and operate at a slow, safe speed consistent with mission and safety during the months indicated below and within a 37 km (20 nm) arc (except as noted) of the specified associated reference points:

(*1*) South and East of Block Island (37 km (20 NM) seaward of line between 41–4.49 N. lat. 071–51.15 W. long. and 41–18.58 N. lat. 070–50.23 W. long): Sept–Oct and Mar–Apr.

(*2*) New York / New Jersey (40–30.64 N. lat. 073–57.76 W. long.): Sep–Oct and Feb–Apr.

(*3*) Delaware Bay (Philadelphia) (38–52.13 N. lat. 075–1.93 W. long.): Oct–Dec and Feb–Mar.

(*4*) Chesapeake Bay (Hampton Roads and Baltimore) (37–1.11 . lat. 075–57.56 W. long.): Nov–Dec and Feb–Apr.

(*5*) North Carolina (34–41.54 N. lat. 076–40.20 W. long.): Dec–Apr.

(*6*) South Carolina (33–11.84 N. lat. 079–8.99 W. long. and 32–43.39 N. lat. 079–48.72 W. long.): Oct–Apr.

(B) During the months indicated in (A), above, Navy vessels shall practice increased vigilance with respect to avoidance of vessel-whale interactions along the mid-Atlantic coast, including transits to and from any mid-Atlantic ports not specifically identified above.

(C) All surface units transiting within 56 km (30 NM) of the coast in the mid-Atlantic shall ensure at least two watchstanders are posted, including at least one lookout who has completed required MSAT training.

(D) Navy vessels shall not knowingly approach any whale head on and shall maneuver to keep at least 457 m (1,500 ft) away from any observed whale, consistent with vessel safety.

(ii) Southeast Atlantic, Offshore of the Eastern United States—for the purposes of the measures below (within (ii)), the ''southeast'' encompasses sea space from Charleston, South Carolina, southward to Sebastian Inlet, Florida, and from the coast seaward to 148 km (80 NM) from shore. North Atlantic right whale critical habitat is the area from 31–15 N. lat. to 30–15 N. lat. extending from the coast out to 28 km (15 NM), and the area from 28–00 N. lat. to 30–15 N. lat. from the coast out to 9 km (5 NM). All mitigation measures described here that apply to the critical habitat also apply to an associated area of concern which extends 9 km (5 NM) seaward of the designated critical habitat boundaries.

(A) Prior to transiting or training in the critical habitat or associated area of concern, ships shall contact Fleet Area Control and Surveillance Facility, Jacksonville, to obtain latest whale sighting and other information needed to make informed decisions regarding safe speed and path of intended movement. Subs shall contact Commander, Submarine Group Ten for similar information.

(B) The following specific mitigation measures apply to activities occurring within the critical habitat and an associated area of concern which extends 9 km (5 NM) seaward of the designated critical habitat boundaries:

(*1*) When transiting within the critical habitat or associated area of concern, vessels shall exercise extreme caution and proceed at a slow safe speed. The speed shall be the slowest safe speed that is consistent with mission, training and operations.

(*2*) Speed reductions (adjustments) are required when a whale is sighted by a vessel or when the vessel is within 9 km (5 NM) of a reported new sighting less then 12 hours old.

(*3*) Additionally, circumstances could arise where, in order to avoid North Atlantic right whale(s), speed reductions could mean vessel must reduce speed to a minimum at which it can safely keep on course or vessels could come to an all stop.

(*4*) Vessels shall avoid head-on approaches to North Atlantic right whale(s) and shall maneuver to maintain at least 457 m (500 yd) of separation from any observed whale if deemed safe to do so. These requirements do not apply if a vessel's safety is threatened, such as when a change of course would create an imminent and serious threat to a person, vessel, or aircraft, and to the extent vessels are restricted in the ability to maneuver.

(*5*) Ships shall not transit through the critical habitat or associated area of concern in a North-South direction.

(*6*) Ships, surfaced subs, and aircraft shall report any whale sightings to Fleet Area Control and Surveillance Facility, Jacksonville, by the most convenient and fastest means. The sighting report shall include the time, latitude/longitude, direction of movement and number and description of whale (i.e., adult/calf).

(iii) Northeast Atlantic, Offshore of the Eastern United States

(A) Prior to transiting the Great South Channel or Cape Cod Bay critical habitat areas, ships shall obtain the latest right whale sightings and other information needed to make informed decisions regarding safe speed. The Great South

Channel critical habitat is defined by the following coordinates: 41–00 N. lat., 69–05 W. long.; 41–45 N. lat, 69–45 W. long; 42–10 N. lat., 68–31 W. long.; 41–38 N. lat., 68–13 W. long.. The Cape Cod Bay critical habitat is defined by the following coordinates: 42–04.8 N. lat., 70–10 W. long.; 42–12 N. lat., 70–15 W. long.; 42–12 N. lat., 70–30 W. long.; 41–46.8 N. lat., 70–30 W. long.

(B) Ships, surfaced subs, and aircraft shall report any North Atlantic right whale sightings (if the whale is identifiable as a right whale) off the northeastern U.S. to Patrol and Reconnaissance Wing (COMPATRECONWING). The report shall include the time of sighting, lat/long, direction of movement (if apparent) and number and description of the whale(s).

(C) Vessels or aircraft that observe whale carcasses shall record the location and time of the sighting and report this information as soon as possible to the cognizant regional environmental coordinator. All whale strikes must be reported. This report shall include the date, time, and location of the strike; vessel course and speed; operations being conducted by the vessel; weather conditions, visibility, and sea state; description of the whale; narrative of incident; and indication of whether photos/videos were taken. Navy personnel are encouraged to take photos whenever possible.

(D) Specific mitigation measures related to activities occurring within the critical habitat include the following:

(*1*) Vessels shall avoid head-on approaches to North Atlantic right whale(s) and shall maneuver to maintain at least 457 m (500 yd) of separation from any observed whale if deemed safe to do so. These requirements do not apply if a vessel's safety is threatened, such as when change of course would create an imminent and serious threat to person, vessel, or aircraft, and to the extent vessels are restricted in the ability to maneuver.

(*2*) When transiting within the critical habitat or associated area of concern, vessels shall use extreme caution and operate at a safe speed so as to be able to avoid collisions with North Atlantic right whales and other marine mammals, and stop within a distance appropriate to the circumstances and conditions.

(*3*) Speed reductions (adjustments) are required when a whale is sighted by a vessel or when the vessel is within 9 km (5 NM) of a reported new sighting less than one week old.

(*4*) Ships transiting in the Cape Cod Bay and Great South Channel critical habitats shall obtain information on recent whale sightings in the vicinity of the critical habitat. Any vessel operating in the vicinity of a North Atlantic right whale shall consider additional speed reductions as per Rule 6 of International Navigational Rules.

§ 216.245 Requirements for monitoring and reporting.

(a) The Navy is required to cooperate with the NMFS, and any other Federal, state or local agency monitoring the impacts of the activity on marine mammals.

(b) As outlined in the AFAST Stranding Communication Plan, the Navy must notify NMFS immediately (or as soon as clearance procedures allow) if the specified activity identified in § 216.240(b) is thought to have resulted in the mortality or injury of any marine mammals, or in any take of marine mammals not identified in § 216.240(c).

(c) The Navy must conduct all monitoring and/or research required under the Letter of Authorization including abiding by the letter of the AFAST Monitoring Plan, which requires the Navy to implement, at a minimum, the monitoring activities summarized in Table 1 to subpart V to this part (and described in more detail in the AFAST Monitoring Plan, which may be viewed at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*).

(d) Report on Monitoring required in sub-paragraph (c) of this section—The Navy shall submit a report annually on September 1 describing the implementation and results (through June 1 of the same year) of the monitoring required in paragraph c, above. Standard marine species sighting forms shall be used by the Navy to standardize data collection and data collection methods will be standardized across ranges to allow for comparison in different geographic locations.

(e) IEER exercises—A yearly report detailing the number of exercises along with the hours of associated marine mammal survey and associated marine mammal sightings, number of times employment was delayed by marine mammal sightings, and the number of total detonated charges and self-scuttled charges shall be submitted to NMFS.

(f) MFAS/HFAS exercises—The Navy shall submit an After Action Report to the Office of Protected Resources, NMFS, within 120 days of the completion of any Major Training Exercise (SEASWITI, IAC, COMPTUEX, JTFEX, but not Group Sails). For other ASW and MIW exercises, the Navy shall submit a yearly summary report. These reports shall, at a minimum, include the following information:

(1) The estimated number of hours of sonar operation, subdivided by source type;

(2) The total number of hours of observation effort (including observation time when sonar was not operating), if obtainable;

(3) All marine mammal sightings (at any distance—not just within a particular distance) to include, when possible, and if not classified:

(i) Species.

(ii) Number of animals sighted.

(iii) Geographic location of marine mammal sighting.

(iv) Distance of animal from any ship with observers.

(v) Whether animal is fore, aft, port, or starboard.

(vi) Direction of animal movement in relation to boat (towards, away, parallel).

(vii) Any observed behaviors of marine mammals.

(4) The status of any sonar sources (what sources were in use) and whether or not they were powered down or shut down as a result of the marine mammal observation.

(5) The platform that the marine mammals were initially sighted from.

(g) AFAST Comprehensive Report—The Navy shall submit to NMFS a draft report that analyzes and summarizes all of the multi-year marine mammal information gathered during all training for which individual reports are required in § 216.145 (d–f). This report shall be submitted at the end of the fourth year of the rule (November 2012), covering activities that have occurred through June 1, 2012.

(h) The Navy shall respond to NMFS comments on the draft comprehensive report if NMFS provides the Navy with comments on the draft report within 3 months of receipt. The report shall be considered final after the Navy has addressed NMFS' comments, or three months after the submittal of the draft if NMFS does not comment by then.

(i) Comprehensive National Sonar Report—By June, 2014, the Navy shall submit a draft National Report that analyzes, compares, and summarizes the active sonar data gathered from the watchstanders and pursuant to the implementation of the Monitoring Plans for AFAST, the Hawaii Range Complex (HRC), the Southern California (SOCAL) Range Complex, the Marianas Range Complex, and the Northwest Training Range.

(j) The Navy shall respond to NMFS comments on the draft comprehensive report if NMFS provides the Navy with comments on the draft report within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or three months after the submittal of the draft if NMFS does not comment by then.

§ 216.246 Applications for Letters of Authorization.

To incidentally take marine mammals pursuant to these regulations, the Navy conducting the activity identified in § 216.240(a) must apply for and obtain either an initial Letter of Authorization in accordance with §§ 216.247 or a renewal under § 216.248.

§ 216.247 Letter of Authorization.

(a) A Letter of Authorization, unless suspended or revoked, will be valid for a period of time not to exceed the period of validity of this subpart, but must be renewed annually subject to annual renewal conditions in § 216.248.

(b) Each Letter of Authorization shall set forth:

(1) Permissible methods of incidental taking;

(2) Means of effecting the least practicable adverse impact on the species, its habitat, and on the availability of the species for subsistence uses (i.e., mitigation); and

(3) Requirements for mitigation, monitoring and reporting.

(c) Issuance and renewal of the Letter of Authorization shall be based on a determination that the total number of marine mammals taken by the activity as a whole will have no more than a negligible impact on the affected species or stock of marine mammal(s).

§ 216.248 Renewal of Letters of Authorization and adaptive management.

(a) A Letter of Authorization issued under § 216.106 and § 216.147 for the activity identified in § 216.140(c) will be renewed annually upon:

(1) Notification to NMFS that the activity described in the application submitted under § 216.246 will be undertaken and that there will not be a substantial modification to the described work, mitigation or monitoring undertaken during the upcoming 12 months;

(2) Receipt of the monitoring reports and notifications within the indicated timeframes required under § 216.245(b–j); and

(3) A determination by the NMFS that the mitigation, monitoring and reporting measures required under § 216.244 and the Letter of Authorization issued under §§ 216.106 and 216.247, were undertaken and will be undertaken during the upcoming annual period of validity of a renewed Letter of Authorization.

(b) Adaptive Management—Based on new information, NMFS may modify or augment the existing mitigation measures if new data suggests that such modifications would have a reasonable likelihood of reducing adverse effects to marine mammals and if the measures are practicable. Similarly, NMFS may coordinate with the Navy to modify or augment the existing monitoring requirements if the new data suggest that the addition of a particular measure would likely fill in a specifically important data gap. The following are some possible sources of new and applicable data:

(1) Results from the Navy's monitoring from the previous year (either from the AFAST Study Area or other locations);

(2) Results from specific stranding investigations (either from the AFAST Study Area or other locations, and involving coincident MFAS/HFAS training or not involving coincident use) or NMFS' long term prospective stranding investigation discussed in the preamble to this proposed rule;

(3) Results from general marine mammal and sound research (funded by the Navy or otherwise).

(c) If a request for a renewal of a Letter of Authorization issued under §§ 216.106 and 216.248 indicates that a substantial modification to the described work, mitigation or monitoring undertaken during the upcoming season will occur, or if NMFS utilizes the adaptive management mechanism addressed in (b) above to modify or augment the mitigation or monitoring measures, the NMFS shall provide the public a period of 30 days for review and comment on the request. Review and comment on renewals of Letters of Authorization would be restricted to:

(1) New cited information and data indicating that the determinations made in this document are in need of reconsideration, and

(2) Proposed changes to the mitigation and monitoring requirements contained in these regulations or in the current Letter of Authorization.

(c) A notice of issuance or denial of a renewal of a Letter of Authorization will be published in the **Federal Register**.

§ 216.249 Modifications to Letters of Authorization.

(a) Except as provided in paragraph (b) of this section, no substantive modification (including withdrawal or suspension) to the Letter of Authorization by NMFS, issued pursuant to §§ 216.106 and 216.247 and subject to the provisions of this subpart, shall be made until after notification and an opportunity for public comment has been provided. For purposes of this paragraph, a renewal of a Letter of Authorization under § 216.248, without modification (except for the period of validity), is not considered a substantive modification.

(b) If the Assistant Administrator determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in § 216.240(b), a Letter of Authorization issued pursuant to §§ 216.106 and 216.247 may be substantively modified without prior notification and an opportunity for public comment. Notification will be published in the **Federal Register** within 30 days subsequent to the action.

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STUDY 1 and 3 (exposures and behavioral responses)	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**	**FY13**
Aerial surveys	Award monitoring contract, develop	SEASWITI, shallow COMPTUEX, or	SEASWITI, shallow COMPTUEX, or	SEASWITI, shallow COMPTUEX, or	SEASWITI, shallow COMPTUEX, or	SEASWITI, shallow COMPTUEX, or
Marine Mammal Observers	Opportunistic as staff and SOP developed	SEASWITI or ULT - 60 hours	SEASWITI or ULT - 60 hours	SEASWITI or ULT - 60 hours	SEASWITI or ULT - 60 hours	SEASWITI or ULT - 60 hours
Vessel surveys (study 3 only)	Award monitoring contract, develop SOP	SEASWITI, shallow COMPTUEX, or ULT- 100 hours	SEASWITI, shallow COMPTUEX, or ULT- 100 hours	SEASWITI, shallow COMPTUEX, or ULT- 100 hours	SEASWITI, shallow COMPTUEX, or ULT- 100 hours	SEASWITI, shallow COMPTUEX, or ULT - 100 hours
STUDY 2 (geographic redistribution)	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**	**FY13**
Aerial surveys before and after training events	SEASWITI, shallow COMPTUEX, or ULT- 24 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours
Onslow Bay and Jacksonville Aerial surveys	288 hours	288 hours	576 hours	576 hours	576 hours	576 hours
Onslow Bay and Jacksonville Shipboard surveys	288 hours	288 hours	576 hours	576 hours	576 hours	576 hours
Passive Acoustics	Award monitoring contract 1 HARP in place and use of pop-up buoys for exercise monitoring Begin recording	Installation of remaining 3 HARPS (4 total) and use of pop-up buoys for exercise monitoring Begin recording and data analysis	Continue recording and data analysis	Continue recording and data analysis	Continue recording and data analysis	Continue recording and data analysis
STUDY 4 (mitigation effectiveness)	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**	**FY13**
Marine mammal observers/lookout comparison	SEASWITI or ULT- 24 hours	SEASWITI or ULT- 40 hours	SEASWITI or ULT- 40 hours	SEASWITI or ULT- 40 hours	SEASWITI or ULT- 40 hours	SEASWITI or ULT- 40 hours
Aerial surveys before and after training events	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours	SEASWITI, shallow COMPTUEX, or ULT- 40 hours

Table 1 of Subpart V. Summary of monitoring effort proposed in draft Monitoring Plan for AFAST

Figure 1 to Subpart V – [Reserved]

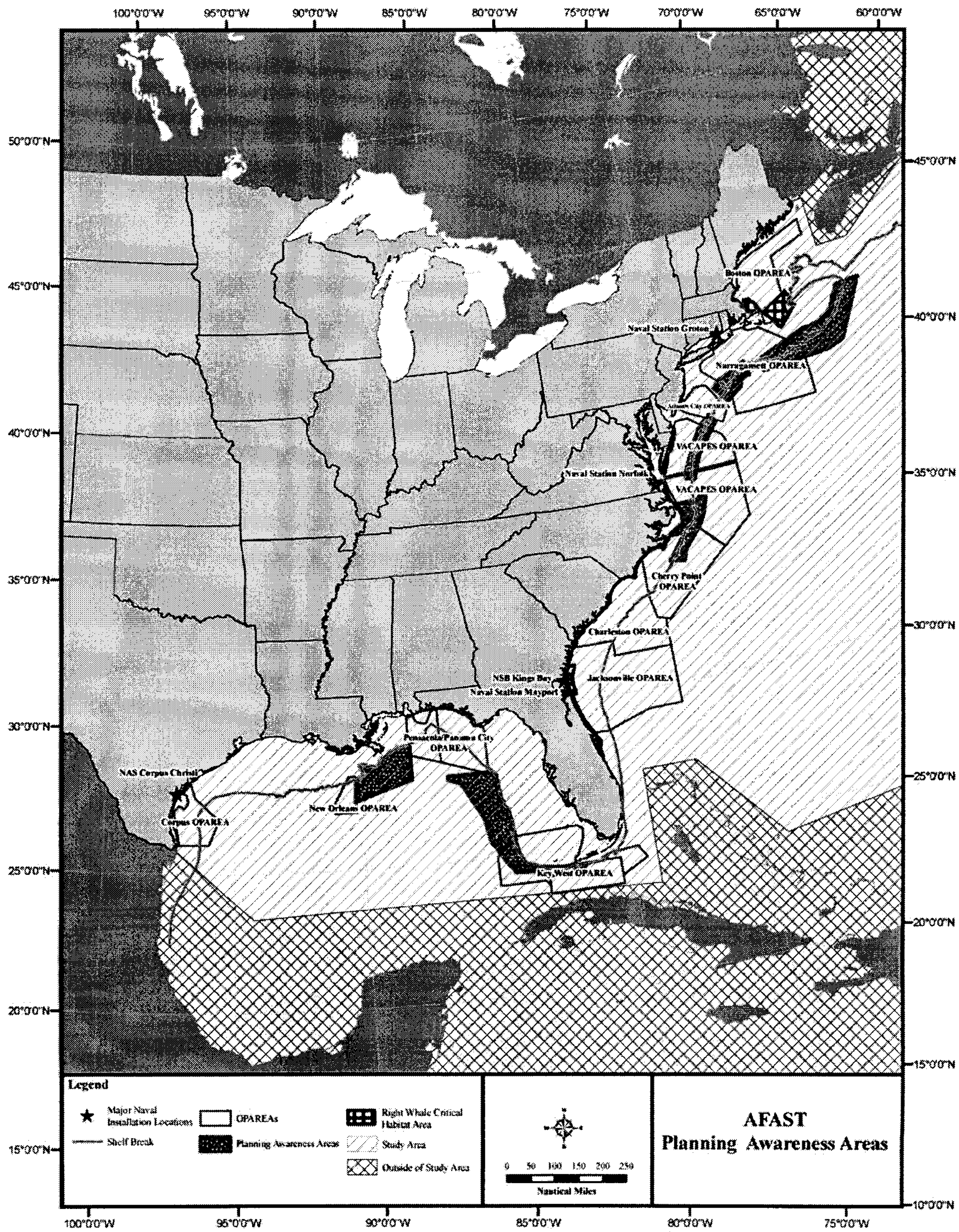

Figure 2 to Subpart V. Planning Awareness Areas

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