



BILLING CODE 3510-22-P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 218

[Docket No. 140211133-5621-01]

RIN 0648-BD69

Takes of Marine Mammals Incidental to Specified Activities; U.S. Navy Training and Testing Activities in the Mariana Islands Training and Testing Study Area

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

ACTION: Final rule.

SUMMARY: Upon application from the U.S. Navy (Navy), we (the National Marine Fisheries Service) are issuing regulations under the Marine Mammal Protection Act (MMPA) to govern the unintentional taking of marine mammals incidental to training and testing activities conducted in the Mariana Islands Training and Testing (MITT) Study Area from August 2015 through August 2020. These regulations allow us to issue a Letter of Authorization (LOA) for the incidental take of marine mammals during the Navy's specified activities and timeframes, set forth the permissible methods of taking, set forth other means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, and set forth requirements pertaining to the monitoring and reporting of the incidental take.

DATES: Effective August 3, 2015 through August 3, 2020.

ADDRESSES: To obtain an electronic copy of the Navy's application or other referenced documents, visit the internet at: <http://www.nmfs.noaa.gov/pr/permits/incidental/>. Documents cited in this rule may also be viewed, by appointment, during regular business hours, at 1315 East-West Highway, SSMC III, Silver Spring MD 20912.

FOR FURTHER INFORMATION CONTACT: John Fiorentino, Office of Protected Resources, NMFS, (301) 427-8401.

SUPPLEMENTARY INFORMATION:

Availability

A copy of the Navy's application, which contains a list of the references used in this document, may be obtained by visiting the internet at:

<http://www.nmfs.noaa.gov/pr/permits/incidental/>. The Navy's Final Environmental Impact Statement/Overseas Environmental Impact Statement (FEIS/OEIS) for MITT, which also contains a list of the references used in this document, may be viewed at <http://www.mitt-eis.com>. Documents cited in this rule may also be viewed, by appointment, during regular business hours, at the aforementioned address (see **ADDRESSES**).

Background

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

Authorization for incidental takings 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 (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring, and reporting of such takings 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) (Public Law 108-136) removed the “small numbers” and “specified geographical region” limitations indicated above 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 (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 April 22, 2013, NMFS received an application from the Navy requesting an LOA for the take of 26 species of marine mammals incidental to Navy training and testing activities to be conducted in the MITT Study Area over 5 years. The Navy is requesting regulations that would establish a process for authorizing take, via one 5-year LOA, of marine mammals for training and testing activities, proposed to be conducted from 2015 through 2020. The Study Area

includes the existing Mariana Islands Range Complex (MIRC) and surrounding seas, a transit corridor between the Mariana Islands and the Navy's Hawaii Range Complex, and Navy pierside locations where sonar maintenance or testing may occur (see Figure 2-1 of the Navy's LOA application for a map of the MITT Study Area). These activities are classified as military readiness activities. Marine mammals present in the Study Area may be exposed to sound from active sonar and underwater detonations. The Navy is requesting authorization to take 26 marine mammal species by Level B harassment (behavioral) and two species by Level A harassment (injury).

The Navy's application and the MITT FEIS/OEIS contain acoustic thresholds that, in some instances, represent changes from what NMFS has used to evaluate the Navy's activities for previous authorizations. The revised thresholds, which the Navy developed in coordination with NMFS, are based on the evaluation and inclusion of new information from recent scientific studies; a detailed explanation of how they were derived is provided in the MITT FEIS/OEIS Criteria and Thresholds Technical Report (available at <http://www.mitt-eis.com>). The revised thresholds are adopted for this rulemaking after providing the public with an opportunity for review and comment via the proposed rule for this action, which published on March 19, 2014 (79 FR 15388).

Further, more generally, NMFS is committed to the use of the best available science. NMFS uses an adaptive transparent process that allows for both timely scientific updates and public input into agency decisions regarding the use of acoustic research and thresholds. NOAA is currently in the process of developing Acoustic Guidance (the Guidance) on thresholds for onset of auditory impacts from exposure to sound, which will be used to support assessments of the effects of anthropogenic sound on marine mammals. To develop this Guidance, NOAA is

compiling, interpreting, and synthesizing the best information currently available on the effects of anthropogenic sound on marine mammals, and is committed to finalizing the Guidance through a systematic, transparent process that involves internal review, external peer review, and public comment. In December 2013, NOAA released for public comment draft Acoustic Guidance that provides acoustic threshold levels for onset of permanent threshold shift (PTS) and temporary threshold shifts (TTS) in marine mammals for all sound sources. NOAA has since been working to incorporate the relevant information received during the public comment period and to make appropriate changes. In January 2015, while NOAA was still working to finalize the Guidance, the U.S. Navy provided NOAA with a technical paper by Finneran (2015) describing Navy's proposed methodology for updating auditory weighting functions and numeric thresholds for predicting onset of auditory effects (TTS/PTS thresholds) on marine animals exposed to active sonars and other active acoustic sources utilized during Navy training and testing activities. NOAA is working to evaluate and incorporate the information in Finneran (2015) into its Acoustic Guidance before it becomes final. Before doing so, NOAA will complete an independent peer review of the Navy's technical paper and provide an additional public comment period for the draft Guidance. After the second peer review and public comment processes are complete, NOAA will determine how best to incorporate the Navy's methodology into its final Acoustic Guidance. The Guidance likely will not be finalized until later this year. Thereafter, any new Navy modeling based on our final Acoustic Guidance would likely take a minimum of several months to complete. Consequently, the results of prior Navy modeling described in this rule represent the best available estimate of the number and type of take that may result from the Navy's use of acoustic sources in the MITT Study Area. NOAA's continued evaluation of all available science for the Acoustic Guidance could result in changes to

the acoustic criteria used to model the Navy's activities in the MITT Study Area, and, consequently, the enumerations of "take" estimates. However, consideration of the draft Guidance and information contained in Finneran (2015) does not alter our assessment of the likely responses of affected marine mammal species to acoustic sources employed by Navy in the MITT Study Area, or the likely fitness consequences of those responses. Further, while acoustic criteria may also inform mitigation and monitoring decisions, the Navy has a robust adaptive management program that regularly addresses new information and allows for modification of mitigation and/or monitoring measures as appropriate.

Description of the Specified Activity

The proposed rule (79 FR 15388, March 19, 2014) and MITT FEIS/OEIS include a complete description of the Navy's specified activities that are being authorized in this final rule. Sonar use and underwater detonations are the stressors most likely to result in impacts on marine mammals that could rise to the level of harassment. Detailed descriptions of these activities are provided in the MITT FEIS/OEIS and LOA application

(<http://www.nmfs.noaa.gov/pr/permits/incidental/>) and are summarized here.

Overview of Training Activities

The Navy, U.S. Air Force, U.S. Marine Corps, and U.S. Coast Guard routinely train in the MITT Study Area in preparation for national defense missions. Training activities are categorized into eight functional warfare areas (anti-air warfare; amphibious warfare; strike warfare; anti-surface warfare; anti-submarine warfare; electronic warfare; mine warfare; and naval special warfare). The Navy determined that the following stressors used in these warfare areas are most likely to result in impacts on marine mammals:

- Anti-surface warfare (underwater detonations)

- Anti-submarine warfare (active sonar, underwater detonations)
- Mine warfare (active sonar, underwater detonations)
- Naval special warfare (underwater detonations)

Additionally, some activities described as Major Training Activities in the MITT FEIS/OEIS and other activities are included in the analysis. The Navy's activities in amphibious warfare, anti-air warfare, strike warfare, and electronic warfare do not involve stressors that could result in harassment of marine mammals. Therefore, these activities are not discussed further. The analysis and rationale for excluding these warfare areas are contained in the MITT FEIS/OEIS.

Overview of Testing Activities

The Navy researches, develops, tests, and evaluates new platforms, systems, and technologies. Many tests are conducted in realistic conditions at sea, and can range in scale from testing new software to operating portable devices to conducting tests of live weapons to ensure they function as intended. Testing activities may occur independently of or in conjunction with training activities. Many testing activities are conducted similarly to Navy training activities and are also categorized under one of the primary mission areas. Other testing activities are unique and are described within their specific testing categories. The Navy determined that stressors used during the following testing activities are most likely to result in impacts on marine mammals:

- Naval Air Systems Command (NAVAIR) Testing
 - Anti-surface warfare testing (underwater detonations)
 - Anti-submarine warfare testing (active sonar, underwater detonations)
- Naval Sea Systems command (NAVSEA) Testing

- New ship construction (active sonar, underwater detonations)
- Life cycle activities (active sonar, underwater detonations)
- Anti-surface warfare/anti-submarine warfare testing (active sonar, underwater detonations)
- Ship protection systems and swimmer defense testing (active sonar)
- Office of Naval Research (ONR) and Naval Research Laboratory (NRL) Testing
 - ONR/NRL research, development, test, and evaluation (active sonar)

Other Navy testing activities do not involve stressors that could result in marine mammal harassment. Therefore, these activities are not discussed further.

Classification of Non-impulsive and Impulsive Sources Analyzed

In order to better organize and facilitate the analysis of about 300 sources of underwater non-impulsive sound or impulsive energy, the Navy developed a series of source classifications, or source bins. This method of analysis provides the following benefits:

- Allows for new sources to be covered under existing authorizations, as long as those sources fall within the parameters of a “bin;”
- Simplifies the data collection and reporting requirements anticipated under the MMPA;
- Ensures a conservative approach to all impact analysis because all sources in a single bin are modeled as the loudest source (e.g., lowest frequency, highest source level, longest duty cycle, or largest net explosive weight within that bin);
- Allows analysis to be conducted more efficiently, without compromising the results;
- Provides a framework to support the reallocation of source usage (hours/explosives) between different source bins, as long as the total number and severity of marine mammal takes remain within the overall analyzed and authorized limits. This flexibility

is required to support evolving Navy training and testing requirements, which are linked to real world events.

A description of each source classification is provided in Tables 1 and 2. Non-impulsive sources are grouped into bins based on the frequency, source level when warranted, and how the source would be used. Impulsive bins are based on the net explosive weight of the munitions or explosive devices. The following factors further describe how non-impulsive sources are divided:

- Frequency of the non-impulsive source:
 - Low-frequency sources operate below 1 kilohertz (kHz)
 - Mid-frequency sources operate at or above 1 kHz, up to and including 10 kHz
 - High-frequency sources operate above 10 kHz, up to and including 100 kHz
 - Very high-frequency sources operate above 100, but below 200 kHz
- Source level of the non-impulsive source:
 - Greater than 160 decibels (dB), but less than 180 dB
 - Equal to 180 dB and up to 200 dB
 - Greater than 200 dB

How a sensor is used determines how the sensor's acoustic emissions are analyzed.

Factors to consider include pulse length (time source is on); beam pattern (whether sound is emitted as a narrow, focused beam, or, as with most explosives, in all directions); and duty cycle (how often a transmission occurs in a given time period during an event).

There are also non-impulsive sources with characteristics that are not anticipated to result in takes of marine mammals. These sources have low source levels, narrow beam widths, downward directed transmission, short pulse lengths, frequencies beyond known hearing ranges

of marine mammals, or some combination of these factors. These sources generally have frequencies greater than 200 kHz and/or source levels less than 160 dB and are qualitatively analyzed in the MITT FEIS/OEIS.

Table 1. Impulsive training and testing source classes analyzed.

Source Class	Representative Munitions	Net Explosive Weight (lbs)
E1	Medium-caliber projectiles	0.1-0.25 (45.4-113.4 g)
E2	Medium-caliber projectiles	0.26-0.5 (117.9-226.8 g)
E3	Large-caliber projectiles	>0.5-2.5 (>226.8 g-1.1 kg)
E4	Improved Extended Echo Ranging Sonobuoy	>2.5-5.0 (1.1-2.3 kg)
E5	5 in. (12.7 cm) projectiles	>5-10 (>2.3-4.5 kg)
E6	15 lb. (6.8 kg) shaped charge	>10-20 (>4.5-9.1 kg)
E8	250 lb. (113.4 kg) bomb	>60-100 (>27.2-45.4 kg)
E9	500 lb. (226.8 kg) bomb	>100-250 (>45.4-113.4 kg)
E10	1,000 lb. (453.6 kg) bomb	>250-500 (>113.4-226.8 kg)
E11	650 lb. (294.8 kg) mine	>500-650 (>226.8-294.8 kg)
E12	2,000 lb. (907.2 kg) bomb	>650-1,000 (>294.8-453.6 kg)

Table 2. Non-impulsive training and testing source classes analyzed.

Source Class Category	Source Class	Description
Low-Frequency (LF): Sources that produce low-frequency (less than 1 kilohertz [kHz]) signals	LF4	Low-frequency sources equal to 180 dB and up to 200 dB
	LF5	Low-frequency sources less than 180 dB
	LF6	Low-frequency sonar currently in development (e.g., anti-submarine warfare sonar associated with the Littoral Combat Ship)
Mid-Frequency (MF): Tactical and non-tactical sources that produce mid-frequency (1 to 10 kHz) signals	MF1	Active hull-mounted surface ship sonar (e.g., AN/SQS-53C and AN/SQS-60)
	MF2	Active hull-mounted surface ship sonar (e.g., AN/SQS-56)
	MF3	Active hull-mounted submarine sonar (e.g., AN/BQQ-10)
	MF4	Active helicopter-deployed dipping sonar (e.g., AN/AQS-22 and AN/AQS-13)
	MF5	Active acoustic sonobuoys (e.g., DICASS)

	MF6	Active underwater sound signal devices (e.g., MK-84)
	MF8	Active sources (greater than 200 dB) not otherwise binned
	MF9	Active sources (equal to 180 dB and up to 200 dB)
	MF10	Active sources (greater than 160 dB, but less than 180 dB) not otherwise binned
	MF11	Hull-mounted surface ship sonar with an active duty cycle greater than 80%
	MF12	High duty cycle – variable depth sonar
High-Frequency (HF) and Very High-Frequency (VHF): Tactical and non-tactical sources that produce high-frequency (greater than 10 kHz but less than 200 kHz) signals	HF1	Active hull-mounted submarine sonar (e.g., AN/BQQ-10)
	HF4	Active mine detection, classification, and neutralization sonar (e.g., AN/SQS-20)
	HF5	Active sources (greater than 200 dB)
	HF6	Active sources (equal to 180 dB and up to 200 dB)
Anti-Submarine Warfare (ASW): Tactical sources such as active sonobuoys and acoustic countermeasures systems used during ASW training and testing activities	ASW1	MF active Deep Water Active Distributed System (DWADS)
	ASW2	MF active Multistatic Active Coherent (MAC) sonobuoy (e.g., AN/SSQ-125)
	ASW3	MF active towed active acoustic countermeasure systems (e.g., AN/SLQ-25)
Torpedoes (TORP): Source classes associated with active acoustic signals produced by torpedoes	TORP1	Lightweight torpedo (e.g., MK-46, MK-54, or Anti-Torpedo Torpedo)
	TORP2	Heavyweight torpedo (e.g., MK-48)
Acoustic Modems (M): Systems used to transmit data acoustically through water	M3	Mid-frequency acoustic modems (greater than 190 dB)
Swimmer Detection Sonar (SD): Systems used to detect divers and submerged swimmers	SD1	High-frequency sources with short pulse lengths, used for the detection of swimmers and other objects for the purpose of port security.

Airguns (AG) ¹ : Underwater airguns are used during swimmer defense and diver deterrent training and testing activities	AG	Up to 60 cubic inch airguns (e.g., Sercel Mini-G)
---	----	---

¹ There are no Level A or Level B takes proposed from airguns; therefore, airguns are not discussed further in this rule

Proposed Action

The Navy proposes to continue conducting training and testing activities within the MITT Study Area. The Navy has been conducting military readiness training and testing activities in the MITT Study Area for decades.

Training and Testing

The Navy proposes to conduct training and testing activities in the Study Area as described in Tables 3 and 4. Detailed information about each proposed activity (stressor, training or testing event, description, sound source, duration, and geographic location) can be found in the MITT FEIS/OEIS. NMFS used the detailed information in the MITT FEIS/OEIS to help analyze the potential impacts to marine mammals. Table 3 describes the annual number of impulsive source detonations during training and testing activities within the Study Area, and Table 4 describes the annual number of hours or items of non-impulsive sources used during training and testing within the Study Area.

Table 3. Annual number of impulsive source detonations during training and testing activities in the Study Area.

Explosive Class	Net Explosive Weight (NEW)	Annual In-Water Detonations
E1	(0.1 lb. – 0.25 lb.)	10,140
E2	(0.26 lb. – 0.5 lb.)	106
E3	(>0.5 lb. – 2.5 lb.)	932
E4	(>2.5 lb.-5 lb.)	420
E5	(>5 lb.-10 lb.)	684
E6	(>10 lb.-20 lb.)	76
E8	(>60 lb.-100 lb.)	16

E9	(>100 lb. – 250 lb.)	4
E10	(>250 lb. – 500 lb.)	12
E11	(>500 lb. – 650 lb.)	6
E12	(>650 lb. – 2,000 lb.)	184

Table 4. Annual hours or items of non-impulsive sources used during training and testing activities within the Study Area.

Source Class Category	Source Class	Annual Use
Low-Frequency (LF): Sources that produce signals less than 1 kHz	LF4	123 hours
	LF5	11 hours
	LF6	40 hours
Mid-Frequency (MF): Tactical and non-tactical sources from 1 to 10 kHz	MF1	1,872 hours
	MF2	625 hours
	MF3	192 hours
	MF4	214 hours
	MF5	2,588 items
	MF6	33 items
	MF8	123 hours
	MF9	47 hours
	MF10	231 hours
	MF11	324 hours
High-Frequency (HF) and Very High-Frequency (VHF): Tactical and non-tactical sources that produce signals greater than 10 kHz but less than 200 kHz	HF1	113 hours
	HF4	1,060 hours
	HF5	336 hours
	HF6	1,173 hours
Anti-Submarine Warfare (ASW): Tactical sources used during anti-submarine warfare training and testing activities	ASW1	144 hours
	ASW2	660 items
	ASW3	3,935 hours
	ASW4	32 items
Torpedoes (TORP): Source classes associated with active acoustic signals produced by torpedoes	TORP1	115 items
	TORP2	62 items
Acoustic Modems (M): Transmit data acoustically through the water	M3	112 hours
Swimmer Detection Sonar (SD): Used to detect divers and submerged swimmers	SD1	2,341 hours

Vessels

Vessels used as part of the proposed action include ships, submarines, and boats ranging in size from small, 5-m Rigid Hull Inflatable Boats to 333-m long aircraft carriers.

Representative Navy vessel types, lengths, and speeds used in both training and testing activities are shown in Table 5. While these speeds are representative, some vessels operate outside of these speeds due to unique training or safety requirements for a given event. Examples include increased speeds needed for flight operations, full speed runs to test engineering equipment, time critical positioning needs, etc. Examples of decreased speeds include speeds less than 5 knots or completely stopped for launching small boats, certain tactical maneuvers, target launch or retrievals, etc.

The number of Navy vessels in the Study Area varies based on training and testing schedules. Most activities include either one or two vessels, with an average of one vessel per activity, and last from a few hours up to two weeks. Multiple ships, however, can be involved with major training events, although ships can often operate for extended periods beyond the horizon and out of visual sight from each other.

Table 5. Typical Navy boat and vessel types with length greater than 18 meters used within the MITT Study Area.

Vessel Type (>18 m)	Example(s) (specifications in meters (m) for length, metric tons (mt) for mass, and knots for speed)	Typical Operating Speed (knots)
Aircraft Carrier	Aircraft Carrier (CVN) length: 333 m beam: 41 m draft: 12 m displacement: 81,284 mt max. speed: 30+ knots	10 to 15
Surface Combatants	Cruiser (CG) length: 173 m beam: 17 m draft: 10 m displacement: 9,754 mt max. speed: 30+ knots	10 to 15
	Destroyer (DDG) length: 155 m beam: 18 m draft: 9 m displacement: 9,648 mt max. speed: 30+ knots	

	Frigate (FFG) length: 136 m beam: 14 m draft: 7 m displacement: 4,166 mt max. speed: 30+ knots	
	Littoral Combat Ship (LCS) length: 115 m beam: 18 m draft: 4 m displacement: 3,000 mt max. speed: 40+ knots	
Amphibious Warfare Ships	Amphibious Assault Ship (LHA, LHD) length: 253 m beam: 32 m draft: 8 m displacement: 42,442 mt max. speed: 20+knots	10 to 15
	Amphibious Transport Dock (LPD) length: 208 m beam: 32 m draft: 7 m displacement: 25,997 mt max. speed: 20+knots	
	Dock Landing Ship (LSD) length: 186 m beam: 26 m draft: 6 m displacement: 16,976 mt max. speed: 20+knots	
Mine Warship Ship	Mine Countermeasures Ship (MCM) length: 68 m beam: 12 m draft: 4 m displacement: 1,333 max. speed: 14 knots	5 to 8
Submarines	Attack Submarine (SSN) length: 115 m beam: 12 m draft: 9 m displacement: 12,353 mt max. speed: 20+knots	8 to 13
	Guided Missile Submarine (SSGN) length: 171 m beam: 13 m draft: 12 m displacement: 19,000 mt max. speed: 20+knots	
Combat Logistics Force Ships ¹	Fast Combat Support Ship (T-AOE) length: 230 m beam: 33 m draft: 12 m displacement: 49,583 max. speed: 25 knots	8 to 12
	Dry Cargo/Ammunition Ship (T-AKE) length: 210 m beam: 32 m draft: 9 m displacement: 41,658 mt max speed: 20 knots	
	Fleet Replenishment Oilers (T-AO) length: 206 m beam: 30 m draft: 11 displacement: 42,674 mt max. speed: 20 knots	
	Fleet Ocean Tugs (T-ATF) length: 69 m beam: 13 m draft: 5 m displacement: 2,297 max. speed: 14 knots	
	Joint High Speed Vessel (JHSV) ² length: 103 m beam; 28.5 m draft; 4.57 m displacement; 2,362 mt max speed: 40 knots	
Support Craft/Other	Landing Craft, Utility (LCU) length: 41m beam: 9 m draft: 2 m displacement: 381 mt max. speed: 11 knots	3 to 5
	Landing Craft, Mechanized (LCM) length: 23 m beam: 6 m draft: 1 m displacement: 107 mt max. speed: 11 knots	
Support Craft/Other Specialized High Speed	MK V Special Operations Craft length: 25 m beam: 5 m displacement: 52 mt max. speed: 50 knots	Variable

¹ CLF vessels are not permanently homeported in the Marianas, but are used for various fleet support and training support events in the Study Area.

² Typical operating speed of the Joint High Speed Vessel is 25-32 knots.

Dates and Location

The description of the location of authorized activities has not changed from what was provided in the proposed rule (79 FR 15388, March 19, 2014; pages 15394-15395) and MITT FEIS/OEIS (<http://www.mitt-eis.com>). For a complete description, please see those documents. Training and testing activities will be conducted in the MITT Study Area for the reasonably foreseeable future. The MITT Study Area is comprised of the established ranges, operating areas, and special use airspace in the region of the Mariana Islands that are part of the Mariana Islands Range Complex (MIRC), its surrounding seas, and a transit corridor between the Mariana Islands and the Hawaii Range Complex. The defined Study Area has expanded beyond the areas included in previous Navy authorizations to include transit routes and pierside locations. This expansion is not an increase in the Navy's training and testing area, but rather an increase in the area to be analyzed (i.e., not previously analyzed) under an incidental take authorization in support of the MITT EIS/OEIS. The MIRC, like all Navy range complexes, is an organized and designated set of specifically bounded geographic areas, which includes a water component (above and below the surface), airspace, and sometimes a land component. Operating areas (OPAREAs) and special use airspace are established within each range complex. These designations are further described in Chapter 2 of the Navy's LOA application.

Description of Marine Mammals in the Area of the Specified Activity

Twenty-six marine mammal species may occur in the Study Area, including seven mysticetes (baleen whales) and 19 odontocetes (dolphins and toothed whales). The Description of Marine Mammals in the Area of the Specified Activities section has not changed from what

was in the proposed rule (79 FR 15388, March 19, 2014; pages 15395-15396). Table 6 of the proposed rule provided a list of marine mammals with possible or confirmed occurrence within the MITT Study Area, including stock, abundance, and status. Since publishing the proposed rule, NMFS released new stock assessment reports for some of the marine mammal species occurring within the MITT Study Area. The new species abundance estimates were considered in making our final determinations. The MITT FEIS/OEIS includes the revised species abundance estimates. Although not repeated in this final rule, we have reviewed these data, determined them to be the best available scientific information for the purposes of the rulemaking, and consider this information part of the administrative record for this action.

The proposed rule, the Navy's LOA application, and the MITT FEIS/OEIS include a complete description of information on the status, distribution, abundance, vocalizations, density estimates, and general biology of marine mammal species in the Study Area. In addition, NMFS publishes annual stock assessment reports for marine mammals, including some stocks that occur within the Study Area (<http://www.nmfs.noaa.gov/pr/species/mammals>).

Potential Effects of Specified Activities on Marine Mammals

The Navy has requested authorization for the take of marine mammals that may occur incidental to training and testing activities in the Study Area. The Navy has analyzed potential impacts to marine mammals from impulsive and non-impulsive sound sources and vessel strike.

Other potential impacts to marine mammals from training activities in the Study Area were analyzed in the MITT FEIS/OEIS, in consultation with NMFS as a cooperating agency, and determined to be unlikely to result in marine mammal harassment. Therefore, the Navy has not requested authorization for take of marine mammals that might occur incidental to other components of their proposed activities. In this document, NMFS analyzes the potential effects

on marine mammals from exposure to non-impulsive sound sources (sonar and other active acoustic sources), impulsive sound sources (underwater detonations), and vessel strikes.

For the purpose of MMPA authorizations, NMFS' effects assessments serve four primary purposes: (1) to prescribe the permissible methods of taking (i.e., Level B harassment (behavioral harassment), Level A harassment (injury), or mortality, including an identification of the number and types of take that could occur by harassment or mortality) and to prescribe other means of effecting the least practicable adverse impact on such species or stock and its habitat (i.e., mitigation); (2) to determine whether the specified activity would have a negligible impact on the affected species or stocks of marine mammals (based on the likelihood that the activity would adversely affect the species or stock through effects on annual rates of recruitment or survival); (3) to determine whether the specified activity would have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses; and (4) to prescribe requirements pertaining to monitoring and reporting.

This section focuses qualitatively on the different ways that non-impulsive and impulsive sources may affect marine mammals (some of which NMFS would not classify as harassment). In the Estimated Take section, we will relate the potential effects to marine mammals from non-impulsive and impulsive sources to the MMPA definitions of Level A and Level B harassment and will attempt to quantify those effects.

Non-impulsive Sources

Direct Physiological Effects

Based on the literature, there are two basic ways that non-impulsive sources 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 could 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 detect them) following exposure to an intense sound or sound for long duration, it is referred to as a noise-induced threshold shift (TS). An animal can experience TTS or PTS. TTS can last from minutes or hours to days (i.e., there is complete recovery), can occur 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 initially by only 6 dB or reduced by 30 dB). PTS is permanent, but some recovery is possible. PTS can also occur 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 TS: 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 can 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 intermittent sounds, less TS could occur than compared to a continuous exposure with the same energy (some recovery could occur between intermittent exposures depending on the duty cycle between sounds) (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, prolonged exposure to sounds 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 mid- and high-frequency active sonar (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 marine mammals, published data are limited to the captive bottlenose dolphin, beluga, harbor porpoise, and Yangtze finless porpoise (Finneran *et al.*, 2000, 2002b, 2003, 2005a, 2007, 2010a, 2010b; Finneran and Schlundt, 2010; Lucke *et al.*, 2009; Mooney *et al.*, 2009a, 2009b; Popov *et al.*, 2011a, 2011b; Kastelein *et al.*, 2012a; Schlundt *et al.*, 2000; Nachtigall *et al.*, 2003, 2004). For pinnipeds in water, data are limited to measurements of TTS in harbor seals, an elephant seal, and California sea lions (Kastak *et al.*, 1999, 2005; Kastelein *et al.*, 2012b).

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 occurs during a time 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 aging has been observed in marine mammals, as well as humans and other taxa (Southall *et al.*, 2007), so one can infer that strategies exist for coping with this condition to some degree, though likely not without cost.

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 or explosion sounds 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. Recent research with *ex vivo* supersaturated bovine tissues suggested that, for a 37 kHz signal, a sound exposure of approximately 215 dB referenced to (re) 1 μ Pa would be required before microbubbles became destabilized and grew (Crum *et al.*, 2005). Assuming spherical spreading loss and a nominal sonar source level of 235 dB re 1 μ Pa at 1 m, a whale would need to be within 10 m (33 ft.) of the sonar dome to be exposed to such sound levels. Furthermore, tissues in the study were supersaturated by exposing them to pressures of 400–700 kilopascals for periods of hours and then releasing them to ambient pressures. Assuming the equilibration of gases with the tissues occurred when the tissues were exposed to the high pressures, levels of supersaturation in the tissues could have been as high as 400–700 percent. These levels of tissue supersaturation are substantially higher than model predictions for marine mammals (Houser *et al.*, 2001; Saunders *et al.*, 2008). It is improbable that this mechanism is responsible for stranding events or traumas associated with beaked whale strandings. Both the degree of supersaturation and exposure levels observed to cause microbubble destabilization are unlikely to occur, either alone or in concert.

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; Fernández *et al.*, 2012). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. Alternatively, Tyack *et al.* (2006) studied the deep diving behavior of beaked whales and concluded that: “Using current models of breath-hold diving, we infer that their natural diving behavior is inconsistent with known problems of acute nitrogen supersaturation and embolism.” 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, 2012) 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 non-impulsive sources can lead to strandings is included in the Stranding and Mortality section

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). A recent study by Nachtigall and Supin (2008) showed that false killer whales adjust their hearing to compensate for ambient sounds and the intensity of returning echolocation signals.

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, 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 takes of marine mammals (because of the source strength and number of hours it's conducted), the pulse length and low duty cycle of the MFAS/HFAS signal makes it less likely that masking would 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 environmental 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 adjustments to vocalization characteristics such as the frequency structure, amplitude, temporal structure, and temporal delivery.

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 responses.

In the case of many stressors, an animal's first and sometimes 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 systems; the system that has received the most study has been the hypothalamus-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), 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" (Seyle, 1950) or "allostatic loading" (McEwen and Wingfield, 2003). This pathological state will last until the animal replenishes its biotic reserves sufficient to restore normal function. Note that these examples involved a long-term (days or weeks) stress response exposure to stimuli.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses have also been documented fairly well through controlled experiments; 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). Information has also been collected on the physiological responses of marine mammals to exposure to anthropogenic sounds (Fair and Becker, 2000; Romano *et al.*, 2002; Wright *et al.*, 2008). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. In a conceptual model developed by the Population Consequences of Acoustic Disturbance (PCAD) working group, serum hormones were identified as possible indicators of behavioral effects that are translated into altered rates of reproduction and mortality. The Office of Naval Research hosted a workshop (Effects of Stress on Marine Mammals Exposed to Sound) in 2009 that focused on this very topic (ONR, 2009).

Studies of other marine animals and terrestrial animals would also 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), for example, 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 affect 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 no response or responses including, but not limited to: 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 interpretations 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). Although hypothetical, discussions surrounding this potential process are controversial.

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). However, Miller *et al.* (2009) reported buzz rates (a proxy for feeding) 19 percent lower during exposure to distant signatures of seismic airguns. 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 levels were 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. Blue whales exposed to simulated mid-frequency sonar in the Southern California Bight were less likely to produce low frequency calls usually associated with feeding behavior (Melcón *et al.*, 2012). However, Melcon *et al.* (2012) were unable to determine if suppression of low frequency calls reflected a change in their feeding performance or abandonment of foraging behavior and indicated that implications of the documented responses

are unknown. Further, it is not known whether the lower rates of calling actually indicated a reduction in feeding behavior or social contact since the study used data from remotely deployed, passive acoustic monitoring buoys. In contrast, blue whales increased their likelihood of calling when ship noise was present, and decreased their likelihood of calling in the presence of explosive noise, although this result was not statistically significant (Melcón *et al.*, 2012). Additionally, the likelihood of an animal calling decreased with the increased received level of mid-frequency sonar, beginning at a SPL of approximately 110–120 dB re 1 μ Pa (Melcón *et al.*, 2012). Preliminary results from the 2010–2011 field season of an ongoing behavioral response study in Southern California waters indicated that, in some cases and at low received levels, tagged blue whales responded to mid-frequency sonar but that those responses were mild and there was a quick return to their baseline activity (Southall *et al.*, 2011). 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. Goldbogen *et al.*, (2013) monitored behavioral responses of tagged blue whales located in feeding areas when exposed simulated MFA sonar. Responses varied depending on behavioral context, with deep feeding whales being more significantly affected (i.e., generalized avoidance; cessation of feeding; increased swimming speeds; or directed travel away from the source) compared to surface feeding individuals that typically showed no change in behavior. Non-feeding whales also seemed to be affected by exposure. The authors indicate that disruption of feeding and displacement could impact individual fitness and health. However, for this to be true, we would have to assume that an individual whale could not compensate for this lost feeding opportunity by either immediately feeding at another location, by feeding shortly after cessation of acoustic

exposure, or by feeding at a later time. There is no indication this is the case, particularly since unconsumed prey would likely still be available in the environment in most cases following the cessation of acoustic exposure.

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 (Southall *et al.*, 2007; Henderson *et al.*, 2014).

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 U.S. 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; NOAA, 2014b). 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 deterrents have 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).

Maybaum (1993) conducted sound playback experiments to assess the effects of MFAS on humpback whales in Hawaiian waters. Specifically, she exposed focal pods to sounds of a 3.3-kHz sonar pulse, a sonar frequency sweep from 3.1 to 3.6 kHz, and a control (blank) tape while monitoring behavior, movement, and underwater vocalizations. The two types of sonar signals (which both contained mid- and low-frequency components) differed in their effects on the humpback whales, but both resulted in avoidance behavior. The whales responded to the pulse by increasing their distance from the sound source and responded to the frequency sweep by increasing their swimming speeds and track linearity. In the Caribbean, sperm whales avoided exposure to mid-frequency submarine sonar pulses, in the range of 1000 Hz to 10,000 Hz (IWC 2005).

Kvadsheim *et al.*, (2007) conducted a controlled exposure experiment in which killer whales fitted with D-tags were exposed to mid-frequency active sonar (Source A: a 1.0 second up sweep 209 dB @ 1 - 2 kHz every 10 seconds for 10 minutes; Source B: with a 1.0 second up sweep 197 dB @ 6 - 7 kHz every 10 seconds for 10 minutes). When exposed to Source A, a tagged whale and the group it was traveling with did not appear to avoid the source. When exposed to Source B, the tagged whales along with other whales that had been carousel feeding, ceased feeding during the approach of the sonar and moved rapidly away from the source. When exposed to Source B, Kvadsheim and his co-workers reported that a tagged killer whale seemed to try to avoid further exposure to the sound field by the following behaviors: immediately swimming away (horizontally) from the source of the sound; engaging in a series of erratic and frequently deep dives that seemed to take it below the sound field; or swimming away while engaged in a series of erratic and frequently deep dives. Although the sample sizes in this study are too small to support statistical analysis, the behavioral responses of the orcas were consistent with the results of other studies.

In 2007, the first in a series of behavioral response studies, a collaboration by the Navy, NMFS, and other scientists showed one beaked whale (*Mesoplodon densirostris*) responding to an MFAS playback. Tyack *et al.* (2011) indicates that the playback began when the tagged beaked whale was vocalizing at depth (at the deepest part of a typical feeding dive), following a previous control with no sound exposure. The whale appeared to stop clicking significantly earlier than usual, when exposed to mid-frequency signals in the 130–140 dB (rms) received level range. After a few more minutes of the playback, when the received level reached a maximum of 140–150 dB, the whale ascended on the slow side of normal ascent rates with a longer than normal ascent, at which point the exposure was terminated. The results are from a

single experiment and a greater sample size is needed before robust and definitive conclusions can be drawn.

Tyack *et al.* (2011) also indicates that Blainville's beaked whales appear to be sensitive to noise at levels well below expected TTS (~160 dB re 1 μ Pa). This sensitivity is manifest by an adaptive movement away from a sound source. This response was observed irrespective of whether the signal transmitted was within the band width of MFAS, which suggests that beaked whales may not respond to the specific sound signatures. Instead, they may be sensitive to any pulsed sound from a point source in this frequency range. The response to such stimuli appears to involve maximizing the distance from the sound source.

Stimpert *et al.* (2014) tagged a Baird's beaked whale, which was subsequently exposed to simulated mid-frequency sonar. Received levels of sonar on the tag increased to a maximum of 138 dB re 1 μ Pa, which occurred during the first exposure dive. Some sonar received levels could not be measured due to flow noise and surface noise on the tag.

Results from a 2007-2008 study conducted near the Bahamas showed a change in diving behavior of an adult Blainville's beaked whale to playback of mid-frequency source and predator sounds (Boyd *et al.*, 2008; Southall *et al.* 2009; Tyack *et al.*, 2011). Reaction to mid-frequency sounds included premature cessation of clicking and termination of a foraging dive, and a slower ascent rate to the surface. Results from a similar behavioral response study in southern California waters have been presented for the 2010-2011 field season (Southall *et al.* 2011; DeRuiter *et al.*, 2013b). DeRuiter *et al.* (2013b) presented results from two Cuvier's beaked whales that were tagged and exposed to simulated mid-frequency active sonar during the 2010 and 2011 field seasons of the southern California behavioral response study. The 2011 whale was also incidentally exposed to mid-frequency active sonar from a distant naval exercise.

Received levels from the mid-frequency active sonar signals from the controlled and incidental exposures were calculated as 84–144 and 78–106 dB re 1 μ Pa root mean square (rms), respectively. Both whales showed responses to the controlled exposures, ranging from initial orientation changes to avoidance responses characterized by energetic fluking and swimming away from the source. However, the authors did not detect similar responses to incidental exposure to distant naval sonar exercises at comparable received levels, indicating that context of the exposures (e.g., source proximity, controlled source ramp-up) may have been a significant factor. Cuvier's beaked whale responses suggested particular sensitivity to sound exposure as consistent with results for Blainville's beaked whale. Similarly, beaked whales exposed to sonar during British training exercises stopped foraging (DSTL, 2007), and preliminary results of controlled playback of sonar may indicate feeding/foraging disruption of killer whales and sperm whales (Miller *et al.*, 2011).

In the 2007–2008 Bahamas study, playback sounds of a potential predator—a killer whale—resulted in a similar but more pronounced reaction, which included longer inter-dive intervals and a sustained straight-line departure of more than 20 km from the area. The authors noted, however, that the magnified reaction to the predator sounds could represent a cumulative effect of exposure to the two sound types since killer whale playback began approximately 2 hours after mid-frequency source playback. Pilot whales and killer whales off Norway also exhibited horizontal avoidance of a transducer with outputs in the mid-frequency range (signals in the 1–2 kHz and 6–7 kHz ranges) (Miller *et al.*, 2011). Additionally, separation of a calf from its group during exposure to mid-frequency sonar playback was observed on one occasion (Miller *et al.*, 2011). In contrast, preliminary analyses suggest that none of the pilot whales or

false killer whales in the Bahamas showed an avoidance response to controlled exposure playbacks (Southall *et al.*, 2009).

Through analysis of the behavioral response studies, a preliminary overarching effect of greater sensitivity to all anthropogenic exposures was seen in beaked whales compared to the other odontocetes studied (Southall *et al.*, 2009). Therefore, recent studies have focused specifically on beaked whale responses to active sonar transmissions or controlled exposure playback of simulated sonar on various military ranges (Defence Science and Technology Laboratory, 2007; Claridge and Durban, 2009; Moretti *et al.*, 2009; McCarthy *et al.*, 2011; Tyack *et al.*, 2011). In the Bahamas, Blainville's beaked whales located on the range will move off-range during sonar use and return only after the sonar transmissions have stopped, sometimes taking several days to do so (Claridge and Durban 2009; Moretti *et al.*, 2009; McCarthy *et al.*, 2011; Tyack *et al.*, 2011). Moretti *et al.* (2014) used recordings from seafloor-mounted hydrophones at the Atlantic Undersea Test and Evaluation Center (AUTEK) to analyze the probability of Blainsville's beaked whale dives before, during, and after Navy sonar exercises.

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 MFAS. 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 MFAS.

Behavioral Responses

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 μ Pa 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 are 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 to 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.

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. There is limited 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 subconsciously (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" (Cowlshaw *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 as 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 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 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 had a 17-percent reproductive success rate. Similar reductions in reproductive success have been reported for mule deer 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 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 reported that bears disturbed by hikers reduced their energy intake by an average of 12 kcal/minute (50.2×10^3 kJ/minute), and spent energy fleeing or acting aggressively toward hikers (White *et al.*, 1999). Alternately, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a 5-day period did not cause any sleep deprivation or stress effects such as changes in cortisol or epinephrine levels.

Lusseau and Bejder (2007) present data from three long-term studies illustrating the connections between disturbance from whale-watching boats and population-level effects in cetaceans. In Sharks Bay Australia, the abundance of bottlenose dolphins was compared within adjacent control and tourism sites over three consecutive 4.5-year periods of increasing tourism levels. Between the second and third time periods, in which tourism doubled, dolphin abundance

decreased by 15 percent in the tourism area and did not change significantly in the control area. In Fiordland, New Zealand, two populations (Milford and Doubtful Sounds) of bottlenose dolphins with tourism levels that differed by a factor of seven were observed and significant increases in travelling time and decreases in resting time were documented for both. Consistent short-term avoidance strategies were observed in response to tour boats until a threshold of disturbance was reached (average 68 minutes between interactions), after which the response switched to a longer term habitat displacement strategy. For one population tourism only occurred in a part of the home range, however, tourism occurred throughout the home range of the Doubtful Sound population and once boat traffic increased beyond the 68-minute threshold (resulting in abandonment of their home range/preferred habitat), reproductive success drastically decreased (increased stillbirths) and abundance decreased significantly (from 67 to 56 individuals in short period). Last, in a study of northern resident killer whales off Vancouver Island, exposure to boat traffic was shown to reduce foraging opportunities and increase traveling time. A simple bioenergetics model was applied to show that the reduced foraging opportunities equated to a decreased energy intake of 18 percent, while the increased traveling incurred an increased energy output of 3-4 percent, which suggests that a management action based on avoiding interference with foraging might be particularly effective.

On a related note, many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour 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 1 day and not recurring on subsequent days is not considered particularly severe unless it could

directly affect reproduction or survival (Southall *et al.*, 2007). Note that there is a difference between multiple-day substantive behavioral reactions and multiple-day anthropogenic activities. For example, just because an at-sea exercise lasts for multiple days does not necessarily mean that individual animals are either exposed to that exercise for multiple days or, further, exposed in a manner resulting in a sustained multiple day substantive behavioral responses.

In order to understand how the effects of activities may or may not impact stocks and populations of marine mammals, it is necessary to understand not only what the likely disturbances are going to be, but how those disturbances may affect the reproductive success and survivorship of individuals, and then how those impacts to individuals translate to population changes. Following on the earlier work of a committee of the U.S. National Research Council (NRC, 2005), New *et al.* (2014), in an effort termed the Potential Consequences of Disturbance (PCoD), outline an updated conceptual model of the relationships linking disturbance to changes in behavior and physiology, health, vital rates, and population dynamics (below). As depicted, behavioral and physiological changes can either have direct (acute) effects on vital rates, such as when changes in habitat use or increased stress levels raise the probability of mother-calf separation or predation, or they can have indirect and long-term (chronic) effects on vital rates, such as when changes in time/energy budgets or increased disease susceptibility affect health, which then affects vital rates (New *et al.*, 2014). In addition to outlining this general framework and compiling the relevant literature that supports it, New *et al.* (2014) have chosen four example species for which extensive long-term monitoring data exist (southern elephant seals, North Atlantic right whales, Ziphiidae beaked whales, and bottlenose dolphins) and developed state-space energetic models that can be used to effectively forecast longer-term, population-level impacts from behavioral changes. While these are very specific models with very specific

data requirements that cannot yet be applied broadly to project-specific risk assessments, they are a critical first step.

NMFS is constantly evaluating new science and how to best incorporate it into our decisions. This process involves careful consideration of new data and how it is best interpreted within the context of a given management framework. Since preparation of the proposed rule, NMFS has considered additional studies regarding behavioral responses that are relevant to the proposed activities and energy sources. A recent study by Moore and Barlow (2013) emphasizes the importance of context (e.g., behavioral state of the animals, distance from the sound source, etc.) in evaluating behavioral responses of marine mammals to acoustic sources. In addition, Houser *et al.*, 2013 and Claridge, 2013 were recently published.

Houser *et al.* (2013) performed a controlled exposure study involving California sea lions exposed to a simulated mid-frequency sonar signal. The purpose of this Navy-sponsored study was to determine the probability and magnitude of behavioral responses by California sea lions exposed to differing intensities of simulated mid-frequency sonar signals. Houser *et al.*'s findings are consistent with current scientific studies and criteria development concerning marine mammal reactions to mid-frequency sonar sounds.

Claridge's (2013) PhD thesis investigated the potential effects exposure to mid-frequency active sonar could have on beaked whale demographics. In summary, Claridge suggested that lower reproductive rates observed at the Navy's Atlantic Undersea Test and Evaluation Center (AUTECE), when compared to a control site, were due to stressors associated with frequent and repeated use of Navy sonar. However, the author noted that there may be other unknown differences between the sites. It is also important to note that there were some relevant shortcomings of this study. For example, all of the re-sighted whales during the 5-year study at

both sites were female, which Claridge acknowledged can lead to a negative bias in the abundance estimation. There was also a reduced effort and shorter overall study period at the AUTECH site that failed to capture some of the emigration/immigration trends identified at the control site. Furthermore, Claridge assumed that the two sites were identical and therefore should have equal potential abundances; when in reality, there were notable physical differences. All of the aforementioned studies were considered in NMFS' determination to issue regulations and associated LOA to the Navy for their proposed activities in the MITT Study Area.

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; NMFS, 2007). The legal definition for a stranding within the U.S. 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 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, biotoxigenesis, 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 to 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). For reference, between 2001 and 2009, there was an annual average of 1,400 cetacean strandings and 4,300 pinniped strandings along the coasts of the continental U.S. and Alaska (NMFS, 2011).

Several sources have published lists of mass stranding events of cetaceans in an attempt 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 had been reported and one mass stranding of four Baird's beaked whale. 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 (Frantzis, 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, three (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 (seven or 10 percent), and Blainville's and Gervais' beaked whales (four each or 6 percent). Naval activities (not just activities conducted by the U.S. Navy) that might have involved active sonar are reported to have coincided with nine or 10 (13 to 14 percent) of those stranding events. Between the mid-1980s and 2003 (the period reported by the International Whaling Commission), NMFS identified reports of 44 mass cetacean stranding events of which at least seven were coincident with naval exercises that were using MFAS.

Strandings Associated with Impulse Sound

During a Navy training event on March 4, 2011, at the Silver Strand Training Complex in San Diego, California, three or possibly four dolphins were killed in an explosion. During an underwater detonation training event, a pod of 100 to 150 long-beaked common dolphins were observed moving towards the 700-yd (640.1-m) exclusion zone around the explosive charge, monitored by personnel in a safety boat and participants in a dive boat. Approximately 5 minutes remained on a time-delay fuse connected to a single 8.76 lb (3.97 kg) explosive charge (C-4 and detonation cord). Although the dive boat was placed between the pod and the explosive in an effort to guide the dolphins away from the area, that effort was unsuccessful and three long-beaked common dolphins near the explosion died. In addition to the three dolphins found dead on March 4, the remains of a fourth dolphin were discovered on March 7, 2011 near

Ocean Beach, California (3 days later and approximately 11.8 mi. [19 km] from Silver Strand where the training event occurred), which might also have been related to this event.

Association of the fourth stranding with the training event is uncertain because dolphins strand on a regular basis in the San Diego area. Details such as the dolphins' depth and distance from the explosive at the time of the detonation could not be estimated from the 250 yd (228.6 m) standoff point of the observers in the dive boat or the safety boat.

These dolphin mortalities are the only known occurrence of a U.S. Navy training or testing event involving impulse energy (underwater detonation) that caused mortality or injury to a marine mammal. Despite this being a rare occurrence, the Navy has reviewed training requirements, safety procedures, and possible mitigation measures and implemented changes to reduce the potential for this to occur in the future. Discussions of procedures associated with these and other training and testing events are presented in the Mitigation section.

Strandings Associated with MFAS

Over the past 16 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). Additionally, in 2004, during the Rim of the Pacific (RIMPAC) exercises, between 150 and 200 usually pelagic melon-headed whales occupied the shallow waters of Hanalei Bay, Kauai, Hawaii for over 28 hours. NMFS determined that MFAS was a plausible, if not likely, contributing factor in what may have been a confluence of events that led to the stranding. 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 and only one of these stranding events, the Bahamas (2000), was associated with exercises conducted by the U.S. Navy. Most recently, the Independent Scientific Review Panel investigating potential contributing factors to a 2008 mass stranding of melon-headed whales in Antsohihy, Madagascar released its final report suggesting that the stranding was likely initially triggered by an industry seismic survey. This report suggests that the operation of a commercial high-powered 12 kHz multi-beam echosounder during an industry seismic survey was a plausible and likely initial trigger that caused a large group of melon-headed whales to leave their typical habitat and then ultimately strand as a result of secondary factors such as malnourishment and dehydration. The report indicates that the risk of this particular convergence of factors and ultimate outcome is likely very low, but recommends that the potential be considered in environmental planning. Because of the association between tactical mid-frequency active sonar use and a small number of marine mammal strandings, the Navy and NMFS have been considering and addressing the potential for strandings in association with Navy activities for years. In addition to a suite of mitigation intended to more broadly minimize impacts to marine mammals, the Navy and NMFS have a detailed Stranding Response Plan that outlines reporting, communication, and response protocols intended both to minimize the impacts of, and enhance the analysis of, any potential stranding in areas where the Navy operates.

Greece (1996) – Twelve Cuvier's beaked whales stranded atypically (in both time and space) along a 38.2-km strand of the Kyparissiakos Gulf coast on May 12 and 13, 1996 (Frantzis, 1998). From May 11 through May 15, the North Atlantic Treaty Organization (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: 1 μ Pa, respectively (D'Amico and Verboom, 1998; D'Spain *et al.*, 2006). The

timing and location of the testing encompassed the time and location of the 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. 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. 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).

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 thought to be 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). A Bioacoustics Panel convened by NATO concluded that the evidence available did not allow them to accept or reject sonar exposures as a causal agent in these stranding events. 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 (five Cuvier's beaked whales, one Blainville's beaked whale, and the spotted dolphin), while the other 10 were returned to the water alive (though their ultimate fate is unknown). As discussed in the Bahamas report (DOC/DON, 2001), there is no likely association between the minke whale and spotted dolphin strandings and the operation of MFAS.

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 active 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 active 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 and 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 fathoms (1,000 to 6,000 m) occurring across a relatively short horizontal distance (Freitas, 2004); multiple ships were operating around Madeira, though it is not known if MFAS was used, and the specifics of the sound sources used are unknown (Cox *et al.*, 2006, Freitas, 2004); and 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 MFAS 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 three 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 MFAS 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, cavitory 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 MFAS 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; Fernández *et al.*, 2005; Fernández *et al.*, 2012).

Hanalei Bay (2004) – On July 3 and 4, 2004, approximately 150 to 200 melon-headed whales occupied the shallow waters of the Hanalei Bay, Kaua'i, Hawaii for over 28 hrs. Attendees of a canoe blessing observed the animals entering the Bay in a single wave formation at 7 a.m. on July 3, 2004. The animals were observed moving back into the shore from the mouth of the Bay at 9 a.m. The usually pelagic animals milled in the shallow bay and were returned to deeper water with human assistance beginning at 9:30 a.m. on July 4, 2004, and were out of sight by 10:30 a.m.

Only one animal, a calf, was known to have died following this event. The animal was noted alive and alone in the Bay on the afternoon of July 4, 2004, and was found dead in the Bay the morning of July 5, 2004. A full necropsy, magnetic resonance imaging, and computerized tomography examination were performed on the calf to determine the manner and cause of death. The combination of imaging, necropsy and histological analyses found no evidence of infectious, internal traumatic, congenital, or toxic factors. Cause of death could not be definitively determined, but it is likely that maternal separation, poor nutritional condition, and dehydration contributed to the final demise of the animal. Although it is not known when the calf was separated from its mother, the animals' movement into the Bay and subsequent milling and re-grouping may have contributed to the separation or lack of nursing, especially if the maternal bond was weak or this was an inexperienced mother with her first calf.

Environmental factors, abiotic and biotic, were analyzed for any anomalous occurrences that would have contributed to the animals entering and remaining in Hanalei Bay. The Bay's

bathymetry is similar to many other sites within the Hawaiian Island chain and dissimilar to sites that have been associated with mass strandings in other parts of the U.S. The weather conditions appeared to be normal for that time of year with no fronts or other significant features noted. There was no evidence of unusual distribution, occurrence of predator or prey species, or unusual harmful algal blooms, although Mobley *et al.*, 2007 suggested that the full moon cycle that occurred at that time may have influenced a run of squid into the Bay. Weather patterns and bathymetry that have been associated with mass strandings elsewhere were not found to occur in this instance.

The Hanalei event was spatially and temporally correlated with RIMPAC. Official sonar training and tracking exercises in the Pacific Missile Range Facility (PMRF) warning area did not commence until approximately 8 a.m. on July 3 and were thus ruled out as a possible trigger for the initial movement into the Bay. However, six naval surface vessels transiting to the operational area on July 2 intermittently transmitted active sonar (for approximately 9 hours total between the hours of 1:15 p.m. and 12:30 a.m.) as they approached from the south. The potential for these transmissions to have triggered the whales' movement into Hanalei Bay was investigated. Analyses with the information available indicated that animals to the south and east of Kaua'i could have detected active sonar transmissions on July 2, and reached Hanalei Bay on or before 7 a.m. on July 3. However, data limitations regarding the position of the whales prior to their arrival in the Bay, the magnitude of sonar exposure, behavioral responses of melon-headed whales to acoustic stimuli, and other possible relevant factors preclude a conclusive finding regarding the role of sonar in triggering this event. Propagation modeling suggests that transmissions from sonar use during the July 3 exercise in the PMRF warning area may have been detectable at the mouth of the Bay. If the animals responded negatively to these signals, it

may have contributed to their continued presence in the Bay. The U.S. Navy ceased all active sonar transmissions during exercises in this range on the afternoon of July 3. Subsequent to the cessation of sonar use, the animals were herded out of the Bay.

While causation of this stranding event may never be unequivocally determined, NMFS consider the active sonar transmissions of July 2-3, 2004, a plausible, if not likely, contributing factor in what may have been a confluence of events. This conclusion is based on the following: (1) the evidently anomalous nature of the stranding; (2) its close spatiotemporal correlation with wide-scale, sustained use of sonar systems previously associated with stranding of deep-diving marine mammals; (3) the directed movement of two groups of transmitting vessels toward the southeast and southwest coast of Kauai; (4) the results of acoustic propagation modeling and an analysis of possible animal transit times to the Bay; and (5) the absence of any other compelling causative explanation. The initiation and persistence of this event may have resulted from an interaction of biological and physical factors. The biological factors may have included the presence of an apparently uncommon, deep-diving cetacean species (and possibly an offshore, non-resident group), social interactions among the animals before or after they entered the Bay, and/or unknown predator or prey conditions. The physical factors may have included the presence of nearby deep water, multiple vessels transiting in a directed manner while transmitting active sonar over a sustained period, the presence of surface sound ducting conditions, and/or intermittent and random human interactions while the animals were in the Bay.

A separate event involving melon-headed whales and rough-toothed dolphins took place over the same period of time in the Northern Mariana Islands (Jefferson *et al.*, 2006), which is several thousand miles from Hawaii. Some 500 to 700 melon-headed whales came into

Sasanhaya Bay on July 4, 2004, near the island of Rota and then left of their own accord after 5.5 hours; no known active sonar transmissions occurred in the vicinity of that event. The Rota incident led to scientific debate regarding what, if any, relationship the event had to the simultaneous events in Hawaii and whether they might be related by some common factor (e.g., there was a full moon on July 2, 2004, as well as during other melon-headed whale strandings and nearshore aggregations (Brownell *et al.*, 2009; Lignon *et al.*, 2007; Mobley *et al.*, 2007). Brownell *et al.* (2009) compared the two incidents, along with one other stranding incident at Nuka Hiva in French Polynesia and normal resting behaviors observed at Palmyra Island, in regard to physical features in the areas, melon-headed whale behavior, and lunar cycles. Brownell *et al.*, (2009) concluded that the rapid entry of the whales into Hanalei Bay, their movement into very shallow water far from the 100-m contour, their milling behavior (typical pre-stranding behavior), and their reluctance to leave the bay constituted an unusual event that was not similar to the events that occurred at Rota (but was similar to the events at Palmyra), which appear to be similar to observations of melon-headed whales resting normally at Palmyra Island. Additionally, there was no correlation between lunar cycle and the types of behaviors observed in the Brownell *et al.* (2009) examples. Since that time there have been two “out of habitat” or “near mass strandings” of melon-headed whales in the Philippines (Aragones *et al.*, 2010). Pictures of one of these events depict grouping behavior like that displayed at Hanalei Bay in July 2004. No naval sonar activity was noted in the area, although it was suspected by the authors, based on personal communication with a government fisheries representative, that dynamite blasting in the area may have occurred within the days prior to one of the events (Aragones *et al.*, 2010). Although melon-headed whales entering embayments may be

infrequent and rare, there is precedent for this type of occurrence on other occasions in the absence of naval activity.

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 (these later died). Two other whales were discovered during the day on January 27, but had already died. The first three animals were located near the town of Mojacar and the fourth animal was found dead, a few kilometers north of the first three animals. From January 25-26, 2006, Standing 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 (1,000 m) depth near a shoreline where there is a rapid change in bathymetry on the order of 547 to 3,281 fathoms (1,000 to 6,000 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; and exercises took place in an area surrounded by landmasses, or in an embayment. Exercises involving multiple ships employing MFAS 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, NMFS 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 (e.g., acoustically mediated bubble growth, as 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 the following: 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 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; (2) relatively slow, controlled ascents; and (3) a series of “bounce” dives between 100 and 400 m 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.

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; Fernández *et al.*, 2012) 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). Baird *et al.* (2008), in a beaked whale tagging study off Hawaii, showed that deep dives are equally common during day or night, but “bounce dives” are typically a daytime behavior, possibly associated with visual predator avoidance. This may indicate that “bounce dives” are associated with something other than behavioral regulation of dissolved nitrogen levels, which would be necessary day and night.

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.

Impulsive Sources

Underwater explosive detonations send a shock wave and sound energy 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. 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.

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 susceptible to injury (Ketten, 2000). Sound-related damage associated with sound energy from detonations can be theoretically distinct from injury from the shock wave, particularly farther from the explosion. If a noise is audible to an animal, it has the potential to damage the animal's hearing by causing decreased sensitivity (Ketten, 1995). 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 compared to MFAS/HFAS. However, though the nature of the sound waves emitted from an explosion are different (in shape and rise time) from MFAS/HFAS, NMFS still anticipates the same sorts of behavioral responses 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).

Baleen whales have shown a variety of responses to impulse sound sources, including avoidance, reduced surface intervals, altered swimming behavior, and changes in vocalization rates (Richardson *et al.*, 1995; Gordon *et al.*, 2003; Southall, 2007). While most bowhead whales did not show active avoidance until within 8 km of seismic vessels (Richardson *et al.*, 1995), some whales avoided vessels by more than 20 km at received levels as low as 120 dB re 1 μ Pa rms. Additionally, Malme *et al.* (1988) observed clear changes in diving and respiration patterns in bowheads at ranges up to 73 km from seismic vessels, with received levels as low as 125 dB re 1 μ Pa.

Gray whales migrating along the U.S. west coast showed avoidance responses to seismic vessels by 10 percent of animals at 164 dB re 1 μ Pa, and by 90 percent of animals at 190 dB re 1 μ Pa, with similar results for whales in the Bering Sea (Malme 1986, 1988). In contrast, noise from seismic surveys was not found to impact feeding behavior or exhalation rates while resting or diving in western gray whales off the coast of Russia (Yazvenko *et al.*, 2007; Gailey *et al.*, 2007).

Humpback whales showed avoidance behavior at ranges of 5–8 km from a seismic array during observational studies and controlled exposure experiments in western Australia (McCauley, 1998; Todd *et al.*, 1996) found no clear short-term behavioral responses by foraging humpbacks to explosions associated with construction operations in Newfoundland, but did see a trend of increased rates of net entanglement and a shift to a higher incidence of net entanglement closer to the noise source.

Seismic pulses at average received levels of 131 dB re 1 micropascal squared second ($\mu\text{Pa}^2\text{-s}$) caused blue whales to increase call production (Di Iorio and Clark, 2010). In contrast, McDonald *et al.* (1995) tracked a blue whale with seafloor seismometers and reported that it stopped vocalizing and changed its travel direction at a range of 10 km from the seismic vessel (estimated received level 143 dB re 1 μPa peak-to-peak). These studies demonstrate that even low levels of noise received far from the noise source can induce behavioral responses.

Madsen *et al.* (2006) and Miller *et al.* (2009) tagged and monitored eight sperm whales in the Gulf of Mexico exposed to seismic airgun surveys. Sound sources were from approximately 2 to 7 nm away from the whales and based on multipath propagation received levels were as high as 162 dB SPL re 1 μPa with energy content greatest between 0.3 and 3.0 kHz (Madsen, 2006). The whales showed no horizontal avoidance, although the whale that was approached most closely had an extended resting period and did not resume foraging until the airguns had ceased firing (Miller *et al.*, 2009). The remaining whales continued to execute foraging dives throughout exposure; however, swimming movements during foraging dives were 6 percent lower during exposure than control periods, suggesting subtle effects of noise on foraging behavior (Miller *et al.*, 2009). Captive bottlenose dolphins sometimes vocalized after an exposure to impulse sound from a seismic watergun (Finneran *et al.*, 2010a).

A review of behavioral reactions by pinnipeds to impulse noise can be found in Richardson *et al.* (1995) and Southall *et al.* (2007). Blackwell *et al.* (2004) observed that ringed seals exhibited little or no reaction to pipe-driving noise with mean underwater levels of 157 dB re 1 μPa rms and in air levels of 112 dB re 20 μPa , suggesting that the seals had habituated to the noise. In contrast, captive California sea lions avoided sounds from an impulse source at levels of 165–170 dB re 1 μPa (Finneran *et al.*, 2003b). Experimentally, Götz and Janik (2011) tested

underwater, startle responses to a startling sound (sound with a rapid rise time and a 93 dB sensation level [the level above the animal's threshold at that frequency]) and a non-startling sound (sound with the same level, but with a slower rise time) in wild-captured gray seals. The animals exposed to the startling treatment avoided a known food source, whereas animals exposed to the non-startling treatment did not react or habituated during the exposure period. The results of this study highlight the importance of the characteristics of the acoustic signal in an animal's response of habituation.

Vessels

Commercial and Navy ship strikes of cetaceans can cause major wounds, which may lead to the death of the animal. An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or an animal just below the surface could be cut by a vessel's propeller. The severity of injuries typically depends on the size and speed of the vessel (Knowlton and Kraus, 2001; Laist *et al.*, 2001; Vanderlaan and Taggart, 2007). The most vulnerable marine mammals are those that spend extended periods of time at the surface in order to restore oxygen levels within their tissues after deep dives (e.g., the sperm whale). In addition, some baleen whales, such as the North Atlantic right whale, seem generally unresponsive to vessel sound, making them more susceptible to vessel collisions (Nowacek *et al.*, 2004). These species are primarily large, slow moving whales. Smaller marine mammals (e.g., bottlenose dolphin) move quickly through the water column and are often seen riding the bow wave of large ships. Marine mammal responses to vessels may include avoidance and changes in dive pattern (NRC, 2003).

An examination of all known ship strikes from all shipping sources (civilian and military) indicates vessel speed is a principal factor in whether a vessel strike results in death (Knowlton

and Kraus, 2001; Laist *et al.*, 2001; Jensen and Silber, 2003; Vanderlaan and Taggart, 2007). In assessing records in which vessel speed was known, Laist *et al.* (2001) found a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. The authors concluded that most deaths occurred when a vessel was traveling in excess of 13 knots.

Jensen and Silber (2003) detailed 292 records of known or probable ship strikes of all large whale species from 1975 to 2002. Of these, vessel speed at the time of collision was reported for 58 cases. Of these cases, 39 (or 67 percent) resulted in serious injury or death (19 of those resulted in serious injury as determined by blood in the water, propeller gashes or severed tailstock, and fractured skull, jaw, vertebrae, hemorrhaging, massive bruising or other injuries noted during necropsy and 20 resulted in death). Operating speeds of vessels that struck various species of large whales ranged from 2 to 51 knots. The majority (79 percent) of these strikes occurred at speeds of 13 knots or greater. The average speed that resulted in serious injury or death was 18.6 knots. Pace and Silber (2005) found that the probability of death or serious injury increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 to 75 percent as vessel speed increased from 10 to 14 knots, and exceeded 90 percent at 17 knots. Higher speeds during collisions result in greater force of impact and also appear to increase the chance of severe injuries or death. While modeling studies have suggested that hydrodynamic forces pulling whales toward the vessel hull increase with increasing speed (Clyne, 1999; Knowlton *et al.*, 1995), this is inconsistent with Silber *et al.* (2010), which demonstrated that there is no such relationship (i.e., hydrodynamic forces are independent of speed).

The Jensen and Silber (2003) report notes that the database represents a minimum number of collisions, because the vast majority probably goes undetected or unreported. In contrast, Navy vessels are likely to detect any strike that does occur, and they are required to report all ship strikes involving marine mammals. Overall, the percentages of Navy traffic relative to overall large shipping traffic are very small (on the order of 2 percent).

There are no records of any Navy vessel strikes to marine mammals during training or testing activities in the MITT Study Area. There have been Navy strikes of large whales in areas outside the Study Area, such as Hawaii and Southern California. However, these areas differ significantly from the Study Area given that both Hawaii and Southern California have a much higher number of Navy vessel activities and much higher densities of large whales.

Other efforts have been undertaken to investigate the impact from vessels (both whale-watching and general vessel traffic noise) and demonstrated impacts do occur (Bain, 2002; Erbe, 2002; Lusseau, 2009; Williams *et al.*, 2006, 2009, 2011b, 2013, 2014a, 2014b; Noren *et al.*, 2009; Read *et al.*, 2014; Rolland *et al.*, 2012; Pirotta *et al.*, 2015). This body of research for the most part has investigated impacts associated with the presence of chronic stressors, which differ significantly from generally intermittent Navy training and testing activities. For example, in an analysis of energy costs to killer whales, Williams *et al.* (2009) suggested that whale-watching in the Johnstone Strait resulted in lost feeding opportunities due to vessel disturbance, which could carry higher costs than other measures of behavioral change might suggest. Ayres *et al.* (2012) recently reported on research in the Salish Sea involving the measurement of southern resident killer whale fecal hormones to assess two potential threats to the species recovery: lack of prey (salmon) and impacts to behavior from vessel traffic. Ayres *et al.* (2012) suggested that the lack

of prey overshadowed any population-level physiological impacts on southern resident killer whales from vessel traffic.

Mitigation

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.” NMFS’ duty under this “least practicable adverse impact” standard is to prescribe mitigation reasonably designed to minimize, to the extent practicable, any adverse population-level impacts, as well as habitat impacts. While population-level impacts are minimized by reducing impacts on individual marine mammals, not all takes have a reasonable potential for translating to population-level impacts. NMFS’ objective under the “least practicable adverse impact” standard is to design mitigation targeting those impacts on individual marine mammals that are reasonably likely to contribute to adverse population-level effects.

The NDAA of 2004 amended the MMPA as it relates to military-readiness activities and the ITA 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 and testing activities described in the Navy’s LOA application are considered military readiness activities.

In *Conservation Council for Hawaii v. National Marine Fisheries Service*, No. 1:13-cv-00684 (D. Hawaii March 31, 2015), the court stated that NMFS “appear[s] to think that [it] satisf[ies] the statutory ‘least practicable adverse impact’ requirement with a ‘negligible impact’ finding.” In light of the court’s decision, we take this opportunity to make clear our position that

the “negligible impact” and “least practicable adverse impact” requirements are distinct, even though the focus of both is on population-level impacts.

A population-level impact is an impact on the population numbers (survival) or growth and reproductive rates (recruitment) of a particular marine mammal species or stock. As we noted in the preamble to our general MMPA implementing regulations, not every population-level impact violates the negligible impact requirement. As we explained, the negligible impact standard does not require a finding that the anticipated take will have “no effect” on population numbers or growth rates: “The statutory standard does not require that the same recovery rate be maintained, rather that no significant effect on annual rates of recruitment or survival occurs... [T]he key factor is the significance of the level of impact on rates of recruitment or survival. Only insignificant impacts on long-term population levels and trends can be treated as negligible.” See 54 Fed. Reg. 40338, 40341-42 (Sept 29, 1989). Nevertheless, while insignificant impacts on population numbers or growth rates may satisfy the negligible impact requirement, such impacts still must be mitigated, to the extent practicable, under the “least practicable adverse impact” requirement. Thus, the negligible impact and least practicable adverse impact requirements are clearly distinct, even though both focus on population-level effects.

As explained in the proposed rule, 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 accomplishing one or more of the general goals listed below:

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

- b. Reduce 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. Reduce 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. Reduce 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. Avoid or minimize 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 – increase the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation (shut-down zone, etc.).

Our final evaluation of measures that meet one or more of the above goals includes consideration of the following factors in relation to one another: The manner in which, and the degree to which, the successful implementation of the mitigation measures is expected to reduce population-level impacts to marine mammal species and stocks and impacts to their habitat; the

proven or likely efficacy of the measures; and the practicability of the suite of measures for applicant implementation, including consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

NMFS reviewed the proposed activities and the suite of proposed mitigation measures as described in the Navy's LOA application to determine if they would result in the least practicable adverse effect on marine mammals. NMFS described the Navy's proposed mitigation measures in detail in the proposed rule (79 FR 15388, March 19, 2014; pages 15414-15422), and they have not changed. NMFS worked with the Navy in the development of the Navy's initially proposed measures, and they are informed by years of experience and monitoring. As described in the Mitigation Conclusions below and in responses to comments, and in the MITT FEIS/OEIS, additional measures were considered and analyzed, but ultimately not chosen for implementation. Below are the mitigation measures as agreed upon by the Navy and NMFS. For additional details regarding the Navy's mitigation measures, see Chapter 5 in the MITT FEIS/OEIS.

- At least one Lookout during applicable training and testing activities;
- Mitigation zones ranging from 70 yards (yd) (64 m) to 2.5 nautical miles (nm) during applicable activities that involve the use of impulse and non-impulse sources to avoid or reduce the potential for onset of the lowest level of injury, PTS, out to the predicted maximum range (Tables 6 and 7);
- Mitigation zones of 500 yd (457 m) for whales and 200 yd (183 m) for all other marine mammals (except bow riding dolphins) during vessel movement, and a mitigation zone of 250 yd (229 m) for marine mammals during use of towed in-water devices being towed from manned platforms; and

- Mitigation zones ranging from 200 yd (183 m) to 1,000 yd (914 m) during activities that involve the use of non-explosive practice munitions.

Table 6. Predicted ranges to TTS, PTS, and recommended mitigation zones.

Activity Category	Bin (Representative Source)*	Predicted Average (Longest) Range to TTS	Predicted Average (Longest) Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone
Non-Impulse Sound					
Low-Frequency and Hull-Mounted Mid-Frequency Active Sonar	MF1 (SQS-53 ASW hull-mounted sonar)	Page: 83 3,821 yd (3.5 km) for one ping	Page: 83 100 yd (91 m) for one ping	Not Applicable	6 dB power down at 1,000 yd. (914 m); 4 dB power down at 500 yd. (457 m); and shutdown at 200 yd. (183 m)
	LF4 (low-frequency sonar)**	3,821 yd. (3.5 km) for one ping	100 yd. (91 m) for one ping	Not Applicable	200 yd. (183 m)**
High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar	MF4 (AQS-22 ASW dipping sonar)	230 yd. (210 m) for one ping	20 yd. (18 m) for one ping	Not Applicable	200 yd. (183 m)
Explosive and Impulse Sound					
Improved Extended Echo Ranging Sonobuoys	E4 (Explosive sonobuoy)	434 yd. (397 m)	156 yd. (143 m)	563 yd. (515 m)	600 yd. (549 m)
Explosive Sonobuoys using 0.6–2.5 lb. NEW	E3 (Explosive sonobuoy)	290 yd. (265 m)	113 yd. (103 m)	309 yd. (283 m)	350 yd. (320 m)
Anti-Swimmer Grenades	E2 (Up to 0.5 lb. NEW)	190 yd. (174 m)	83 yd. (76 m)	182 yd. (167 m)	200 yd. (183 m)
Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices	NEW dependent (see Table 7)				
Mine Neutralization Diver-Placed Mines Using Time-Delay Firing Devices	E6 (Up to 20 lb. NEW)	407 yd. (372 m)	98 yd. (90 m)	102 yd. (93 m)	1,000 yd. (914 m)

Gunnery Exercises – Small- and Medium-Caliber (Surface Target)	E2 (40 mm projectile)	190 yd. (174 m)	83 yd. (76 m)	182 yd. (167 m)	200 yd. (183 m)
Gunnery Exercises – Large-Caliber (Surface Target)	E5 (5 in. projectiles at the surface***)	453 yd. (414 m)	186 yd. (170 m)	526 yd. (481 m)	600 yd. (549 m)
Missile Exercises up to 250 lb. NEW (Surface Target)	E9 (Maverick missile)	949 yd. (868 m)	398 yd. (364 m)	699 yd. (639 m)	900 yd. (823 m)
Missile Exercises > 250 to 500 lb. NEW (Surface Target)	E10 (Harpoon missile)	1,832 yd. (1,675 m)	731 yd. (668 m)	1,883 yd. (1,721 m)	2,000 yd. (1.8 km)
Bombing Exercises	E12 (MK-84 2,000 lb. bomb)	2,513 yd. (2.3 km)	991 yd. (906 m)	2,474 yd. (2.3 km)	2,500 yd. (2.3 km)****
Torpedo (Explosive) Testing	E11 (MK-48 torpedo)	1,632 yd. (1.5 km)	697 yd. (637 m)	2,021 yd. (1.8 km)	2,100 yd. (1.9 km)
Sinking Exercises	E12 (Various sources up to the MK-84 2,000 lb. bomb)	2,513 yd. (2.3 km)	991 yd. (906 m)	2,474 yd. (2.3 km)	2.5 nm****

ASW = anti-submarine warfare, km = kilometers, lb.= pound(s), m = meters, mm = millimeters, NEW = net explosive weight, nm = nautical miles, PTS = Permanent Threshold Shift, TTS = Temporary Threshold Shift, yd. = yards

* This table does not provide an inclusive list of source bins; bins presented here represent the source bin with the largest range to effects within the given activity category.

** The representative source bin and mitigation zone applies to sources that cannot be powered down (e.g., bins LF4 and LF5).

*** The representative source bin E5 has different range to effects depending on the depth of activity occurrence (at the surface or at various depths).

**** Recommended mitigation zones are larger than the modeled injury zones to account for multiple types of sources or charges being used

Table 7. Predicted ranges to effects and mitigation zone radius for mine countermeasure and neutralization activities using positive control firing devices.

Charge Size Net Explosive Weight (Bins)	General Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices*				Mine Countermeasure and Neutralization Activities Using Diver Placed Charges under Positive Control**			
	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone
2.5–5 lb. (1.2-2.3 kg) (E4)	434 yd.	197 yd.	563 yd.	600 yd.	545 yd.	169 yd.	301 yd.	350 yd.
	(474 m)	(180 m)	(515 m)	(549 m)	(498 m)	(155 m)	(275 m)	(320 m)
5–10 lb. (2.7-4.5 kg)	525 yd.	204 yd.	649 yd.	800 yd.	587 yd.	203 yd.	464 yd.	500 yd.

(E5)	(480 m)	(187 m)	(593 m)	(732 m)	(537 m)	(185 m)	(424 m)	(457 m)
>10–20 lb. (5-9.1 kg) (E6)	766 yd.	288 yd.	648 yd.	800 yd.	647 yd.	232 yd.	469 yd.	500 yd.
	(700 m)	(263 m)	(593 m)	(732 m)	(592 m)	(212 m)	(429 m)	(457 m)
PTS: permanent threshold shift; TTS: temporary threshold shift *These mitigation zones are applicable to all mine countermeasure and neutralization activities conducted in all locations specified in Chapter 2 of the Navy's LOA application. **These mitigation zones are only applicable to mine countermeasure and neutralization activities involving the use of diver placed charges. These activities are conducted in shallow-water and the mitigation zones are based only on the functional hearing groups with species that occur in these areas (mid-frequency cetaceans and sea turtles).								

Stranding Response Plan

NMFS and the Navy developed a Stranding Response Plan for MIRC in 2010 as part of the incidental take authorization process. In addition, Regional Stranding Implementation Assistance Plans for MIRC were established in 2011 per a Navy-NMFS MOU. The Stranding Response Plan is specifically intended to outline the applicable requirements in the event that a marine mammal stranding is reported in the MIRC during a major training exercise. NMFS considers all plausible causes within the course of a stranding investigation and these plans in no way presume that any strandings in a Navy range complex are related to, or caused by, Navy training and testing activities, absent a determination made during investigation. The plans are designed to address mitigation, monitoring, and compliance. The Navy worked with NMFS to refine these plans for the new MITT Study Area (to include regionally specific plans that include more logistical detail) and these revised plans are available here:

<http://www.nmfs.noaa.gov/pr/permits/incidental/>. Modifications to the Stranding Response Plan may also be made through the adaptive management process.

Mitigation Conclusions

NMFS has carefully evaluated the Navy's proposed mitigation measures – many of which were developed with NMFS' input during the first phase of authorizations – and considered a range of other measures in the context of ensuring that NMFS prescribes the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Based on our evaluation of the Navy's proposed measures, as well as other measures considered by NMFS, NMFS has determined that the Navy's proposed mitigation measures (especially when the adaptive management component is taken into consideration (see Adaptive Management, below)) 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.

Monitoring

Section 101(a)(5)(A) of the MMPA states that in order to issue an ITA for an activity, NMFS must set forth “requirements pertaining to the monitoring and reporting of such taking.” The MMPA implementing regulations at 50 CFR 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.

NMFS provided an overview of Navy monitoring and research, highlighted recent findings, and explained the Navy's new approach to monitoring in the proposed rule (79 FR 15388; pages 15422-15426). Below is a summary of the Navy's Integrated Comprehensive Monitoring Program (ICMP) and the Navy's Strategic Planning Process for Marine Species

Monitoring.

Integrated Comprehensive Monitoring Program

The Navy's ICMP is intended to coordinate monitoring efforts across all regions and to allocate the most appropriate level and type of effort for each range complex based on a set of standardized objectives, and in acknowledgement of regional expertise and resource availability. The ICMP is designed to be flexible, scalable, and adaptable through the adaptive management and strategic planning processes to periodically assess progress and reevaluate objectives. Although the ICMP does not specify actual monitoring field work or projects, it does establish top-level goals that have been developed in coordination with NMFS. As the ICMP is implemented, detailed and specific studies will be developed which support the Navy's top-level monitoring goals. In essence, the ICMP directs that monitoring activities relating to the effects of Navy training and testing activities on marine species should be designed to contribute towards one or more of the following top-level goals:

- An increase in our understanding of the likely occurrence of marine mammals and/or ESA-listed marine species in the vicinity of the action (i.e., presence, abundance, distribution, and/or density of species);
- An increase in our understanding of the nature, scope, or context of the likely exposure of marine mammals and/or ESA-listed species to any of the potential stressor(s) associated with the action (e.g., tonal and impulsive sound), through better understanding of one or more of the following: (1) the action and the environment in which it occurs (e.g., sound source characterization, propagation, and ambient noise levels); (2) the affected species (e.g., life history or dive patterns); (3) the likely co-occurrence of marine mammals and/or ESA-listed marine species with the action (in whole or part) associated with

specific adverse effects, and/or; (4) the likely biological or behavioral context of exposure to the stressor for the marine mammal and/or ESA-listed marine species (e.g., age class of exposed animals or known pupping, calving or feeding areas);

- An increase in our understanding of how individual marine mammals or ESA-listed marine species respond (behaviorally or physiologically) to the specific stressors associated with the action (in specific contexts, where possible, e.g., at what distance or received level);
- An increase in our understanding of how anticipated individual responses, to individual stressors or anticipated combinations of stressors, may impact either: (1) the long-term fitness and survival of an individual; or (2) the population, species, or stock (e.g., through effects on annual rates of recruitment or survival);
- An increase in our understanding of the effectiveness of mitigation and monitoring measures;
- A better understanding and record of the manner in which the authorized entity complies with the ITA and Incidental Take Statement;
- An increase in the probability of detecting marine mammals (through improved technology or methods), both specifically within the safety zone (thus allowing for more effective implementation of the mitigation) and in general, to better achieve the above goals; and
- A reduction in the adverse impact of activities to the least practicable level, as defined in the MMPA.

Monitoring addresses the ICMP top-level goals through a collection of specific regional and ocean basin studies based on scientific objectives. Quantitative metrics of monitoring effort (e.g., 20 days of aerial surveys) are not a specific requirement. The adaptive management process and reporting requirements serve as the basis for evaluating performance and compliance, primarily considering the quality of the work and results produced, as well as peer review and publications, and public dissemination of information, reports, and data. Details of the ICMP and all MIRC monitoring reports are available online (<http://www.navymarinespeciesmonitoring.us/>).

Strategic Planning Process for Marine Species Monitoring

The Navy also developed the Strategic Planning Process for Marine Species Monitoring, which establishes the guidelines and processes necessary to develop, evaluate, and fund individual projects based on objective scientific study questions. The process uses an underlying framework designed around top-level goals, a conceptual framework incorporating a progression of knowledge, and consultation with a Scientific Advisory Group and other regional experts. The Strategic Planning Process for Marine Species Monitoring has been used to set intermediate scientific objectives, identify potential species of interest at a regional scale, and evaluate and select specific monitoring projects to fund or continue supporting for a given fiscal year. This process would also address relative investments to different range complexes based on goals across all range complexes, and monitoring would leverage multiple techniques for data acquisition and analysis whenever possible. The Strategic Planning Process for Marine Species Monitoring is also available online (<http://www.navymarinespeciesmonitoring.us/>).

Past Monitoring in the MITT Study Area

NMFS has received multiple years' worth of annual exercise and monitoring reports addressing active sonar use and explosive detonations within the MIRC and other Navy range complexes. The data and information contained in these reports have been considered in developing mitigation and monitoring measures for the proposed training and testing activities within the Study Area. The Navy's annual exercise and monitoring reports may be viewed at: <http://www.nmfs.noaa.gov/pr/permits/incidental/> and <http://www.navy-marinespeciesmonitoring.us>. NMFS' summary of the Navy's annual monitoring reports was included in the proposed rule (79 FR 15388, March 19, 2014; pages 15423-15424). The Navy has since submitted to NMFS the 5-year Comprehensive Monitoring Report for MIRC, which is available at: <http://www.nmfs.noaa.gov/pr/permits/incidental/>.

Proposed Monitoring for the MITT Study Area

Based on discussions between the Navy and NMFS, future monitoring should address the ICMP top-level goals through a collection of specific regional and ocean basin studies based on scientific objectives. Monitoring would follow the strategic planning process and conclusions from adaptive management review by shifting from applying quantitative effort-based metrics, and instead demonstrating progress on the goals of specific scientific monitoring questions. The adaptive management process and reporting requirements would serve as the basis for evaluating performance and compliance, primarily considering the quality of the work and results produced, as well as peer review and publications, and public dissemination of information, reports, and data. The strategic planning process would be used to set intermediate scientific objectives, identify potential species of interest at a regional scale, and evaluate and select specific monitoring projects to fund or continue supporting for a given fiscal year. The strategic planning process would also address relative investments to different range complexes based on

goals across all range complexes, and monitoring would leverage multiple techniques for data acquisition and analysis whenever possible.

The Scientific Advisory Group (SAG) confirmed the Navy/NMFS decision made in 2009 that because so little is known about species occurrence in this area, the priority for the MIRC should be establishing basic marine mammal occurrence. Passive acoustic monitoring, small boat surveys, biopsy sampling, satellite tagging, and photo-identification are all appropriate methods for evaluating marine mammal occurrence and abundance in the MITT Study Area. Fixed acoustic monitoring and development of local expertise ranked highest among the SAG's recommended monitoring methods for the area. There is an especially high level of return for monitoring around the Mariana Islands because so little is currently known about this region. Specific monitoring efforts would result from future Navy/NMFS monitoring program management.

A more detailed description of the Navy's planned projects starting in 2015 (and some continuing from previous years) is available at the Navy's Marine Species Monitoring web portal: <http://www.navymarinespeciesmonitoring.us/>. The Navy will update the status of its monitoring program and funded projects through their Marine Species Monitoring web portal. NMFS will provide one public comment period on the Navy's monitoring program during the 5-year regulations. At this time, the public will have an opportunity (likely in the second or third year) to comment specifically on the Navy's MITT monitoring projects and data collection to date, as well as planned projects for the remainder of the regulations.

Through the adaptive management process (including annual meetings), the Navy will coordinate with NMFS and the Marine Mammal Commission (Commission) to review and provide input for projects that will meet the scientific objectives that are used to guide

development of individual monitoring projects. The adaptive management process will continue to serve as the primary venue for both NMFS and the Commission to provide input on the Navy's monitoring program, including ongoing work, future priorities, and potential new projects. The Navy will continue to submit annual monitoring reports to NMFS as part of the MITT rulemaking and LOA requirements. Each annual report will contain a section describing the adaptive management process and summarize the Navy's anticipated monitoring projects for the next reporting year. Following annual report submission to NMFS, the final rule language mandates a 3-month NMFS review prior to each report being finalized. This will provide ample time for NMFS and the Commission to comment on the next year's planned projects as well as ongoing regional projects or proposed new starts. Comments will be received by the Navy prior to the annual adaptive management meeting to facilitate a meaningful and productive discussion. NMFS and the Commission will also have the opportunity for involvement at the annual monitoring program science review meetings and/or regional Scientific Advisory Group meetings. This will help NMFS and the Commission stay informed and understand the scientific considerations and limitations involved with planning and executing various monitoring projects.

Ongoing Navy Research

The Navy is one of the world's leading organizations in assessing the effects of human activities on the marine environment, and provides a significant amount of funding and support to marine research, outside of the monitoring required by their incidental take authorizations. They also develop approaches to ensure that these resources are minimally impacted by current and future Navy operations. Navy scientists work cooperatively with other government researchers and scientists, universities, industry, and non-governmental conservation organizations in collecting, evaluating, and modeling information on marine resources, including

working towards a better understanding of marine mammals and sound. From 2004 to 2014, the Navy has provided over \$250 million for marine species research. The Navy sponsors 70 percent of all U.S. research concerning the effects of human-generated sound on marine mammals and 50 percent of such research conducted worldwide. Major topics of Navy-supported marine species research directly applicable to proposed activities within the MITT Study Area include the following:

- Better understanding of marine species distribution and important habitat areas;
- Developing methods to detect and monitor marine species before, during, and after training and testing activities;
- Better understanding the impacts of sound on marine mammals, sea turtles, fish, and birds; and
- Developing tools to model and estimate potential impacts of sound.

It is imperative that the Navy's research and development (R&D) efforts related to marine mammals are conducted in an open, transparent manner with validated study needs and requirements. The goal of the Navy's R&D program is to enable collection and publication of scientifically valid research as well as development of techniques and tools for Navy, academic, and commercial use. The two Navy organizations that account for most funding and oversight of the Navy marine mammal research program are the Office of Naval Research (ONR) Marine Mammals and Biology Program, and the Office of the Chief of Naval Operations (CNO) Energy and Environmental Readiness Division (N45) Living Marine Resources (LMR) Program. The primary focus of these programs has been on understanding the effects of sound on marine mammals, including physiological, behavioral and ecological effects.

The ONR Marine Mammals and Biology Program supports basic and applied research and technology development related to understanding the effects of sound on marine mammals, including physiological, behavioral, ecological, and population-level effects. Current program thrusts include:

- Monitoring and detection;
- Integrated ecosystem research including sensor and tag development;
- Effects of sound on marine life including hearing, behavioral response studies, diving and stress physiology, and Population Consequences of Acoustic Disturbance (PCAD); and
- Models and databases for environmental compliance.

To manage some of the Navy's marine mammal research programmatic elements, OPNAV N45 developed in 2011 a Living Marine Resources (LMR) Research and Development Program (www.lmr.navy.mil). The mission of the LMR program is to develop, demonstrate, and assess information and technology solutions to protect living marine resources by minimizing the environmental risks of Navy at-sea training and testing activities while preserving core Navy readiness capabilities. This mission is accomplished by:

- Improving knowledge of the status and trends of marine species of concern and the ecosystems of which they are a part;
- Developing the scientific basis for the criteria and thresholds to measure the effects of Navy generated sound;
- Improving understanding of underwater sound and sound field characterization unique to assessing the biological consequences resulting from underwater sound (as opposed to tactical applications of underwater sound or propagation loss modeling for military communications or tactical applications); and

- Developing technologies and methods to monitor and, where possible, mitigate biologically significant consequences to living marine resources resulting from naval activities, emphasizing those consequences that are most likely to be biologically significant.

The program is focused on three primary objectives that influence program management priorities and directly affect the program's success in accomplishing its mission:

1. Collect, Validate, and Rank R&D Needs: Expand awareness of R&D program opportunities within the Navy marine resource community to encourage and facilitate the submittal of well-defined and appropriate needs statements.
2. Address High Priority Needs: Ensure that program investments and the resulting projects maintain a direct and consistent link to the defined user needs.
3. Transition Solutions and Validate Benefits: Maximize the number of program-derived solutions that are successfully transitioned to the Fleet and system commands.

The LMR program primarily invests in the following areas:

- Developing Data to Support Risk Threshold Criteria;
- Improved Data Collection on Protected Species, Critical Habitat within Navy Ranges;
- New Monitoring and Mitigation Technology Demonstrations;
- Database and Model Development; and
- Education and Outreach, Emergent Opportunities.

LMR currently supports the Marine Mammal Monitoring on Ranges program at the Pacific Missile Range Facility on Kauai and, along with ONR, the multi-year Southern California Behavioral Response Study (<http://www.socal-brs.org>). This type of research helps in

understanding the marine environment and the effects that may arise from underwater noise in oceans.

Adaptive Management

Although substantial improvements have been made in our understanding of the effects of Navy training and testing activities (e.g., sonar, underwater detonations) on marine mammals, 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.

The reporting requirements associated with this rule are designed to provide NMFS with monitoring data from the previous year to allow NMFS to consider whether any changes are appropriate. NMFS and the Navy would meet to discuss the monitoring reports, Navy R&D developments, and current science and whether mitigation or monitoring modifications are appropriate. The use of adaptive management allows NMFS to consider new information from different sources to determine (with input from the Navy regarding practicability) on an annual or biennial basis if mitigation or monitoring measures should be modified (including additions or deletions). Mitigation measures could be modified 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.

The following are some of the possible sources of applicable data to be considered through the adaptive management process: (1) results from monitoring and exercises reports, as required by MMPA authorizations; (2) compiled results of Navy funded R&D studies; (3) results from specific stranding investigations; (4) results from general marine mammal and sound

research; and (5) any information which reveals that marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOA.

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. NMFS described the proposed Navy reporting requirements in the proposed rule (79 FR 15388, March 19, 2014; page 15426). Reports from individual monitoring events, results of analyses, publications, and periodic progress reports for specific monitoring projects will be posted to the Navy’s Marine Species Monitoring web portal: <http://www.navymarinespeciesmonitoring.us> and NMFS’ website: <http://www.nmfs.noaa.gov/pr/permits/incidental/>. There are several different reporting requirements that are further detailed in the regulatory text at the end of this document and summarized below.

General Notification of Injured or Dead Marine Mammals

Navy personnel would ensure that NMFS (the appropriate 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 mid-frequency active sonar, high-frequency active sonar, or underwater explosive detonations. The Navy would provide NMFS with species identification or a 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 photographs

or video (if available). The MITT Stranding Response Plan contains further reporting requirements for specific circumstances (<http://www.nmfs.noaa.gov/pr/permits/incidental/>).

Vessel Strike

Since the proposed rule, NMFS has added the following language to address monitoring and reporting measures specific to vessel strike. Most of this language comes directly from the Stranding Response Plan. This section has also been included in the regulatory text at the end of this document. Vessel strike during Navy training and testing activities in the Study Area is not anticipated; however, in the event that a Navy vessel strikes a whale, the Navy shall do the following:

Immediately report to NMFS (pursuant to the established Communication Protocol) the:

- Species identification (if known);
- Location (latitude/longitude) of the animal (or location of the strike if the animal has disappeared);
- Whether the animal is alive or dead (or unknown); and
- The time of the strike.

As soon as feasible, the Navy shall report to or provide to NMFS, the:

- Size, length, and description (critical if species is not known) of animal;
- An estimate of the injury status (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared, etc.);
- Description of the behavior of the whale during event, immediately after the strike, and following the strike (until the report is made or the animal is no longer sighted);
- Vessel class/type and operational status;
- Vessel length;

- Vessel speed and heading; and
- To the best extent possible, obtain a photo or video of the struck animal, if the animal is still in view.

Within 2 weeks of the strike, provide NMFS:

- A detailed description of the specific actions of the vessel in the 30-minute timeframe immediately preceding the strike, during the event, and immediately after the strike (e.g., the speed and changes in speed, the direction and changes in direction, other maneuvers, sonar use, etc., if not classified);
- A narrative description of marine mammal sightings during the event and immediately after, and any information as to sightings prior to the strike, if available; and use established Navy shipboard procedures to make a camera available to attempt to capture photographs following a ship strike.

NMFS and the Navy will coordinate to determine the services the Navy may provide to assist NMFS with the investigation of the strike. The response and support activities to be provided by the Navy are dependent on resource availability, must be consistent with military security, and must be logistically feasible without compromising Navy personnel safety.

Assistance requested and provided may vary based on distance of strike from shore, the nature of the vessel that hit the whale, available nearby Navy resources, operational and installation commitments, or other factors.

Annual Monitoring Reports

As noted above, reports from individual monitoring events, results of analyses, publications, and periodic progress reports for specific monitoring projects would be posted to the Navy's Marine Species Monitoring web portal and NMFS' website as they become available.

Progress and results from all monitoring activity conducted within the MITT Study Area, as well as required Major Training Exercise activity, would be summarized in an annual report. A draft report would be submitted either 90 days after the calendar year or 90 days after the conclusion of the monitoring year, date to be determined by the adaptive management review process. In the past, each annual report has summarized data for a single year. At the Navy's suggestion, future annual reports would take a cumulative approach in that each report will compare data from that year to all previous years. For example, the third annual report will include data from the third year and compare it to data from the first and second years. This will provide an ongoing cumulative look at the Navy's annual monitoring and exercise and testing reports and eliminate the need for a separate comprehensive monitoring and exercise summary report at the end of the 5-year period.

Annual Exercise and Testing Reports

The Navy shall submit preliminary reports detailing the status of authorized sound sources within 21 days after the anniversary of the date of issuance of the LOA. The Navy shall submit detailed reports 3 months after the anniversary of the date of issuance of the LOA. The detailed annual reports shall contain information on Major Training Exercises (MTE), Sinking Exercise (SINKEX) events, and a summary of sound sources used, as described below. The analysis in the detailed reports will be based on the accumulation of data from the current year's report and data collected from previous reports.

Comments and Responses

On March 19, 2014 (79 FR 15388), NMFS published a proposed rule in response to the Navy's request to take marine mammals incidental to training and testing activities in the MITT Study Area and requested comments, information, and suggestions concerning the request.

During the 45-day public comment period, NMFS received comments from the Marine Mammal Commission, private citizens, and an elected official (Senator Vicente (ben) C. Pangelinan, 32nd Guam legislature). Comments specific to section 101(a)(5)(A) of the MMPA and NMFS' analysis of impacts to marine mammals are summarized, sorted into general topic areas, and addressed below and/or throughout the final rule. Comments specific to the MITT EIS/OEIS, which NMFS participated in developing as a cooperating agency and adopted, or that were also submitted to the Navy during the MITT DEIS/OEIS public comment period are addressed in Appendix E (Public Participation) of the FEIS/OEIS. The Natural Resources Defense Council (NRDC) did not submit comments specific to the proposed MITT rulemaking; however, NRDC has indicated their full endorsement of the comments and management recommendations submitted on the MITT DEIS/OEIS by the Commonwealth of the Northern Mariana Islands (Governor Eloy S. Inos). Those comments are addressed in Appendix E of the FEIS/OEIS and are considered by NMFS and the Navy in the context of both this rulemaking and related NEPA compliance. Comments submitted by Governor Inos that are most applicable to this rulemaking include recommended mitigation areas and are addressed below. Last, some commenters presented technical comments on the general behavioral risk function that are largely identical to those posed during the comment period for proposed rules for the Hawaii Range Complex (HRC), Atlantic Fleet Active Sonar Training (AFAST), Atlantic Fleet Training and Testing (AFTT), and Hawaii-Southern California Training and Testing (HSTT) study areas, predecessors to the MITT rule. The behavioral risk function remains unchanged since then, and here we incorporate our responses to those initial technical comments (74 FR 1455, Acoustic Threshold for Behavioral Harassment section, page 1473; 74 FR 4844, Behavioral Harassment Threshold section, page 4865; 78 FR 73010, Acoustic Thresholds section, page 73038; 78 FR 78106,

Acoustic Thresholds section, page 78129). Full copies of the comment letters may be accessed at <http://www.regulations.gov>.

Marine Mammal Density Estimates

Comment 1: The Commission recommended that NMFS require the Navy to (1) account for uncertainty in extrapolated density estimates for all species by using the upper limit of the 95% confidence interval or the arithmetic mean plus two standard deviations and (2) then re-estimate the numbers of takes accordingly.

Response 1: The Navy coordinated with both NMFS' Pacific Islands Fisheries Science Center (PIFSC) and Southwest Fisheries Science Center (SWFSC) to identify the best available density estimates for marine mammals occurring in the Study Area. In all cases, a conservative (i.e., greater) estimate was selected. The Navy's use of a mean density estimate is consistent with the approach taken by NMFS to estimate and report the populations of marine mammals in their Stock Assessment Reports and the estimated mean is thus considered the "best available data." Adjusting the mean estimates as suggested would result in unreasonable measures, particularly given the very high coefficient of variation (CV) associated with most marine mammal density estimates. Further, the Navy's acoustic model includes conservative estimates of all parameters (e.g., assumes that the animals do not move horizontally, assumes animals are always head-on to the sound source so that they receive the maximum amount of energy, etc.) resulting in a more conservative (i.e., greater) assessment of potential impacts.

Mitigation, Monitoring, and Reporting

Comment 2: Governor Eloy S. Inos (Commonwealth of the Northern Mariana Islands [CNMI]) recommended (via comments submitted on the MITT DEIS/OEIS) specific geographic marine mammal mitigation areas—or habitat protection areas—to be avoided by all Navy sonar

and explosives training and testing activities. These include near-island habitat in the vicinity of the islands of the CNMI, landward of the 3,500 m isobath (based on concentrations of insular populations of odontocetes within the 3,500 m isobath around the Hawaiian Islands); and from the West Mariana Ridge (a chain of conical seamounts paralleling 145 to 170 km west of the Mariana Islands) to the 3,500 m isobaths around the ridge, between roughly 13° and 18° N where two beaked whale sightings were made during a Navy line-transect survey in 2007, passive acoustic data acquired during that same survey showed multiple detections of short-finned pilot whales around the ridgeline, and satellite tagging efforts showed use of the ridge by at least one false killer whale tagged off Rota (Hill *et al.*, 2013).

Response 2: Under section 101(a)(5)(A) of the MMPA, NMFS must set forth the “means of effecting the least practical adverse impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.” The NDAA amended the MMPA as it relates to military-readiness activities (which these Navy activities are) 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.” Therefore, as discussed earlier in the Mitigation section, in making a determination of “least practicable adverse impact,” NMFS considers the likely benefits of a mitigation measures being considered to affected species or stocks and their habitat, as well as the likely effect of those measures on personnel safety, practicality of implementation, and the impact on the effectiveness of the military readiness activity.

With respect to the effectiveness of area limitations, temporal (e.g., seasonal) or geographic limitations (time/area limitations) are a direct and effective means of reducing

adverse impacts to marine mammals. By reducing the overlap in time and space of the known concentrations of marine mammals and the acoustic footprint associated with the thresholds for the different types of take (either at all times and places where animals are concentrated, or times and places where they are concentrated for specifically important behaviors (such as reproduction or feeding)), the amount of take can be reduced. It is most effective when these measures are used carefully at times and places where their effects are relatively well known. For example, if there is credible evidence that concentrations of marine mammals are known to be high at a specific place or during a specific time of the year (such as the high densities of humpback whales delineated on the Mobley map in the HRC, or North Atlantic right whale critical habitat on the east coast), then these seasonal or geographic exclusions or limitations may be appropriate. However, if marine mammals are known to *prefer* certain *types* of areas (as opposed to specific areas) for certain functions, such as beaked whale use of seamounts or marine mammal use of productive areas like cyclonic eddies, which means that they may or may not be present at any specific time, it is less effective to require avoidance or limited use of the area because they may not be present.

The Governor's recommendation that the Navy exclude sonar and explosives training and testing in the vicinity of the islands of the CNMI landward of the 3,500 m isobaths is based on the fact that in Hawaii insular populations of odontocetes are generally concentrated on important near-island habitat within the 3,500 m isobaths. However, there is nothing to suggest that a similar isobath represents the delineation of important near-island habitat for concentrations of marine mammals around the islands of the CNMI. In fact, satellite tag deployment data from cetacean (short-finned pilot whales, false killer whales, rough-toothed dolphins, bottlenose dolphins, and melon-headed whales) surveys in the waters surrounding

Guam and the CNMI during 2010-2014, conducted by the Pacific Islands Fisheries Science Center (PIFSC) in partnership with the Navy, showed that multiple tagged species utilized the areas far offshore beyond the 3,500 m isobath (Hill *et al.*, 2014). These findings are corroborated by line transect surveys conducted by Fulling *et al.* (2011), which document multiple encounters and wide distribution of bottlenose dolphins, rough-toothed dolphins, pantropical spotted dolphins, false killer whales, and sperm whales far offshore of Guam and the CNMI at depths up to 9,874 m. NMFS, therefore, does not consider the near-island waters landward of the 3,500 m isobaths around the islands of the CNMI an appropriate time/area limitation for training and testing activities in the Study Area.

Regarding the Governor's recommendation that the Navy not conduct sonar and explosives training and testing from the West Mariana Ridge to the 3,500 m isobath around the ridge, the relatively limited data cited by the Governor is not suggestive of high concentrations of marine mammals or marine mammal species (*i.e.*, two beaked whales, three short-finned pilot whales, one false killer whale) specific to this ridge. In fact, satellite tagging efforts by PIFSC indicated the vast majority of tagged false killer whales occurred well beyond, and east of, the West Mariana Ridge ridgeline (Hill *et al.*, 2014 and 2015). And while the Navy's line-transect survey and passive acoustic monitoring conducted in 2007 noted the presence of a few individuals of short-finned pilot whales (and beaked whales) along portions of the West Mariana Ridge, PIFSC telemetry data analyzed by Hill *et al.* (2015) indicate a preference away from the ridge and closer to the near-island waters around Guam (though not exclusively so). NMFS recognizes the generally biologically productive nature of some ridges and seamounts; however, there are no data to suggest that important or species-specific habitat (rookeries, reproductive, feeding) exists along the West Mariana Ridge or within the 3,500 m isobath around the ridge.

In addition to NMFS' consideration of the effectiveness of the time/area restrictions recommended by Governor Eloy S. Inos, the Navy has provided in the MITT FEIS/OEIS the following specific reasons explaining why these types of geographic restrictions or limitations are considered impracticable for the Navy:

- Broad Coastal Restrictions (*e.g.*, around entire islands) Based on Distances from Isobaths or Shorelines – Avoiding locations for training and testing activities within the Study Area based on wide-scale distances from isobaths or the shoreline for the purpose of mitigation would be impractical with regard to implementation of military readiness activities, result in unacceptable impact on readiness, and would not be an effective means of mitigation, and would increase safety risks to personnel. Training in shallower water is an essential component to maintaining military readiness. Sound propagates differently in shallower water and operators must learn to train in this environment. Additionally, submarines have become quieter through the use of improved technology and have learned to hide in the higher ambient noise levels of the shallow waters of coastal environments. In real world events, it is highly likely Sailors would be working in, and therefore must train in, these types of areas. The littoral waterspace is also the most challenging area to operate in due to a diverse acoustic environment. It is not realistic or practicable to refrain from training in the areas that are the most challenging and operationally important. Operating in shallow water is essential in order to provide realistic training on real world combat conditions with regard to shallow water sound propagation.

- Avoiding Locations Based on Bathymetry - Requiring training and testing to avoid large areas that encompass a large portion of a particular bathymetric conditions (e.g., high-relief seamounts such as those that comprise the West Mariana Ridge) within a designated Range Complex or study area for the purpose of mitigation would increase safety risks to personnel and result in unacceptable impact on readiness. Limiting training and testing (including the use of sonar and other active acoustic sources or explosives) to avoid steep or complex bathymetric features (e.g., seamounts) would reduce the realism of the military readiness activity. Systems must be tested in a variety of bathymetric conditions to ensure functionality and accuracy in a variety of environments. Sonar operators need to train as they would operate during real world combat situations. Because real world combat situations include diverse bathymetric conditions, Sailors must be trained to handle bottom bounce, sound passing through changing currents, eddies, or across changes in ocean temperature, pressure, or salinity. Training with reduced realism would alter Sailors' abilities to effectively operate in a real world combat situation, thereby resulting in an unacceptable increased risk to personnel safety and the sonar operator's ability to achieve mission success.

A more detailed discussion can be found in Section 5.3.4.1 of the MITT FEIS/OEIS.

In conclusion, NMFS has considered the time/area restrictions recommended by Governor Eloy S. Inos and has determined that requiring those measures would not reduce adverse effects to marine mammal populations or stocks or provide additional protection of marine mammal populations or stocks in the Study Area beyond those mitigation measures already proposed in the MITT EIS/OEIS and in this final rule (see Mitigation section above).

Further, NMFS has considered the Navy's conclusion that such limitations would impose an increased safety risk to personnel, an unacceptable impact on the effectiveness of training and testing activities that would affect military readiness, and an impractical burden with regard to implementation (This process is further detailed in Section 5.2.3 of the MITT FEIS/OEIS).

Comment 3: Senator Vicente (ben) C. Pangelinan (32nd Guam Legislature) expressed concerns with the effectiveness of the mitigation measures (e.g., Lookouts) outlined in the proposed rule. The Senator also questioned whether or not animals exposed to Navy sound sources will return to their usual locations.

Response 3: NMFS has carefully evaluated the Navy's proposed suite of mitigation measures and considered a broad range of other measures (including those recommended during the proposed rule public comment period) in the context of ensuring that NMFS prescribes the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Based on our evaluation of the Navy's proposed measures, as well as other measures considered by NMFS or recommended by the public, NMFS has determined that the Navy's proposed mitigation measures (especially when the adaptive management component is taken into consideration (see Adaptive Management, below)), along with the additions detailed in the Mitigation section above, 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.

Regarding Navy Lookouts, Lookouts are a vital aspect of the strategy for limiting potential impacts from Navy activities. Lookouts are qualified and experienced observers of

the marine environment. All Lookouts take part in Marine Species Awareness Training so that they are better prepared to spot marine mammals. Detailed information on the Navy's Marine Species Awareness Training program, which speaks to qualifications and training, is also provided in Chapter 5 of the MITT FEIS/OEIS. Their primary duty is to detect objects in the water, estimate the distance from the ship, and identify them as any number of inanimate or animate objects that are significant to a Navy activity or as a marine mammal so that the mitigation measure can be implemented. Lookouts are on duty at all times, day and night, when a ship or surfaced submarine is moving through the water. Lookouts are used continuously, throughout the duration of activities that involve the following: active sonar, Improved Extended Echo Ranging (IEER) sonobuoys, anti-swimmer grenades, positive control firing devices, timedelay firing devices, gunnery exercises (surface target), missile exercises (surface target), bombing exercises, torpedo (explosive) testing, sinking exercises, at-sea explosives testing, vessels underway, towed in-water devices (from manned platforms), and non-explosive practice munitions. Visual detections of marine mammals would be communicated immediately to a watch station for information disseminations and appropriate mitigation action. The Navy will use passive acoustic monitoring to supplement visual observations by Lookouts during IEER sonobuoy activities, explosive sonobuoys using 0.6–2.5 pound (lb) net explosive weight, torpedo (explosive) testing, and sinking exercises, to detect marine mammal vocalizations. Passive acoustic detections will be reported to Lookouts to increase vigilance of the visual observation. NMFS has carefully considered Navy's use of Lookouts and determined that in combination with the Stranding Response Plans, and the other mitigation measures identified, the Navy's mitigation plan will effect the least practicable adverse impacts on marine mammal species or stocks and their habitat.

There are numerous studies which document the return of marine mammals (both odontocetes and mysticetes) following displacement of an individual (i.e., short-term avoidance) from an area as a result of the presence of a sound (Bowles *et al.*, 1994; Goold, 1996; 1998; Stone *et al.*, 2000; Morton and Symonds, 2002; Gailey *et al.*, 2007; Claridge and Durban 2009; Moretti *et al.*, 2009; McCarthy *et al.*, 2011; Tyack *et al.*, 2011). These studies are referenced and discussed in both the Navy's LOA application (Chapter 6) and the proposed rule (79 FR 15403, March 19, 2014), as well as in the Analysis and Negligible Impact Determination section of this final rule.

Comment 4: Senator Vicente (ben) C. Pangelinan (32nd Guam Legislature) expressed concerns with the Navy's inability to mitigate for onset of TTS during every activity. Other commenters (e.g., Governor Eloy S. Inos, CNMI) on the MITT DEIS/OEIS expressed similar concerns regarding the size of recommended mitigation zones, particularly those proposed for MF1 sonar system activities in which the Governor recommended the Navy "establish a wider buffer, to the maximum extent practicable."

Response 4: As discussed in the proposed rule (79 FR 15388, March 19, 2014), TTS is a type of Level B harassment. In the Estimated Take of Marine Mammal section, we quantify the effects that might occur from the specific training and testing activities that the Navy proposes in the MITT Study Area, which includes the number of takes by Level B harassment (behavioral harassment, acoustic masking and communication impairment, and TTS). Through this rulemaking, NMFS has authorized the Navy to take marine mammals by Level B harassment incidental to Navy training and testing activities in the MITT Study Area. In order to issue an ITA, we must set forth the "permissible methods of taking pursuant to such activity, and other means of effecting the least practical adverse impact on such species or stock and its habitat,

paying particular attention to rookeries, mating grounds, and areas of similar significance.’’ We have determined that the mitigation measures implemented under this rule effect the least practical adverse impact on marine mammal species and stocks and their habitat.

The Navy developed activity-specific mitigation zones based on the Navy’s acoustic propagation model. Each recommended mitigation zone is intended to avoid or reduce the potential for onset of the lowest level of injury, PTS, out to the predicted maximum range. Mitigating to the predicted maximum range to PTS consequently also mitigates to the predicted maximum range to onset mortality (1 percent mortality), onset slight lung injury, and onset slight gastrointestinal tract injury, since the maximum range to effects for these criteria are shorter than for PTS. Furthermore, in most cases, the mitigation zone actually covers the TTS zone. In some instances, the Navy recommended mitigation zones are larger or smaller than the predicted maximum range to PTS based on the associated effectiveness and operational assessments presented in Section 5.2.3 of the MITT FEIS/OEIS. NMFS worked closely with the Navy in the development of the recommendations and carefully considered them prior to adopting them in this final rule. The mitigation zones contained in this final rule represent the maximum area the Navy can effectively observe based on the platform of observation, number of personnel that will be involved, and the number and type of assets and resources available. As mitigation zone sizes increase, the potential for reducing impacts decreases. For instance, if a mitigation zone increases from 1,000 to 4,000 yd. (914 to 3,658 m), the area that must be observed increases sixteen-fold, which is not practicable. The mitigation measures contained in this final rule balance the need to reduce potential impacts with the Navy’s ability to provide effective observations throughout a given mitigation zone. Implementation of mitigation zones is most effective when the zone is appropriately sized to be

realistically observed. The Navy does not have the resources to maintain additional Lookouts or observer platforms that would be needed to effectively observe mitigation zones of increased size.

Comment 5: The Commission recommended that NMFS require the Navy to provide the predicted average and maximum ranges for all impact criteria (i.e., behavioral response, TTS, PTS, onset slight lung injury, onset slight gastrointestinal injury, and onset mortality), for all activities (i.e., based on the activity category and representative source bins and include ranges for more than 1 ping), and for all functional hearing groups of marine mammals within MITT representative environments (including shallow-water nearshore areas).

Response 5: The Navy discusses range to effects in Sections 3.4.4.1.1 and 3.4.4.2.1 of the MITT FEIS/OEIS. The active acoustic tables in Section 3.4.4.1.1 illustrate the ranges to PTS, TTS, and behavioral response. The active acoustic tables for PTS and TTS show ranges for all functional hearing groups and the tables for behavioral response show ranges for low-, mid-, and high-frequency cetaceans. The active acoustic source class bins used to assess range to effects represent some of the most powerful sonar sources and are often the dominant source in an activity. The explosives table in Section 3.4.4.2.1 illustrates the range to effects for onset mortality, onset slight lung injury, onset slight gastrointestinal tract injury, PTS, TTS, and behavioral response. The explosives table shows ranges for all functional hearing groups. The source class bins used for explosives range from the smallest to largest amount of net explosive weight. These ranges represent conservative estimates (i.e., longer ranges) based on the assumption that all impulses are 1-second in duration. In fact, most impulses are much shorter and contain less energy. Therefore, these ranges provide realistic maximum distances over which the specific effects would be possible.

NMFS believes that these representative sources provide adequate information to analyze potential effects on marine mammals. Because the Navy conducts training and testing in a variety of environments having variable acoustic propagation conditions, variations in acoustic propagation conditions are considered in the Navy's acoustic modeling and the quantitative analysis of acoustic impacts.

Average ranges to effect are provided in the MITT FEIS/OEIS to show the reader typical zones of impact around *representative* sources. As noted in the LOA application and MITT FEIS/OEIS, the ranges provided in the analysis sections (Section 6 of the LOA and Chapter 3 of the MITT FEIS/OEIS) are the average range to all effects for representative sources in a variety of environments (shallow and deep water). These are not nominal values for deep-water environments, as repeatedly asserted by the Commission.

Comment 6: The Commission recommended that NMFS require the Navy to use passive and active acoustics to supplement visual monitoring during implementation of mitigation measures for all activities that could cause Level A harassment or mortality beyond those explosive activities for which passive acoustic monitoring was already proposed. Specifically, the Commission questioned why passive and active acoustic monitoring used during the Navy's Surveillance Towed Array Sensory System Low Frequency Active (SURTASS LFA) activities is not applied here.

Response 6: The Navy requested Level A (injury) take of marine mammals for impulse and non-impulse sources during training and testing based on its acoustic analysis. While it is impractical for the Navy to conduct passive acoustic monitoring during all training and testing activities (due to lack of resources), the Navy has engineered the use of passive acoustic detection for monitoring purposes, taking into consideration where the largest impacts could potentially

occur, and the effectiveness and practicability of installing or using these devices. The Navy will use passive acoustic monitoring to supplement visual observations during Improved Extended Echo Ranging (IEER) sonobuoy activities, explosive sonobuoys using 0.6–2.5 pound (lb) net explosive weight, torpedo (explosive) testing, and sinking exercises, to detect marine mammal vocalizations. However, it is important to note that passive acoustic detections do not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections will be reported to lookouts to increase vigilance of the visual observation.

The active sonar system used by SURTASS LFA is unique to the platforms that use SURTASS LFA. Moreover, this system requires the platforms that carry SURTASS LFA to travel at very slow speeds for the system to be effective. For both of these reasons it is not possible for the Navy to use this system for the platforms analyzed in the MITT FEIS/OEIS.

NMFS believes that the Navy's suite of mitigation measures (which include mitigation zones that exceed or meet the predicted maximum distance to PTS) will typically ensure that animals will not be exposed to injurious levels of sound. To date, the monitoring reports submitted by the Navy for MIRC (or the AFTT and HSTT Study Areas), do not show any evidence of injured marine mammals.

Comment 7: The Commission recommended that NMFS require the Navy to use a second clearance category of 60 minutes for deep-diving species (i.e., beaked whales and sperm whales) if the animal has not been observed exiting the mitigation zone following shutdown of acoustic activities due to a marine mammal sighting.

Response 7: NMFS does not concur with the Commission's recommendation that the Navy should use a second clearance category of 60 minutes for deep-diving species for the following reasons:

- As described in the MITT FEIS/OEIS in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring), a 30-minute wait period more than covers the average dive times of most marine mammals.
- The ability of an animal to dive longer than 30 minutes does not mean that it will always do so. Therefore, the 60-minute delay would only potentially add value in instances when animals had remained under water for more than 30 minutes.
- Navy vessels typically move at 10–12 knots (5–6 m/sec) when operating active sonar and potentially much faster when not. Fish *et al.* (2006) measured speeds of seven species of odontocetes and found that they ranged from 1.4–7.30 m/ sec. Even if a vessel was moving at the slower typical speed associated with active sonar use, an animal would need to be swimming near sustained maximum speed for an hour in the direction of the vessel's course to stay within the safety zone of the vessel. Increasing the typical speed associated with active sonar use would further narrow the circumstances in which the 60-minute delay would add value.
- Additionally, the times when marine mammals are deep-diving (i.e., the times when they are under the water for longer periods of time) are the same times that a large portion of their motion is in the vertical direction, which means that they are far less likely to keep pace with a horizontally moving vessel.
- Given that, the animal would need to have stayed in the immediate vicinity of the sound source for an hour, and considering the maximum area that both the vessel and the animal

could cover in an hour, it is improbable that this would randomly occur. Moreover, considering that many animals have been shown to avoid both acoustic sources and ships without acoustic sources, it is improbable that a deep-diving cetacean (as opposed to a dolphin that might bow ride) would choose to remain in the immediate vicinity of the source.

In summary, NMFS believes that it is unlikely that a single cetacean would remain in the safety zone of a Navy sound source for more than 30 minutes, and therefore disagrees with the Commission that a second clearance category of 60 minutes for deep-diving species is necessary.

Comment 8: The Commission recommended that NMFS require the Navy to (1) provide the range to effects for all impact criteria (i.e., behavioral response, TTS, PTS, onset slight lung injury, onset slight gastrointestinal injury, and onset mortality) for underwater detonations that involve time-delay firing devices based on sound propagation in shallow-water nearshore environments for the associated marine mammal functional hearing groups and (2) use those data coupled with the maximum charge weight and average swim speed of the fastest group of marine mammals as the basis for the mitigation zone for underwater detonations that involve time-delay firing devices. If NMFS does not require the Navy to adjust its mitigation zones, then it should authorize the numbers of takes for Level A harassment and mortality based on the possibility that marine mammals could be present in the mitigation zone when the explosives detonate and based on updated, more realistic swim speeds.

Response 8: As shown in the LOA application (Table 11-1) and MITT FEIS/OEIS (Table 5.3-2), which provide ranges to effects for explosive sources used in the MITT Study Area, the maximum range to PTS effects for a 20 lb. NEW charge used with this activity is 102 yd. (93 m), and the average range to TTS effects is 407 yd. (372 m). A 20 lb. NEW charge is the

largest used in Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices. These ranges to effects for explosive sources represent conservative estimates assuming all impulses (i.e., explosions) are 1 second in duration. In fact, most impulses from explosions are much less than 1 second in duration and therefore contain much less energy than the amount of energy used to produce the estimated ranges to effects.

The proposed mitigation zone of 1,000 yd. (914 m) is well beyond the estimated range to effects and is overprotective for mine neutralization activities using diver-placed time-delay firing devices. The ranges to onset mortality, onset slight lung injury, and onset gastrointestinal injury are all less than the range to PTS level effects and would be well within the mitigation zone. As described in Chapter 5, Section 5.3.1.2.2.5 (Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices) of the MITT FEIS/OEIS, four Lookouts and two small boats represent the maximum level of effort that the Navy can commit for observing the mitigation zone for this activity given the number of personnel and assets available. In addition to the four lookouts, divers and aircrew (if aircraft are involved in the activity) would also serve as lookouts in addition to conducting their regular duties to support the activity. As noted by Navy in previous responses to comments on other Navy training and testing EIS/OEISs, the mitigation zone is sufficiently large to account for a portion of the distance that a marine mammal could potentially travel during the time delay based on a reasonable assumption of marine mammal swim speeds.

The supplemental information presented by the Commission to support the comment points out that Table 6-12 in the LOA application does not present ranges to effects for Bin E6 (up to a 20 lb. NEW). As stated in the table heading, the table is intended to be representative and is not specific to the MITT Study Area; therefore not all bins are included. However, the

table shows that the proposed mitigation zone of 1,000 yd. (914 m) would also be protective against injury exposures from explosives in Bin E7 (21 lb. to 60 lb. NEW).

Furthermore, as a result of essential fish habitat consultations with NMFS, the Navy has agreed to maintain the maximum NEW charge used at the Outer Apra Harbor Underwater Detonation Site at 10 lb. NEW and not to increase the maximum NEW to 20 lb., as proposed under Alternatives 1 and 2 of the FEIS/OEIS and in the Navy's LOA application. A maximum charge of 20 lb. NEW is still proposed for use at the Agat Bay Mine Neutralization Site, which is farther from shore and in deeper water. The maximum charge at the Piti Floating Mine Neutralization Site will also remain at 10 lb. NEW.

Comment 9: The Commission recommended that NMFS require the Navy to submit a proposed monitoring plan for the MITT Study Area for public review and comment prior to issuance of final regulations.

Response 9: NMFS provided an overview of the Navy's Integrated Comprehensive Monitoring Program (ICMP) in the proposed rule (79 FR 15388, March 19, 2014). While the ICMP does not specify actual monitoring field work or projects, it does establish top level goals that have been developed by the Navy and NMFS. As explained in the proposed rule, detailed and specific studies will be developed as the ICMP is implemented and funding is allocated.

Since the proposed rule was published, the Navy has provided a more detailed short-term plan for the first year of the rule. Monitoring in 2015 will be a combination of previously funded FY-14 "carry-over" projects from Phase I and new FY-15 project starts under the vision for Phase II monitoring. A more detailed description of the Navy's planned projects starting in 2015

(and some continuing from previous years) are available on NMFS' Web site (www.nmfs.noaa.gov/pr/permits/incidental/).

Additionally, NMFS will provide one public comment period on the Navy's monitoring program during the 5-year regulations. At this time, the public will have an opportunity (likely in the second year) to comment specifically on the Navy's MITT monitoring projects and data collection to date, as well as planned projects for the remainder of the regulations. The public also has the opportunity to review the Navy's monitoring reports, which are posted and available for download every year from the Navy's marine species monitoring Web site: <http://www.navy-marinespeciesmonitoring.us/>. Details of already funded MITT monitoring projects and new start projects are available through the Navy's marine species monitoring Web site: <http://www.navy-marinespeciesmonitoring.us/>. The Navy will update the status of their monitoring projects through the marine species monitoring site, which serves as a public portal for information regarding all aspects of the Navy's monitoring program, including background and guidance documents, access to reports, and specific information on current monitoring projects.

Through the adaptive management process (including annual meetings), the Navy will coordinate with NMFS and the Commission to review and revise, if required, the list of intermediate scientific objectives that are used to guide development of individual monitoring projects. As described previously in the Monitoring section of this document, NMFS and the Commission will also have the opportunity to attend annual monitoring program science review meetings and/or regional Scientific Advisory Group meetings.

The Navy will continue to submit annual monitoring reports to NMFS, which describe the results of the adaptive management process and summarize the Navy's anticipated

monitoring projects for the next reporting year. NMFS will have a three-month review period to comment on the next year's planned projects, ongoing regional projects, and proposed new project starts. NMFS' comments will be submitted to the Navy prior to the annual adaptive management meeting to facilitate a meaningful and productive discussion between NMFS, the Navy, and the Commission.

Effects Analysis/Takes

Comment 10: The Commission recommended that NMFS authorize the total numbers of model-estimated Level A harassment and mortality takes rather than allowing the Navy to reduce the estimated numbers of Level A harassment and mortality takes based on the Navy's proposed post-model analysis.

Response 10: NMFS believes that the post-modeling analysis is an effective method for quantifying the implementation of mitigation measures to reduce impacts on marine mammals, and that the resulting exposure estimates are, nevertheless, a conservative estimate of impacts on marine mammals.

See Section 3.4.3.2 (Marine Mammal Avoidance of Sound Exposures) as presented in the MITT FEIS/OEIS for the discussion of the science regarding the avoidance of sound sources by marine mammals. In addition, the Technical Report, Post-Model Quantitative Analysis of Animal Avoidance Behavior and Mitigation Effectiveness for the Mariana Islands Training and Testing (<http://www.mitt-eis.com>), goes into detail on how the avoidance and mitigation factors were used and provides scientific support from peer-reviewed research. The Navy analysis does not indicate nor is it expected that marine mammals would abandon important habitat on a long-term or even permanent basis. As presented in Section 3.4.5.2 (Summary of Observations During Previous Navy Activities) of the MITT FEIS/OEIS, the information gathered to date

including research, monitoring before, during, and after training and testing events across the Navy since 2006, has resulted in the assessment that it is unlikely there will be impacts on populations of marine mammals (such as whales, dolphins and porpoise) having any long-term consequences as a result of the proposed continuation of training and testing in the ocean areas historically used by the Navy including the Study Area.

As part of the post-modeling analysis, the Navy reduced some predicted PTS exposures and mortality based on the potential for marine mammals to be detected and mitigation implemented. Given this potential, not taking into account some possible reduction in Level A exposures and mortality would result in a less realistic, overestimation of possible Level A and mortality takes, as if there were no mitigation measures implemented. The period of time between clearing the impact area of any non-participants or marine mammals and weapons release is on the order of minutes, making it highly unlikely that a marine mammal would enter the mitigation zone.

The assignment of mitigation effectiveness scores and the appropriateness of consideration of sightability using detection probability, $g(O)$, when assessing the mitigation in the quantitative analysis of acoustic impacts is discussed in the MITI FEIS/OEIS (Section 3.4.3.3, Implementing Mitigation to Reduce Sound Exposures). Additionally, the activity category, mitigation zone size, and number of Lookouts are provided in the proposed rule (FR 79 15388) and MITT FEIS/OEIS (Section 5, Tables 5.3-2 and 5.4-1). In addition to the information already contained within the MITT FEIS/OEIS, the Post-Model Quantitative Analysis of Animal Avoidance Behavior and Mitigation Effectiveness for the Mariana Islands Training and Testing Technical Report (<http://www.mitt-eis.com>) describes the process for the post-modeling analysis in further detail. There is also information on visual detection leading to the implementation of

mitigation in the annual exercise reports provided to NMFS and briefed annually to NMFS and the Commission. These annual exercise reports have been made available and can be found at <http://www.navymarinespeciesmonitoring.us/> in addition to <http://www.nmfs.noaa/pr/permits/incidental>.

In summary, NMFS and the Navy believe consideration of marine mammal sightability and activity-specific mitigation effectiveness is appropriate in the Navy's quantitative analysis in order to provide decision makers a reasonable assessment of potential impacts under each alternative. A comprehensive discussion of the Navy's quantitative analysis of acoustic impacts, including the post-model analysis to account for mitigation and avoidance, is presented in Chapter 6 of the LOA application.

Comment 11: The Commission recommended that NMFS require the Navy to round its takes, based on those takes in the MITT FEIS/OEIS Criteria and Thresholds Technical Report tables, to the nearest whole number or zero in all of its take tables and then authorize those numbers of takes.

Response 11: The exposure numbers presented in the MITT FEIS/OEIS Criteria and Thresholds Technical Report are raw model output that have not been adjusted by post-processing to account for likely marine mammal behavior or the effect from implementation of mitigation measures. All fractional post-processed exposures for a species across all events within each category subtotal (Training, Testing, Impulse, and Non-Impulse) are summed to provide an annual total predicted number of effects. The final exposure numbers presented in the LOA application and the MITT FEIS/OEIS incorporate post-processed exposures numbers that have been rounded down to the nearest integer so that subtotals correctly sum to total annual effects rather than exceed the already overly conservative total exposure numbers.

Comment 12: Senator Vicente (ben) C. Pangelinan (32nd Guam Legislature) expressed concerns with the purported lack of data or supporting studies in the proposed rule on how anthropogenic sound will affect reproduction and survival of marine mammals in the Study Area. The Senator cites studies by Claridge (2013) and others (e.g., International Whaling Commission, 2005) that suggest stressors associated with Navy sonar use and impulse sound may lead to strandings and lower reproductive rates in some species. The Senator also points out that several authors have established that long-term and intense disturbance stimuli can cause population declines in some (terrestrial) species.

Response 12: NMFS fully considers impacts to recruitment and survival (population-level effects) when making a negligible impact determination and when prescribing the means of effecting the least practicable impact on species and stocks. NMFS is constantly evaluating new science and how to best incorporate it into our decisions. This process involves careful consideration of new data and how it is best interpreted within the context of a given management framework. Recent studies have been published regarding behavioral responses that are relevant to the proposed activities and energy sources: Moore and Barlow, 2013; DeRuiter *et al.*, 2013; and Goldbogen *et al.*, 2013, among others. Each of these articles emphasizes the importance of context (e.g., behavioral state of the animals, distance from the sound source, etc.) in evaluating behavioral responses of marine mammals to acoustic sources. In addition, New *et al.*, 2013 and 2014; Houser *et al.*, 2013; and Claridge, 2013 were recently published. These and other relevant studies are discussed in both the Potential Effects of Specified Activities on Marine Mammals section and the Analysis and Negligible Impact Determination section of this final rule.

The Analysis and Negligible Impact Determination section of this final rule includes a species or group-specific analysis (see Group and Species-Specific Analysis) of potential effects on marine mammal in the Study Area, as well as a discussion on long-term consequences (see Long-Term Consequences) for individuals or populations resulting from Navy training and testing activities in the Study Area. As discussed later in this document, populations of beaked whales and other odontocetes in the Bahamas, and in other Navy fixed ranges that have been operating for tens of years, appear to be stable. Range complexes where intensive training and testing have been occurring for decades have populations of multiple species with strong site fidelity (including highly sensitive resident beaked whales at some locations) and increases in the number of some species.

There is no direct evidence that routine Navy training and testing spanning decades has negatively impacted marine mammal populations at any Navy range complex. In at least three decades of similar activities, only one instance of injury to marine mammals (March 4, 2011; three long-beaked common dolphin) has been documented as a result of training or testing using an impulse source (underwater explosion). Years of monitoring of Navy-wide activities (since 2006) have documented hundreds of thousands of marine mammals on the range complexes and there are only two instances of overt behavioral change that have been observed. Years of monitoring of Navy-wide activities on the range complexes have documented no demonstrable instances of injury to marine mammals as a direct result of non-impulsive acoustic sources.

Stranding events coincident with Navy MFAS use in which exposure to sonar is believed to have been a contributing factor were detailed in the Stranding and Mortality section of the proposed rule. However, for some of these stranding events, a causal relationship between sonar exposure and the stranding could not be clearly established (Cox *et al.*, 2006). In other

instances, sonar was considered only one of several factors that, in their aggregate, may have contributed to the stranding event (Freitas, 2004; Cox *et al.*, 2006). NMFS and the Navy have identified certain circumstances/factors (including 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) that have been present in some instances where strandings are associated with active Navy sonar (e.g., Bahamas, 2000). 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. In addition, the Navy has developed specific planning and monitoring measures to use when that suite of factors is present. These circumstances/factors do not exist in their aggregate in the MITT Study Area.

Because of the association between tactical MFA sonar use and a small number of marine mammal strandings, the Navy and NMFS have been considering and addressing the potential for strandings in association with Navy activities for years. In addition to a suite of mitigation intended to more broadly minimize impacts to marine mammals, the Navy and NMFS have a detailed Stranding Response Plan that outlines reporting, communication, and response protocols intended both to minimize the impacts of, and enhance the analysis of, any potential stranding in areas where the Navy operates.

Based on the best available science NMFS concludes that exposures to marine mammal species and stocks due to MITT activities would result in only short-term effects to most individuals exposed and are not expected to affect annual rates of recruitment or survival (population-level impacts having any long-term consequences). Results of the Navy's acoustic analysis and NMFS' analysis, as well as the relevant studies supporting this conclusion, are referenced and summarized in the Analysis and Negligible Impact Determination section of this final rule.

Criteria and Thresholds

Comment 13: The Commission recommended that NMFS require the Navy to (1) use 157 rather than 152 dB re 1 $\mu\text{Pa}^2\text{-sec}$ as the temporary threshold shift (TTS) threshold for high-frequency cetaceans exposed to acoustic sources, (2) use 169 rather than 172 dB re 1 $\mu\text{Pa}^2\text{-sec}$ as the TTS thresholds for mid- and low-frequency cetaceans exposed to explosive sources, (3) use 145 rather than 146 dB re 1 $\mu\text{Pa}^2\text{-sec}$ as the TTS threshold for high-frequency cetaceans for explosive sources, and (4)(a) based on these changes to the TTS thresholds, adjust the permanent threshold shift (PTS) thresholds for high-frequency cetaceans exposed to acoustic sources by increasing the amended TTS threshold by 20 dB, and for low-, mid-, and high-frequency cetaceans exposed to explosive sources, by increasing the amended TTS thresholds by 15 dB and (b) adjust the behavioral thresholds for low-, mid-, and high-frequency cetaceans exposed to explosive sources by decreasing the amended TTS thresholds by 5 dB.

Response 13: NMFS does not concur with the Commissions' recommendations for similar reasons to those provided in prior responses to Commission comments on the HSTT and AFTT proposed rulemakings. The values derived for impulsive and non-impulsive TTS are based on data from peer-reviewed scientific studies. The development of these thresholds and

criteria is detailed in the Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis Technical Report (Finneran and Jenkins, 2012) that is referenced in the MITT FEIS/OEIS (see Section 3.4.3.1.4 [Thresholds and Criteria for Predicting Acoustic and Explosive Impacts on marine mammals]) and available at <http://www.mitt-eis.com>.

As presented in Finneran and Jenkins (2012) the thresholds incorporate new findings since the publication of Southall *et al.* (2007) and the evolution of scientific understanding since that time. Note that Dr. Finneran was one of the authors for Southall *et al.* (2007) and so is completely familiar with the older conclusions presented in the 2007 publication and, therefore, was able to integrate knowledge into development of the refined approach presented in Finneran and Jenkins (2012) based on evolving science since 2007.

Briefly, the original experimental data is weighted using the prescribed weighting function to determine the numerical threshold value. The Commission did not consider the appropriate weighting schemes when comparing thresholds presented in Southall *et al.* (2007) and those presented in Finneran and Jenkins (2012). TTS thresholds presented in Finneran and Jenkins (2012) are appropriate when the applicable weighting function (Type II) is applied to the original TTS data; TTS thresholds in Southall *et al.* (2007) were based on M-weighting.

For example, while it is true that there is an unweighted 12-dB difference for onset-TTS between beluga watergun (Finneran *et al.*, 2002) and tonal exposures (Schlundt *et al.*, 2000), the difference after weighting with the Type II MF-cet weighting function (from Finneran and Jenkins, 2012), is 6-dB. The Commission has confused (a) the 6 dB difference in PTS and TTS thresholds based on peak pressure described in Southall *et al.* 2007 with (b) the difference between impulsive and non-impulsive thresholds in Finneran and Jenkins (2012), which is coincidentally 6 dB.

The same offset between impulsive and non-impulsive temporary threshold shift, for the only species where both types of sound were tested (beluga), was used to convert the Kastak *et al.* (2005) data (which used non-impulsive tones) to an impulsive threshold. This method is explained in Finneran and Jenkins (2012) and Southall *et al.* (2007).

The thresholds and criteria used in the MITT analysis have already incorporated the correct balance of conservative assumptions that tend towards overestimation in the face of uncertainty. Additional details regarding the process are provided in Section 3.4.3.1.5 (Quantitative Analysis) of the MITT FEIS/OEIS. In addition, the summary of the thresholds used in the analysis are presented in Section 3.4.3.1.4 (Thresholds and Criteria for Predicting Acoustic and Explosive Impacts on Marine Mammals) of the MITT FEIS/OEIS. NMFS was included in the development of the current thresholds. The thresholds used in the current analysis remain the best available estimate of the number and type of take that may result from the Navy's use of acoustic sources in the MITT Study Area, although NMFS and the Navy will continue to revise those thresholds based on emergent research.

Comment 14: The Commission recommended that NMFS require the Navy to (1) describe what it used as the upper limit of behavioral response function for low-frequency cetaceans (BRF₁) and the upper limits of BRF₂ for both mid- and high-frequency cetaceans, including if it assumed a 1-sec ping for all sources and (2) if the upper limits of the BRFs were based on weighted thresholds, use the unweighted or M-weighted thresholds of 195 dB re 1 $\mu\text{Pa}^2\text{-sec}$ for low- and mid-frequency cetaceans and 176 dB re 1 $\mu\text{Pa}^2\text{-sec}$ for high-frequency cetaceans to revise its behavior take estimates for all marine mammals exposed to acoustic sources.

Response 14: The behavioral response functions (BRFs) used to define criteria for assessing behavioral responses to underwater sound sources are discussed in Section 3.4.3.1.4 (Thresholds and Criteria for Predicting Acoustic and Explosive Impacts on Marine Mammals) of the FEIS/OEIS and in the Technical Report, Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Finneran and Jenkins, 2012). The BRFs have been used by the Navy to assess behavioral reactions in marine mammals for several years and are described in greater detail in the Atlantic Fleet Active Sonar Training EIS/OEIS (see Section 4.4.5.3.2 Development of the Risk Function), as well as in the Southern California Range Complex EIS/OEIS and the Hawaii Range Complex EIS/OEIS.

Harassment under the BRF and harassment under the TTS criteria are both considered Level B takes under MMPA, and NMFS has determined that animals whose exposure both exceeds TTS threshold and results in behavioral response under the BRF should not be double counted or counted as taken twice by the same acoustic exposure. Although behavioral responses (non-TTS) and TTS are both considered as Level B under the MMPA for military readiness, they are two separate criteria based on different metrics and different frequency weighting systems. Sound exposure level (SEL) is the most appropriate metric to predict TTS, because it accounts for signal duration. Sound pressure level (SPL) is independent of signal duration and is the metric that best correlates with potential behavioral response. Furthermore, to predict TTS, SEL is weighted with a Type II function for cetaceans, whereas to predict a behavioral response, SPL is weighted with a Type I function. Mathematically, SEL (for TTS) and SPL (for behavior) are not on the same linear scale, and their relationship to one another changes based on the frequency and duration of the sounds being analyzed.

Based on the model-estimated exposure results, an animat (virtual representation of an animal) exposed to sound that exceeds both the TTS (SEL) threshold and Behavioral (SPL) threshold is reported as a TTS (higher level) effect. It is important to note that TTS is a step function, so 100 percent of animals predicted to equal or surpass the TTS threshold would be counted as TTS effects. Behavioral effects are estimated as the percentage of animals (i.e. between 0 and 100 percent) that may be affected based on the highest received SPL on a BRF.

Vessel Strikes

Comment 15: The Commission recommended that NMFS require the Navy to use its spatially and temporally dynamic simulation models rather than simple probability calculations to estimate strike probabilities for specific activities (i.e., movement of vessels, torpedoes, unmanned underwater vehicles and use of expended munitions, ordnance, and other devices).

Response 15: The Navy considered using a dynamic simulation model to estimate strike probability. However, the Navy determined, and NMFS concurs, that the use of historical data was a more appropriate way to analyze the potential for strike. The Navy's strike probability analysis in the MITT FEIS/OEIS is based upon actual data collected from historical use of vessels, in-water devices, and military expended materials, and the likelihood that these items may have the potential to strike an animal. This data accounts for real world variables over the course of many years, and any model would be expected to be less accurate than the use of actual data. There is no available science regarding the necessary functional parameters for a complex dynamic whale strike simulation model; there are large unknowns regarding the data that would be necessary such as the density, age classes, and behavior of large whales in the MITT Study Area; and there are no means to validate the output of a model given there is no empirical data (not strikes) to "seed the dynamic simulation." Therefore, use of historical data from identical

activities elsewhere and additional use of a probability analysis remain a more reasonable analytical approach.

The Commission's disagreement over the method the Navy has used to estimate strike probability is noted. Any increase in vessel movement, as discussed in Section 3.4.4.4.1 (Impacts from Vessels) of the MITT FEIS/OEIS, over the No Action is still well below areas such as the Southern California Range Complex (SOCAL) where the density of large whales and the number of Navy Activities is much higher than any of the MITT alternatives and yet strikes to large whales are still relatively rare in SOCAL. Additionally, while the number of training and testing activities is likely to increase, it is not expected to result in an appreciable increase in vessel use or transits since multiple activities usually occur from the same vessel. The Navy is not proposing substantive changes in the locations where vessels have been used over the last decade.

There has never been a vessel strike to a whale during any active training or testing activities in the Study Area. A detailed analysis of strike data is also contained in Chapter 6 (Section 6.3.4, Estimated Take of Large Whales by Navy Vessel Strike) of the LOA application. The Navy does not anticipate vessel strikes to marine mammals during training or testing activities within the Study Area, nor were takes by injury or mortality resulting from vessel strike predicted in the Navy's analysis. Therefore, NMFS is not authorizing mysticete takes (by injury or mortality) from vessel strikes during the 5-year period of the MITT regulations.

General Opposition

Comment 16: One commenter expressed general opposition to Navy activities and NMFS' issuance of an MMPA authorization.

Response 16: NMFS appreciates the commenter's concern for the marine environment. However, the MMPA directs NMFS to issue an incidental take authorization if certain findings can be made. NMFS has determined that the Navy's training and testing activities will have a negligible impact on the affected species or stocks and, therefore, we plan to issue the requested MMPA authorization.

Other

Comment 17: One commenter asked about the effects of Navy activities on marine habitat and other resources not addressed in the proposed rule.

Response 17: The MITT FEIS/OEIS addresses all potential impacts to the human environment, and is available online at <http://www.mitt-eis.com>. The MITT DEIS/OEIS was made available to the public on September 13, 2013 and was referenced in the proposed rule (79 FR 15388, March 19, 2014).

Comment 18: One commenter requested additional details or elaboration regarding specific Navy training and testing activities (e.g., vessel type and speed, inwater detonations, Pierside Location maintenance, etc.).

Response 18: Detailed information about each proposed activity (stressor, training or testing event, description, sound source, duration, and geographic location) can be found in the MITT FEIS/OEIS.

Comment 19: One commenter had several questions regarding information (e.g., species presence, distribution, stock abundance, ESA/MMPA status) presented in Table 6 (Marine Mammals with Possible or Confirmed Presence within the Study Area) and the Description of Marine Mammals in the Area of the Specified Activity section of the proposed rule.

Response 19: As stated in the proposed rule, information on the status, occurrence and distribution, abundance, derivation of density estimates, and vocalizations of marine mammal species in the Study Area may be viewed in Chapters 3 and 4 of the LOA application (<http://www.nmfs.noaa.gov/pr/permits/incidental/>). This information was compiled by the Navy from peer-reviewed literature, NMFS annual stock assessment reports (SARs) for marine mammals (<http://www.nmfs.noaa.gov/pr/species/mammals>; Carretta *et al.*, 2014; Allen and Angliss, 2014), and marine mammal surveys using acoustic and visual observations from aircraft and ships. Further information on the general biology and ecology of marine mammals is included in the MITT FEIS/OEIS (<http://www.mitt-eis.com>).

Comment 20: One commenter questioned NMFS' proposed authorization of take through issuance of a single 5-year LOA (multi-year LOA) rather than issuance of annual LOAs.

Response 20: The ability to issue a multi-year LOA reduces administrative burdens on both NMFS and the Navy. In addition, a multi-year LOA would avoid situations where the last minute issuance of LOAs necessitates the commitment of extensive resources by the Navy for contingency planning.

The regulations still: (1) require the Navy to submit annual monitoring and exercise reports; (2) require that NMFS and the Navy hold annual monitoring and adaptive management meetings that ensure NMFS is able to evaluate the Navy's compliance and marine mammal impacts with the same attention and frequency; and (3) allow for a LOA to be changed at any time, as appropriate, to incorporate any needed mitigation or monitoring measures developed through adaptive management, based on the availability of new information regarding military readiness activities or the marine mammals affected. If, through adaptive management, proposed

modifications to the mitigation, monitoring, or reporting measures are substantial, NMFS would publish a notice of proposed LOA in the **Federal Register** and solicit public comment.

Estimated Take

In the Estimated Take section of the proposed rule, NMFS described the potential effects to marine mammals from active sonar and underwater detonations in relation to the MMPA regulatory definitions of Level A and Level B harassment (79 FR 15388, pages 15426-15430). That information has not changed and is not repeated here. It is important to note that, as Level B Harassment is interpreted here and quantified by the behavioral thresholds described below, the fact that a single behavioral pattern (of unspecified duration) is abandoned or significantly altered and classified as a Level B take does not mean, necessarily, that the fitness of the harassed individual is affected either at all or significantly, or that, for example, a preferred habitat area is abandoned. Further analysis of context and duration of likely exposures and effects is necessary to determine the impacts of the estimated effects on individuals and how those may translate to population-level impacts, and is included in the Analysis and Negligible Impact Determination.

Tables 8 and 9 provide a summary of non-impulsive and impulsive thresholds to TTS and PTS for marine mammals. A detailed explanation of how these thresholds were derived is provided in the MITT FEIS/OEIS Criteria and Thresholds Technical Report (<http://www.mitt-eis.com>) and summarized in Chapter 6 of the Navy’s LOA application (<http://www.nmfs.noaa.gov/pr/permits/incidental/>).

Table 8. Onset TTS and PTS thresholds for non-impulse sound.

Group	Species	Onset TTS	Onset PTS
Low-Frequency Cetaceans	All mysticetes	178 dB re 1µPa ² -sec(LF ₁₁)	198 dB re 1µPa ² -sec(LF ₁₁)

Mid-Frequency Cetaceans	Most delphinids, beaked whales, medium and large toothed whales	178 dB re 1μPa ² -sec(MF _{II})	198 dB re 1μPa ² -sec(MF _{II})
High-Frequency Cetaceans	Porpoises, <i>Kogia</i> spp.	152 dB re 1μPa ² -sec(HF _{II})	172 dB re 1μPa ² -secSEL (HF _{II})

LF_{II}, MF_{II}, HF_{II}: New compound Type II weighting functions.

Table 9. Impulsive sound explosive thresholds for predicting injury and mortality.

Group	Species	Slight Injury			Mortality
		PTS	GI Tract	Lung	
Low-frequency Cetaceans	All mysticetes	187 dB SEL (LF _{II}) or 230 dB Peak SPL			
Mid-frequency Cetaceans	Most delphinids, medium and large toothed whales	187 dB SEL (MF _{II}) or 230 dB Peak SPL	237 dB SPL	Equation 1	Equation 2
High-frequency Cetaceans	Porpoises and <i>Kogia</i> spp.	161 dB SEL (HF _{II}) or 201dB Peak SPL			

Equation 1:

$$= 39.1M^{1/3} (1+[D_{Rm}/10.081])^{1/2} \text{ Pa - sec}$$

Equation 2:

$$= 91.4M^{1/3} (1+[D_{Rm}/10.081])^{1/2} \text{ Pa - sec}$$

Where: M = mass of the animals in kg

D_{Rm} = depth of the receiver (animal) in meters

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

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) or 8 (mysticetes)

Take Request

The MITT FEIS/OEIS considered all training and testing activities proposed to occur in the Study Area that have the potential to result in the MMPA defined take of marine mammals.

The potential stressors associated with these activities included the following:

- Acoustic (sonar and other active acoustic sources, explosives, weapons firing, launch and impact noise, vessel noise, aircraft noise);
- Energy (electromagnetic devices);
- Physical disturbance or strikes (vessels, in-water devices, military expended materials, seafloor devices);
- Entanglement (fiber optic cables, guidance wires, parachutes);
- Ingestion (munitions, military expended materials other than munitions);
- Indirect stressors (impacts to habitat [sediment and water quality, air quality] or prey availability).

NMFS has determined that two stressors could potentially result in the incidental taking of marine mammals from training and testing activities within the Study Area: (1) non-impulse acoustic stressors (sonar and other active acoustic sources) and (2) impulse acoustic stressors (explosives). Non-impulse and impulse stressors have the potential to result in incidental takes of marine mammals by Level A (injury) or Level B (behavioral) harassment. NMFS also considered the potential for vessel strikes to impact marine mammals, and that assessment is presented below. Lethal takes of large whales and beaked whales, while not anticipated or predicted in the Navy's acoustic analysis, were originally conservatively requested by the Navy for MITT training and testing activities over the 5-year period of NMFS' final authorization. That request was included in NMFS' proposed rule (79 FR 15388, Take Request); however,

NMFS has since made the decision not to authorize any lethal takes for MITT activities for reasons discussed below.

Training and Testing Activities – Based on the Navy’s modeling and post-model analysis (i.e., the acoustic analysis) (described in detail in Chapter 6 of their LOA application), Table 10 summarizes the authorized takes for training and testing activities for an annual maximum year (a notional 12-month period when all annual and non-annual events could occur) and the summation over a 5-year period (annual events occurring five times and non-annual events occurring three times). Table 11 summarizes the authorized takes for training and testing activities by species from the modeling estimates.

Predicted effects on marine mammals result from exposures to sonar and other active acoustic sources and explosions during annual training and testing activities. The acoustic analysis predicts the majority of marine mammal species in the Study Area would not be exposed to explosive (impulse) sources associated with training and testing activities that would exceed the current impact thresholds.

No beaked whales are predicted in the acoustic analysis to be exposed to sound levels associated with PTS, other injury, or mortality. The Navy had originally conservatively requested authorization for beaked whale mortality (no more than 10 mortalities over 5 years) that might potentially result from exposure to active sonar, based on the few instances where sonar has been associated with strandings in other areas. That request was included in NMFS’ proposed rule (79 FR 15388, Take Request). However, after decades of the Navy conducting similar activities in the MITT Study Area without incident, neither the Navy nor NMFS expect stranding, injury, or mortality of beaked whales to occur as a result of Navy activities, and therefore, following consultation with the Navy, NMFS is not authorizing any Level A (injury or

mortality) takes for beaked whales. In addition to a suite of mitigation intended to more broadly minimize impacts to marine mammals, the Navy and NMFS have a detailed Stranding Response Plan (described in the Mitigation section of this final rule and available at <http://www.nmfs.noaa.gov/pr/permits/incidental/>) that outlines reporting, communication, and response protocols intended both to minimize the impacts of, and enhance the analysis of, any potential stranding in areas where the Navy operates.

Vessel Strike - There has never been a vessel strike to a marine mammal during any active training or testing activities in the Study Area. A detailed analysis of strike data is contained in Chapter 6 (Section 6.3.4, Estimated Take of Large Whales by Navy Vessel Strike) of the LOA application. There have been Navy strikes of large whales in areas outside the Study Area, such as Hawaii and Southern California. However, these areas differ significantly from the Study Area given that both Hawaii and Southern California have a much higher number of Navy vessel activities and much higher densities of large whales. The Navy does not anticipate vessel strikes to marine mammals during training or testing activities within the Study Area, nor were takes by injury or mortality resulting from vessel strike predicted in the Navy's analysis. Vessel strike to marine mammals is not associated with any specific training or testing activity but rather a limited, sporadic, and accidental result of Navy vessel movement. In order to account for the accidental nature of vessel strikes to large whales in general, and the potential risk from any vessel movement within the MITT Study Area, the Navy had originally conservatively requested authorization for large whale mortalities (no more than 5 mortalities over 5 years) that might potentially result from vessel strike during MITT training and testing activities over the 5-year period of NMFS' final authorization. That request was included in NMFS' proposed rule (79 FR 15388, Take Request). However, after further consideration of the

Navy’s ship strike analysis, the unlikelihood of a ship strike to occur and the fact that there has never been a ship strike to marine mammals in the Study Area, and following consultation with the Navy, NMFS is not authorizing takes (by injury or mortality) from vessel strikes during the 5-year period of the MITT regulations. The Navy has proposed measures (see Mitigation) to mitigate potential impacts to marine mammals from vessel strikes during training and testing activities in the Study Area.

Table 10. Summary of authorized annual and 5-year takes for training and testing activities.

MMPA Category	Source	Training and Testing Activities	
		Annual Authorization ¹	5-Year Authorization ²
Level A	Impulse and Non-Impulse	56 - Species specific data shown in Table 11	280 - Species specific data shown in Table 11
Level B	Impulse and Non-Impulse	81,906 - Species specific data shown in Table 11	409,530 - Species specific data shown in Table 11

¹ These numbers constitute the total for an annual maximum year (a notional 12-month period when all annual and non-annual events could occur).

² These numbers constitute the summation over a 5-year period with annual events occurring five times and non-annual events occurring three times.

Table 11. Authorized species-specific takes from modeling and post-model estimates of impulsive and non-impulsive source effects for all training and testing activities.

Species	ANNUALLY ¹			TOTAL OVER 5-YEAR RULE ²		
	Level B	Level A	Mortality	Level B	Level A	Mortality
Blue whale	28	0	0	140	0	0
Fin whale	28	0	0	140	0	0
Humpback whale	860	0	0	4,300	0	0
Sei whale	319	0	0	1,595	0	0
Sperm whale	506	0	0	2,530	0	0
Bryde’s whale	398	0	0	1,990	0	0
Minke whale	101	0	0	505	0	0
Omura’s whale	103	0	0	515	0	0
Pygmy sperm whale	5,579	15	0	27,895	75	0
Dwarf sperm whale	14,217	41	0	71,085	205	0
Killer whale	84	0	0	420	0	0
False killer whale	555	0	0	2,775	0	0
Pygmy killer whale	105	0	0	525	0	0
Short-finned pilot whale	1,815	0	0	9,075	0	0
Melon-headed whale	2,085	0	0	10,425	0	0
Bottlenose dolphin	741	0	0	3,705	0	0
Pantropical spotted dolphin	12,811	0	0	64,055	0	0
Striped dolphin	3,298	0	0	16,490	0	0
Spinner dolphin	589	0	0	2,945	0	0

Rough toothed dolphin	1,819	0	0	9,095	0	0
Fraser's dolphin	2,572	0	0	12,860	0	0
Risso's dolphin	505	0	0	2,525	0	0
Cuvier's beaked whale	22,541	0	0	112,705	0	0
Blainville's beaked whale	4,426	0	0	22,130	0	0
Longman's beaked whale	1,924	0	0	9,620	0	0
Ginkgo-toothed beaked whale	3,897	0	0	19,485	0	0

¹ These numbers constitute the total for an annual maximum year (a notional 12-month period when all annual and non-annual events could occur).

² These numbers constitute the summation over a 5-year period with annual events occurring five times and non-annual events occurring three times.

Marine Mammal Habitat

The Navy's proposed training and testing activities could potentially affect marine mammal habitat through the introduction of sound into the water column, impacts to the prey species of marine mammals, bottom disturbance, or changes in water quality. Each of these components was considered in Chapter 3 of the MITT FEIS/OEIS. Based on the information in the Marine Mammal Habitat section of the proposed rule (79 FR 15388, March 19, 2014; pages 15412-15414) and the supporting information included in the MITT FEIS/OEIS, NMFS has determined that training and testing activities would not have adverse or long-term impacts on marine mammal habitat. In summary, expected effects to marine mammal habitat will include elevated levels of anthropogenic sound in the water column; short-term physical alteration of the water column or bottom topography; brief disturbances to marine invertebrates; localized and infrequent disturbance to fish; a limited number of fish mortalities; and temporary marine mammal avoidance.

Analysis and Negligible Impact Determination

Negligible impact is "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" (50 CFR 216.103). 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 takes, alone, is not enough information on which to base an impact determination, as the severity of harassment may vary greatly depending on the context and duration of the behavioral response, many of which would not be expected to have deleterious impacts on the fitness of any individuals. In determining whether the expected takes will have a negligible impact, in addition to considering estimates of the number of marine mammals that might be “taken”, 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.), as well as the number and nature (e.g., severity) of estimated Level A harassment takes, the number of estimated mortalities, and the status of the species.

The Navy’s specified activities have been described based on best estimates of the maximum amount of sonar and other acoustic source use or detonations that the Navy would conduct. There may be some flexibility in that the exact number of hours, items, or detonations may vary from year to year, but take totals are not authorized to exceed the 5-year totals indicated in Table 11. We base our analysis and NID on the maximum number of takes authorized.

To avoid repetition, we provide some general analysis immediately below that applies to all the species listed in Table 11, given that some of the anticipated effects (or lack thereof) of the Navy’s training and testing activities on marine mammals are expected to be relatively similar in nature. However, below that, we break our analysis into species, or groups of species where relevant similarities exist, to provide more specific information related to the anticipated effects on individuals or where there is information about the status or structure of any species that would lead to a differing assessment of the effects on the population.

The Navy's take request is based on its model and post-model analysis. In the discussions below, the "acoustic analysis" refers to the Navy's modeling results and post-model analysis. The model calculates sound energy propagation from sonars, other active acoustic sources, and explosives during naval activities; the sound or impulse received by animal dosimeters representing marine mammals distributed in the area around the modeled activity; and whether the sound or impulse received by a marine mammal exceeds the thresholds for effects. The model estimates are then further analyzed to consider animal avoidance and implementation of highly effective mitigation measures to prevent Level A harassment, resulting in final estimates of effects due to Navy training and testing. NMFS provided input to the Navy on this process and the Navy's qualitative analysis is described in detail in Chapter 6 of their LOA application (<http://www.nmfs.noaa.gov/pr/permits/incidental/>).

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. It is important to note that the requested and authorized number of takes does not equate to the number of individual animals the Navy expects to harass (which is lower), but rather to the instances of take (i.e., exposures above the Level B or Level A harassment threshold) that would occur. Additionally, these instances may represent either a very brief exposure (seconds) or, in some cases, longer durations of exposure within a day. Depending on the location, duration, and frequency of activities, along with the distribution and movement of marine mammals, individual animals may be exposed to impulse or non-impulse sounds at or above the harassment thresholds on multiple days. However, the Navy is currently unable to estimate the number of individuals

that may be taken during training and testing activities. The model results estimate the total number of takes that may occur to a smaller number of individuals. While the model shows that an increased number of exposures may take place due to an increase in events/activities and ordnance, the types and severity of individual responses to training and testing activities are not expected to change.

Behavioral Harassment

As discussed previously in the proposed rule, marine mammals can respond to MFAS/HFAS in many different ways, a subset of which qualifies as harassment (see Behavioral Harassment section of proposed rule). One thing that the Level B harassment 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 the percentage of behavioral harassment that would occur within the 6-dB bins (without considering mitigation or avoidance). 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 animal. As illustrated below, the majority (about 80 percent, at least for hull-mounted sonar, which is responsible for most of the sonar takes) of calculated takes from MFAS result from exposures between 150 dB and 162 dB. Less than one percent of the takes are expected to result from exposures above 174 dB.

Specifically, given a range of behavioral responses that may be classified as Level B harassment, to the degree that higher received levels are expected to result in more severe behavioral responses, only a small percentage of the anticipated Level B harassment from Navy activities might necessarily be expected to potentially result in more severe responses, especially when the distance from the source at which the levels below are received is considered (see Table 12). Marine mammals are able to discern the distance of a given sound source, and given other equal factors (including received level), they have been reported to respond more to sounds that are closer (DeRuiter *et al.*, 2013). Further, the estimated number of responses do not reflect either the duration or context of those anticipated responses, some of which will be of very short duration, and other factors should be considered when predicting how the estimated takes may affect individual fitness.

Table 12. Non-impulsive ranges in 6-dB bins and percentage of behavioral harassments.

Received Level	Sonar Bin MF1 (e.g., SQS-53; ASW Hull Mounted Sonar)		Sonar Bin MF4 (e.g., AQS-22; ASW Dipping Sonar)		Sonar Bin MF5 (e.g., SSQ-62; ASW Sonobuoy)		Sonar Bin HF4 (e.g., SQQ-32; MIW Sonar)	
	Distance at Which Levels Occur Within Radius of Source (m)	Percentage of Behavioral Harassments Occurring at Given Levels	Distance at Which Levels Occur Within Radius of Source (m)	Percentage of Behavioral Harassments Occurring at Given Levels	Distance at Which Levels Occur Within Radius of Source (m)	Percentage of Behavioral Harassments Occurring at Given Levels	Distance at Which Levels Occur Within Radius of Source (m)	Percentage of Behavioral Harassments Occurring at Given Levels
Low Frequency Cetaceans								
120 ≤SPL <126	183,000 – 133,000	<1%	71,000 – 65,000	<1%	18,000 – 13,000	<1%	2,300 – 1,700	<1%
126 ≤SPL <132	133,000 – 126,000	<1%	65,000 – 60,000	<1%	13,000 – 7,600	<1%	1,700 – 1,200	<1%
132 ≤SPL <138	126,000 – 73,000	<3%	60,000 – 8,200	42%	7,600 – 2,800	12%	1,200 – 750	<1%
138 ≤SPL <144	73,000 – 67,000	<1%	8,200 – 3,500	10%	2,800 – 900	26%	750-500	5%
144 ≤SPL <150	67,000 – 61,000	3%	3,500 – 1,800	12%	900 – 500	15%	500 – 300	17%
150 ≤SPL <156	61,000 – 17,000	68%	1,800 – 950	15%	500 – 250	21%	300 – 150	34%
156 ≤SPL <162	17,000 – 10,300	12%	950-450	13%	250-100	20%	150 – 100	20%

162 ≤ SPL <168	10,200 - 5,600	9%	450 - 200	6%	100 - <50	6%	100 - <50	24%
168 ≤ SPL <174	5,600 - 1,600	6%	200 - 100	2%	<50	<1%	<50	<1%
174 ≤ SPL <180	1,600 - 800	<1%	100 - <50	<1%	<50	<1%	<50	<1%
180 ≤ SPL <186	800 - 400	<1%	<50	<1%	<50	<1%	<50	<1%
186 ≤ SPL <192	400 - 200	<1%	<50	<1%	<50	<1%	<50	<1%
192 ≤ SPL <198	200 - 100	<1%	<50	<1%	<50	<1%	<50	<1%
Mid-Frequency Cetaceans								
120 ≤ SPL <126	184,000 - 133,000	<1%	72,000 - 66,000	<1%	19,000 - 15,000	<1%	3,600 - 2,800	<1%
126 ≤ SPL <132	133,000 - 126,000	<1%	66,000 - 60,000	<1%	15,000 - 8,500	<1%	2,800 - 2,100	<1%
132 ≤ SPL <138	126,000 - 73,000	<1%	60,000 - 8,300	41%	8,500 - 3,300	3%	2,100 - 1,500	<1%
138 ≤ SPL <144	73,000 - 67,000	<1%	8,300 - 3,600	10%	3,300 - 1,000	12%	1,500 - 1,000	3%
144 ≤ SPL <150	67,000 - 61,000	3%	3,600 - 1,900	12%	1,000 - 500	10%	1,00 - 700	10%
150 ≤ SPL <156	61,000 - 18,000	68%	1,900 - 950	15%	500 - 300	22%	700 - 450	21%
156 ≤ SPL <162	18,000 - 10,300	13%	950 - 480	12%	300 - 150	27%	450 - 250	32%
162 ≤ SPL <168	10,300 - 5,700	9%	480 - 200	7%	150 - <50	25%	250 - 150	19%
168 ≤ SPL <174	5,700 - 1,700	6%	200 - 100	2%	<50	<1%	150 - 100	9%
174 ≤ SPL <180	1,700 - 900	<1%	100 - <50	<1%	<50	<1%	100 - <50	6%
180 ≤ SPL <186	900 - 400	<1%	<50	<1%	<50	<1%	<50	<1%
186 ≤ SPL <192	400 - 200	<1%	<50	<1%	<50	<1%	<50	<1%
192 ≤ SPL <198	200 - 100	<1%	<50	<1%	<50	<1%	<50	<1%

Although the Navy has been monitoring the effects of MFAS/HFAS on marine mammals since 2006, and research on the effects of MFAS is advancing, our understanding of exactly how marine mammals in the Study Area will respond to MFAS/HFAS is still growing. The Navy has submitted reports from more than 60 major exercises across Navy range complexes that indicate no behavioral disturbance was observed. 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* spp.), the full series of behaviors that would more accurately show an important change is not typically seen (i.e., only the surface behaviors are observed), 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.

Diel Cycle

As noted previously, many animals perform vital functions, such as feeding, resting, traveling, and socializing on a diel cycle (24-hour cycle). Behavioral reactions to noise exposure (when taking place in a biologically important context, 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 severe unless it could directly affect reproduction or survival (Southall *et al.*, 2007). Note that there is a difference between multiple-day substantive behavioral reactions and multiple-day anthropogenic activities. For example, just because at-sea exercises last for multiple days does not necessarily mean that individual animals are either exposed to those exercises for multiple days or, further, exposed in a manner resulting in a sustained multiple day substantive behavioral response. Large multi-day Navy exercises typically include assets that travel at high speeds (typically 10-15 knots, or higher) and likely cover large areas that are relatively far from shore, in addition to the fact that marine mammals are moving as well, which would make it unlikely that the same animal could remain in the immediate vicinity of the ship for the entire duration of the exercise. Additionally, the Navy does not necessarily operate active sonar the entire time during an exercise. While it is certainly possible that these sorts of exercises could overlap with individual marine mammals multiple days in a row at levels above those anticipated to result in a take, because of the factors mentioned above, it is considered not to be likely for the majority of takes, does not mean that a behavioral response is necessarily

sustained for multiple days, and still necessitates the consideration of likely duration and context to assess any effects on the individual's fitness.

Durations for non-impulsive activities utilizing tactical sonar sources vary and are fully described in Appendix A of the FEIS/OEIS. ASW training and testing exercises using MFAS/HFAS generally last for 2-16 hours, and may have intervals of non-activity in between. Because of the need to train in a large variety of situations, the Navy does not typically conduct successive MTEs or other ASW exercises in the same locations. Given the average length of ASW exercises (times of continuous sonar use) and typical vessel speed, combined with the fact that the majority of the cetaceans in the Study Area would not likely remain in an area for successive days, it is unlikely that an animal would be exposed to MFAS/HFAS at levels likely to result in a substantive response that would then be carried on for more than one day or on successive days.

Most planned explosive exercises are of a short duration (1-6 hours). Although explosive exercises may sometimes be conducted in the same general areas repeatedly, because of their short duration and the fact that they are in the open ocean and animals can easily move away, it is similarly unlikely that animals would be exposed for long, continuous amounts of time.

TTS

As mentioned previously, TTS can last from a few minutes to days, be of varying degree, and occur across various frequency bandwidths, all of which determine the severity of the impacts on the affected individual, which can range from minor to more severe. The TTS sustained by an animal is primarily classified by three characteristics:

1. Frequency – Available data (of mid-frequency hearing specialists exposed to mid- or 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 more powerful MF sources used 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 fewer hours of HF source use and the sounds would attenuate more quickly, plus they have lower source levels, but if an animal were to incur TTS from these sources, it would cover a higher frequency range (sources are between 20 and 100 kHz, which means that TTS could range up to 200 kHz; however, HF systems are typically used less frequently and for shorter time periods than surface ship and aircraft MF systems, so TTS from these sources is even less likely). TTS from explosives would be broadband. Vocalization data for each species, which would inform how TTS might specifically interfere with communications with conspecifics, was provided in the LOA application.

2. Degree of the shift (i.e., by how many dB the sensitivity of the hearing is reduced) – 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 was discussed previously in this document. 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 Lookouts and the nominal speed of an active sonar vessel (10-15 knots). In the 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-second exposure to a 20 kHz source. However, MFAS emits a nominal ping every 50 seconds, and incurring those levels of TTS is highly unlikely.

3. Duration of TTS (recovery time) – In the TTS laboratory studies, some using exposures of almost an hour in duration or up to 217 SEL, almost all individuals recovered within 1 day (or less, often in minutes), although in one study (Finneran *et al.*, 2007), recovery took 4 days.

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 in the Study Area, it is unlikely that marine mammals would ever sustain a TTS from MFAS that alters their sensitivity by more than 20 dB for more than a few days (and any incident of TTS would likely be far less severe due to the short duration of the majority of the exercises and the speed of a typical vessel). 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 is impeded. Additionally, 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 most likely be sustained because the higher source level and slower attenuation make it more likely that an animal would be exposed to a higher received level) would not usually span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues. If impaired, marine mammals would typically be aware of their impairment and are sometimes able to implement behaviors to compensate (see Acoustic Masking or Communication Impairment section), though these compensations may incur energetic costs.

Acoustic Masking or Communication Impairment

Masking only occurs during the time of the signal (and potential secondary arrivals of indirect rays), versus TTS, which continues beyond the duration of the signal. Standard MFAS nominally pings every 50 seconds for hull-mounted sources. For the sources for which we know the pulse length, most are significantly shorter than hull-mounted active sonar, on the order of several microseconds to tens of microseconds. For hull-mounted active sonar, though some of the vocalizations that marine mammals make are less than one second long, there is only a 1 in 50 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, communication series, or other critical auditory cue, because the signal 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

NMFS believes that many marine mammals would deliberately avoid exposing themselves to the received levels of active sonar necessary to induce injury 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) would typically 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.

If a marine mammal is able to approach a surface vessel within the distance necessary to incur PTS, the likely speed of the vessel (nominal 10-15 knots) would make it very difficult for the animal to remain in range long enough to accumulate enough energy to result in more than a mild case of PTS. As mentioned previously and in relation to TTS, the likely consequences to the health of an individual that incurs PTS can range from mild to more serious, depending upon the degree of PTS and the frequency band it is in, and many animals are able to compensate for the shift, although it may include energetic costs.

As discussed previously, marine mammals (especially beaked whales) 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 mechanism of this potential response, behavioral or physiological, is not known. When naval exercises have been associated with strandings in the past, it has typically been when three or more vessels are operating simultaneously, in the presence of a strong surface duct, and in areas of constricted channels, semi-enclosed areas, and/or steep bathymetry. A combination of these environmental and operational parameters is not present in the MITT action. When this is combined with consideration of the number of hours of active sonar training that will be conducted and the nature of the exercises—which do not typically include the use of multiple hull-mounted sonar sources—we believe that the probability is small that this will occur. Furthermore, given that there has never been a stranding in the Study Area associated with sonar use and based on the number of occurrences where strandings have been definitively associated with military sonar versus the number of hours of active sonar training that have been conducted, we believe that the probability is small that this

will occur as a result of the Navy's proposed training and testing activities. Lastly, an active sonar shutdown protocol for strandings involving live animals milling in the water minimizes the chances that these types of events turn into mortalities.

As stated previously, there have been no recorded Navy vessel strikes of any marine mammals during training or testing in the MITT Study Area to date, nor were takes by injury or mortality resulting from vessel strike predicted in the Navy's analysis.

Important Marine Mammal Habitat

No critical habitat for marine mammals species protected under the ESA has been designated in the MITT Study Area. There are also no known specific breeding or calving areas for marine mammals within the MITT Study Area.

Group and Species-Specific Analysis

Predicted harassment of marine mammals from exposures to sonar and other active acoustic sources and explosions during annual training and testing activities are shown in Table 11. The vast majority of predicted exposures are expected to be Level B harassment (non-injurious TTS and behavioral reactions) from sonar and other active acoustic sources at relatively low received levels (less than 156 dB) (Table 22). As mentioned earlier in the Analysis and Negligible Impact Determination section, an animal's exposure to a higher received level is more likely to adversely affect the health of the animal. The acoustic analysis predicts the majority of marine mammal species in the Study Area would not be exposed to explosive (impulse) sources associated with training and testing activities that exceed the impulsive sound thresholds for injury (Table 9). Only dwarf sperm whale, pygmy sperm whale, Fraser's dolphin, and pantropical spotted dolphin are predicted to have Level B (TTS) exposures resulting from explosives, and only small numbers of dwarf sperm whales and pygmy sperm whales are

expected to have injurious take (PTS or minor tissue damage from explosives) resulting from sonar and other active acoustic sources and explosions. There are no lethal takes predicted for any marine mammal species for the MITT activities.

The analysis below may in some cases (e.g., mysticetes, dolphins) address species collectively if they occupy the same functional hearing group (i.e., low, mid, and high-frequency cetaceans and pinnipeds in water), have similar hearing capabilities, and/or are known to generally behaviorally respond similarly to acoustic stressors. Where there are meaningful differences between species or stocks, or groups of species, in anticipated individual responses to activities, impact of expected take on the population due to differences in population status, or impacts on habitat, they will either be described within the section or the species will be included as a separate sub-section. See the Brief Background on Sound section in the proposed rule for a description of marine mammal functional hearing groups as originally designated by Southall *et al.* (2007).

Mysticetes – The Navy’s acoustic analysis predicts 1,837 takes (Level B harassment) may occur from sonar and other active acoustic stressors associated with mostly training and some testing activities in the Study Area each year. The acoustic analysis indicates up to 28 annual instances of Level B harassment (24 TTS and 4 behavioral reactions) of fin whales, up to 28 annual instances of Level B harassment (25 TTS and 3 behavioral reactions) of blue whales, up to 319 annual instances of Level B harassment (258 TTS and 61 behavioral reactions) of sei whales, up to 860 annual instances of Level B harassment (679 TTS and 181 behavioral reactions) of humpback whales, up to 398 annual instances of Level B harassment (219 TTS and 79 behavioral reactions) of Bryde’s whales, up to 101 annual instances of Level B harassment

(81 TTS and 20 behavioral reactions of minke whales, and up to 103 annual instances of Level B harassment (84 TTS and 19 behavioral reactions) of Omura's whales.

Of these species, humpback, blue, fin, and sei whales are listed as endangered under the ESA and depleted under the MMPA. NMFS has designated two Pacific stocks for blue whales (Eastern North Pacific and Central North Pacific) (Carretta *et al.*, 2014), with blue whales in the Study Area most likely part of the Central North Pacific stock. NMFS has designated four Pacific stocks for humpback whales (Western North Pacific, Central North Pacific, California/Oregon/Washington, and American Samoa) (Carretta *et al.*, 2014; Allen and Angliss, 2014), and while stock structure is not completely known for the Study Area, it is most likely that humpback whales here are part of the Western North Pacific and/or Central North Pacific stock. Although NMFS has designated Pacific stocks for fin, sei, Bryde's, minke, and Omura's whales (Carretta *et al.*, 2014; Allen and Angliss, 2014), little is known about the stock structure for these species in the MITT Study Area and NMFS currently has not designated any stocks specific to the MITT Study Area for these species.

The estimates given above represent 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. In the ocean, the use of sonar and other active acoustic sources is transient and is unlikely to repeatedly expose the same population of animals over a short period. Around heavily trafficked Navy ports and on fixed ranges, the possibility is greater for animals that are resident during all or part of the year to be exposed multiple times to sonar and other active acoustic sources. However, as discussed in the proposed rule, because neither the vessels nor the animals are stationary, significant long-term effects from repeated exposure are not expected.

Level B harassment is anticipated to be in the form of non-TTS behavioral responses and TTS, and no injurious (Level A harassment) takes of mysticete whales from sonar and other active acoustic stressors or explosives are expected. The majority of acoustic effects to mysticetes from sonar and other active sound sources during training and testing activities would be primarily from anti-submarine warfare events involving surface ships and hull mounted (mid-frequency) sonar. Research and observations show that if mysticetes are exposed to sonar or other active acoustic sources they may react in a number of ways depending on the characteristics of the sound source, their experience with the sound source, and whether they are migrating or on seasonal grounds (i.e., breeding or feeding). Reactions may include alerting, breaking off feeding dives and surfacing, diving or swimming away, or no response at all (Richardson, 1995; Nowacek, 2007; Southall *et al.*, 2007). Richardson *et al.* (1995) noted that avoidance (temporary displacement of an individual from an area) reactions are the most obvious manifestations of disturbance in marine mammals. It is qualitatively different from the startle or 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. Additionally, migrating animals may ignore a sound source, or divert around the source if it is in their path.

Specific to U.S. Navy systems using low frequency sound, studies were undertaken in 1997–98 pursuant to the Navy’s Low Frequency Sound Scientific Research Program. These studies found only short-term responses to low frequency sound by mysticetes (fin, blue, and humpback whales) including changes in vocal activity and avoidance of the source vessel (Clark, 2001; Miller *et al.*, 2000; Croll *et al.*, 2001; Fristrup *et al.*, 2003; Nowacek *et al.*, 2007). Baleen whales exposed to moderate low-frequency signals demonstrated no variation in foraging

activity (Croll *et al.*, 2001). Low-frequency signals of the Acoustic Thermometry of Ocean Climate sound source were not found to affect dive times of humpback whales in Hawaiian waters (Frankel and Clark, 2000).

Specific to mid-frequency sound, studies by Melcón *et al.* (2012) in the Southern California Bight found that the likelihood of blue whale low-frequency calling (usually associated with feeding behavior) decreased with an increased level of mid-frequency sonar, beginning at a SPL of approximately 110-120 dB re 1 μ Pa. However, it is not known whether the lower rates of calling actually indicated a reduction in feeding behavior or social contact since the study used data from remotely deployed, passive acoustic monitoring buoys. Preliminary results from the 2010–2011 field season of an ongoing behavioral response study in Southern California waters indicated that in some cases and at low received levels, tagged blue whales responded to mid-frequency sonar but that those responses were mild and there was a quick return to their baseline activity (Southall *et al.*, 2012b). Blue whales responded to a mid-frequency sound source, with a source level between 160 and 210 dB re 1 μ Pa at 1 m and a received sound level up to 160 dB re 1 μ Pa, by exhibiting generalized avoidance responses and changes to dive behavior during controlled exposure experiments (CEE) (Goldbogen *et al.*, 2013). However, reactions were not consistent across individuals based on received sound levels alone, and likely were the result of a complex interaction between sound exposure factors such as proximity to sound source and sound type (mid-frequency sonar simulation vs. pseudo-random noise), environmental conditions, and behavioral state. Surface feeding whales did not show a change in behavior during CEEs, but deep feeding and non-feeding whales showed temporary reactions that quickly abated after sound exposure. Distances of the sound source from the whales during CEEs were sometimes less than a mile. Furthermore, the more dramatic reactions

reported by Goldbogen *et al.* (2013) were from non-sonar like signals, a pseudorandom noise that could likely have been a novel signal to blue whales. The preliminary findings from Goldbogen *et al.* (2013) and Melcón *et al.* (2012) are generally consistent with the Navy's criteria and thresholds for predicting behavioral effects to mysticetes from sonar and other active acoustic sources used in the quantitative acoustic effects analysis for MITT. The behavioral response function predicts a probability of a substantive behavioral reaction for individuals exposed to a received SPL of 120 dB re 1 μ Pa or greater, with an increasing probability of reaction with increased received level as demonstrated in Melcón *et al.* (2012).

High-frequency systems are not within mysticetes' ideal hearing range and it is unlikely that they would cause a significant behavioral reaction.

Most Level B harassments to mysticetes from sonar would result from received levels less than 156 dB SPL. Therefore, the majority of Level B takes are expected to be in the form of milder responses (i.e., lower-level exposures that still rise to the level of take, but would likely be less severe in the range of responses that qualify as take) of a generally short duration. As mentioned earlier in the Analysis and Negligible Impact Determination section, we anticipate more severe effects from takes when animals are exposed to higher received levels. Most low-frequency (mysticetes) cetaceans observed in studies usually avoided sound sources at levels of less than or equal to 160 dB re 1 μ Pa. Occasional behavioral reactions are unlikely to cause long-term consequences for individual animals or populations. Even if sound exposure were to be concentrated in a relatively small geographic area over a long period of time (e.g., days or weeks during major training exercises), we would expect that some individual whales would avoid areas where exposures to acoustic stressors are at higher levels. For example, Goldbogen *et al.* (2013) indicated some horizontal displacement of deep foraging blue whales in response to

simulated MFA sonar. Given these animal's mobility and large ranges, we would expect these individuals to temporarily select alternative foraging sites nearby until the exposure levels in their initially selected foraging area have decreased. Therefore, even temporary displacement from initially selected foraging habitat is not expected to impact the fitness of any individual animals because we would expect equivalent foraging to be available in close proximity. Because we do not expect any fitness consequences from any individual animals, we do not expect any population level effects from these behavioral responses.

As explained above, recovery from a threshold shift (TTS) can take a few minutes to a few days, depending on the exposure duration, sound exposure level, and the magnitude of the initial shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran *et al.*, 2005; Finneran and Schlundt, 2010; Mooney *et al.*, 2009a; Mooney *et al.*, 2009b). However, large threshold shifts are not anticipated for these activities because of the unlikelihood that animals will remain within the ensonified area (due to the short duration of the majority of exercises, the speed of the vessels, and the short distance within which the animal would need to approach the sound source) at high levels for the duration necessary to induce larger threshold shifts. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal's hearing of biologically relevant sounds. Furthermore, the implementation of mitigation and the sightability of mysticetes (due to their large size) reduces the potential for a significant behavioral reaction or a threshold shift to occur.

There has never been a vessel strike to a whale during any active training or testing activities in the Study Area. A detailed analysis of strike data is contained in Chapter 6 (Section 6.3.4, Estimated Take of Large Whales by Navy Vessel Strike) of the LOA application. The

Navy does not anticipate vessel strikes to marine mammals during training or testing activities within the Study Area, nor were takes by injury or mortality resulting from vessel strike predicted in the Navy's analysis. Therefore, NMFS is not authorizing mysticete takes (by injury or mortality) from vessel strikes during the 5-year period of the MITT regulations.

There is no designated critical habitat for mysticetes in the Study Area. There are also no areas of specific importance for reproduction, calving, or feeding for mysticetes in the Study Area

Sperm Whales – The Navy's acoustic analysis indicates that 506 instances of Level B harassment of sperm whales may occur each year from sonar or other active acoustic stressors during training and testing activities. These Level B takes are anticipated to be in the form of TTS (54) and behavioral reactions (452) and no injurious takes of sperm whales from sonar and other active acoustic stressors or explosives are requested or proposed for authorization.

Although NMFS has designated Pacific stocks for sperm whales (Carretta *et al.*, 2014; Allen and Angliss, 2014), little is known about the stock structure for this species in the MITT Study Area and NMFS currently has not designated any sperm whale stocks specific to the MITT Study Area.

Sperm whales have shown resilience to acoustic and human disturbance, although they may react to sound sources and activities within a few kilometers. Sperm whales that are exposed to activities that involve the use of sonar and other active acoustic sources may alert, ignore the stimulus, avoid the area by swimming away or diving, or display aggressive behavior (Richardson, 1995; Nowacek, 2007; Southall *et al.*, 2007). Some (but not all) sperm whale vocalizations might overlap with the MFAS/HFAS TTS frequency range, which could temporarily decrease an animal's sensitivity to the calls of conspecifics or returning echolocation

signals. However, as noted previously, NMFS does not anticipate TTS of a long duration or severe degree to occur as a result of exposure to MFAS/HFAS. Recovery from a threshold shift (TTS) can take a few minutes to a few days, depending on the exposure duration, sound exposure level, and the magnitude of the initial shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran *et al.*, 2005; Finneran and Schlundt, 2010; Mooney *et al.*, 2009a; Mooney *et al.*, 2009b). However, large threshold shifts are not anticipated for these activities because of the unlikelihood that animals will remain within the ensonified area (due to the short duration of the majority of exercises and the speed of the vessels) at high levels for the duration necessary to induce larger threshold shifts. Also, 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 is impeded. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal's hearing of biologically relevant sounds. No sperm whales are predicted to be exposed to MFAS/HFAS sound levels associated with PTS or injury.

The majority of Level B takes are expected to be in the form of milder responses (low-level exposures) and of a generally short duration. Overall, the number of predicted behavioral reactions are unlikely to cause long-term consequences for individual animals or populations. The MITT activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors for sperm whales. Consequently, the activities are not expected to adversely impact rates of recruitment or survival of sperm whales. Sperm whales are listed as endangered under the ESA (and depleted under the MMPA); however, there is no designated critical habitat in the Study Area.

There has never been a vessel strike to a sperm whale during any active training or testing activities in the Study Area. A detailed analysis of strike data is contained in Chapter 6 (Section 6.3.4, Estimated Take of Large Whales by Navy Vessel Strike) of the LOA application. The Navy does not anticipate vessel strikes to marine mammals during training or testing activities within the Study Area, nor were takes by injury or mortality resulting from vessel strike predicted in the Navy's analysis. Therefore, NMFS is not authorizing sperm whale takes (by injury or mortality) from vessel strikes during the 5-year period of the MITT regulations.

Pygmy and Dwarf Sperm Whale – The Navy's acoustic analysis predicts Level B harassment (non-TTS behavioral responses and TTS) of 5,579 pygmy sperm whales and 14,217 dwarf sperm whales may occur annually from sonar and other active acoustic stressors and explosives associated with training and testing activities in the Study Area. These estimates 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 the Level B takes, 5,467 pygmy sperm whale and 13,901 dwarf sperm whale takes are predicted to be in the form of TTS from mainly MFAS/HFAS. The Navy's acoustic analysis (factoring in the post-model correction for avoidance and mitigation) also indicates that 15 injurious (Level A harassment) takes of pygmy sperm whale and 41 injurious (Level A harassment) takes of dwarf sperm whale may occur annually from active sonar.

Although NMFS has designated Pacific stocks for pygmy and dwarf sperm whales (Carretta *et al.*, 2014), little is known about the stock structure for these species in the MITT Study Area and NMFS currently has not designated any pygmy and dwarf sperm whale stocks specific to the MITT Study Area.

Recovery from a threshold shift (TTS; partial hearing loss) can take a few minutes to a few days, depending on the exposure duration, sound exposure level, and the magnitude of the initial shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran *et al.*, 2005; Mooney *et al.*, 2009a; Mooney *et al.*, 2009b; Finneran and Schlundt, 2010). An animal incurring PTS would not fully recover. However, large degrees of threshold shifts (PTS or TTS) are not anticipated for these activities because of the unlikelihood that animals will remain within the ensonified area (due to the short duration of the majority of exercises, the speed of the vessels, and the short distance within which the animal would need to approach the sound source) at high levels for the duration necessary to induce larger threshold shifts. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal hearing biologically relevant sounds. The likely consequences to the health of an individual that incurs PTS can range from mild to more serious, depending upon the degree of PTS and the frequency band it is in, and many animals are able to compensate for the shift, although it may include energetic costs. Furthermore, likely avoidance of intense activity and sound coupled with mitigation measures would further reduce the potential for more-severe PTS exposures to occur. If a pygmy or dwarf sperm whale is able to approach a surface vessel within the distance necessary to incur PTS, the likely speed of the vessel (nominal 10-15 knots) would make it very difficult for the animal to remain in range long enough to accumulate enough energy to result in more than a mild case of PTS. Some *Kogia* spp. vocalizations might overlap with the MFAS/HFAS TTS frequency range (2–20 kHz), but the limited information for *Kogia* spp. indicates that their clicks are at a much higher frequency and that their maximum hearing sensitivity is between 90 and 150 kHz.

Research and observations on *Kogia* spp. are limited. These species tend to avoid human activity and presumably anthropogenic sounds. Pygmy and dwarf sperm whales may startle and leave the immediate area of activity, reducing potential impacts. Pygmy and dwarf sperm whales have been observed to react negatively to survey vessels or low altitude aircraft by quick diving and other avoidance maneuvers, and none were observed to approach vessels (Wursig *et al.*, 1998). Based on their tendency to avoid acoustic stressors (e.g., quick diving and other vertical avoidance maneuvers) coupled with the short duration and intermittent nature (e.g., sonar pings during ASW activities occur about every 50 seconds) of the majority of training and testing exercises and the speed of the Navy vessels involved, it is unlikely that animals would receive multiple exposures over a short period of time, allowing animals to recover lost resources (e.g., food) or opportunities (e.g., mating).

It is worth noting that the amount of explosive and acoustic energy entering the water may be overestimated, as many explosions actually occur upon impact with above-water targets. However, sources such as these were modeled as exploding at 1-meter depth.

The predicted effects to *Kogia* spp. are expected to be mostly temporary and unlikely to cause long-term consequences for individual animals or populations. The MITT activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors. Pacific stocks of *Kogia* are not depleted under the MMPA. Consequently, the activities are not expected to adversely impact rates of recruitment or survival of pygmy and dwarf sperm whales.

Beaked Whales – The Navy’s acoustic analysis predicts Level B harassment of four species of beaked whale annually: 22,541 Cuvier’s beaked whales; 4,426 Blainville’s beaked whale; 1,924 Longman’s beaked whale; and 3,897 ginko-toothed beaked whales. These

estimates represent 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. These takes are anticipated to be in the form of mainly non-TTS behavioral harassment and some TTS, and no injurious takes of beaked whales from sonar and active acoustic stressors or explosives were predicted. Of the Level B takes, 308 Cuvier's beaked whale, 73 Blainville's beaked whale, 29 Longman's beaked whale, and 62 ginko-toothed beaked whale takes are predicted to be in the form of TTS from sonar and other active acoustic sources. Although NMFS has designated Pacific stocks for Cuvier's, Blainville's, and Longman's beaked whales (Carretta *et al.*, 2014; Allen and Angliss, 2014), little is known about the stock structure for beaked whales in the MITT Study Area and NMFS currently has not designated any beaked whale stocks specific to the MITT Study Area.

Of note, the number of beaked whales behaviorally harassed by exposure to MFAS/HFAS is generally higher than the other species because of the low Level B harassment threshold, which essentially makes the ensonified area of effects significantly larger than for the other species. Beaked whales have unique criteria based on specific data that show these animals to be especially sensitive to sound (McCarthy *et al.*, 2011; Tyack *et al.*, 2011). Beaked whale non-impulsive behavioral criteria are used unweighted (*i.e.*, without weighting the received level before comparing it to the threshold (see Finneran and Jenkins, 2012)). The Navy has adopted an unweighted 140 dB re 1 μ Pa SPL threshold for significant behavioral effects for all beaked whales. The fact that the threshold is a step function and not a curve (and assuming uniform density) means that the vast majority of the takes occur in the very lowest levels that exceed the threshold (it is estimated that approximately 80 percent of the takes are from exposures of 140 dB to 146 dB), which means that the anticipated effects for the majority of exposures are not

expected to be severe (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 an animal). Further, Moretti *et al.* (2014) recently derived an empirical risk function for Blainville's beaked whale that predicts there is a 0.5 probability of disturbance at a received level of 150 dB (CI: 144–155), suggesting that in some cases the current Navy step function overestimate the effects of an activity using sonar on beaked whales. Irrespective of the Moretti *et al.* (2014) risk function, NMFS' analysis assumes that all of the beaked whale Level B takes that are proposed for authorization will occur, and we base our negligible impact determination, in part, on the fact that these exposures would mainly occur at the very lowest end of the 140-dB behavioral harassment threshold where behavioral effects are expected to be much less severe and generally temporary in nature.

Behavioral responses of beaked whales can range from a mild orienting response, or a shifting of attention, to flight and panic (Richardson, 1995; Nowacek, 2007; Southall *et al.*, 2007; Finneran and Jenkins, 2012). Research has also shown that beaked whales are sensitive to the presence of human activity (Tyack *et al.*, 2011; Pirota *et al.*, 2012). Beaked whales have been documented to exhibit avoidance of human activity or respond to vessel presence (Pirota *et al.*, 2012). Beaked whales were observed to react negatively to survey vessels or low altitude aircraft by quick diving and other avoidance maneuvers, and none were observed to approach vessels (Wursig *et al.*, 1998). Some beaked whale vocalizations may overlap with the MFAS/HFAS TTS frequency range (2–20 kHz); however, as noted above, NMFS does not anticipate TTS of a serious degree or extended duration to occur as a result of exposure to MFA/HFAS. Recovery from a threshold shift (TTS) can take a few minutes to a few days, depending on the exposure duration, sound exposure level, and the magnitude of the initial shift,

with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran *et al.*, 2005; Finneran and Schlundt, 2010; Mooney *et al.*, 2009a; Mooney *et al.*, 2009b). However, large threshold shifts are not anticipated for these activities because of the unlikelihood that animals will remain within the ensonified area (due to the short duration of the majority of exercises, the speed of the vessels, and the short distance within which the animal would need to approach the sound source) at high levels for the duration necessary to induce larger threshold shifts. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal's hearing of biologically relevant sounds.

No beaked whales are predicted in the acoustic analysis to be exposed to sound levels associated with PTS, other injury, or mortality. After decades of the Navy conducting similar activities in the MITT Study Area without incident, NMFS does not expect stranding, injury, or mortality of beaked whales to occur as a result of Navy activities. Therefore, NMFS is not authorizing any Level A (injury or mortality) takes for beaked whales. Additionally, through the MMPA process (which allows for adaptive management), NMFS and the Navy will determine the appropriate way to proceed in the event that a causal relationship were to be found between Navy activities and a future stranding.

NMFS also considered New *et al.* (2013) and their mathematical model simulating a functional link between foraging energetics and requirements for survival and reproduction for 21 species of beaked whales. However, NMFS concluded that the New *et al.* (2013) model lacks critical data and accurate inputs necessary to form valid conclusions specifically about impacts of anthropogenic sound from Navy activities on specific beaked whale populations. The study itself notes the need for "future research," identifies "key data needs" relating to input

parameters that “particularly affected” the model results, and states only that the use of the model “in combination with more detailed research” *could* help predict the effects of management actions on beaked whale species. In short, information is not currently available to specifically support the use of this model in a project-specific evaluation of the effects of Navy activities on the impacted beaked whale species in MITT.

It has been speculated for some time that beaked whales might have unusual sensitivities to sonar sound due to their likelihood of stranding in conjunction with mid-frequency sonar use. Research and observations show that if beaked whales are exposed to sonar or other active acoustic sources they may startle, break off feeding dives, and avoid the area of the sound source to levels of 157 dB re 1 μ Pa, or below (McCarthy *et al.*, 2011). Acoustic monitoring during actual sonar exercises revealed some beaked whales continuing to forage at levels up to 157 dB re 1 μ Pa (Tyack *et al.* 2011). Stimpert *et al.* (2014) tagged a Baird’s beaked whale, which was subsequently exposed to simulated mid-frequency sonar. Received levels of sonar on the tag increased to a maximum of 138 dB re 1 μ Pa, which occurred during the first exposure dive. Some sonar received levels could not be measured due to flow noise and surface noise on the tag. Manzano-Roth *et al.* (2013) found that for beaked whale dives that continued to occur during MFAS activity, differences from normal dive profiles and click rates were not detected with estimated received levels up to 137 dB re 1 μ Pa while the animals were at depth during their dives. In research done at the Navy's fixed tracking range in the Bahamas, animals were observed to leave the immediate area of the anti-submarine warfare training exercise (avoiding the sonar acoustic footprint at a distance where the received level was “around 140 dB” SPL, according to Tyack *et al.* [2011]) but return within a few days after the event ended (Claridge and Durban, 2009; Moretti *et al.*, 2009, 2010; Tyack *et al.*, 2010, 2011; McCarthy *et al.*, 2011).

Tyack *et al.* (2011) report that, in reaction to sonar playbacks, most beaked whales stopped echolocating, made long slow ascent to the surface, and moved away from the sound. A similar behavioral response study conducted in Southern California waters during the 2010-2011 field season found that Cuvier's beaked whales exposed to MFAS displayed behavior ranging from initial orientation changes to avoidance responses characterized by energetic fluking and swimming away from the source (DeRuiter *et al.*, 2013). However, the authors did not detect similar responses to incidental exposure to distant naval sonar exercises at comparable received levels, indicating that context of the exposures (e.g., source proximity, controlled source ramp-up) may have been a significant factor. The study itself found the results inconclusive and meriting further investigation.

Populations of beaked whales and other odontocetes in the Bahamas and other Navy fixed ranges that have been operating for tens of years appear to be stable. Significant behavioral reactions seem likely in most cases if beaked whales are exposed to anti-submarine sonar within a few tens of kilometers, especially for prolonged periods (a few hours or more), since this is one of the most sensitive marine mammal groups to anthropogenic sound of any species or group studied to date and research indicates beaked whales will leave an area where anthropogenic sound is present (Tyack *et al.*, 2011; De Ruiter *et al.*, 2013; Manzano-Roth *et al.*, 2013; Moretti *et al.*, 2014). Research involving tagged Cuvier's beaked whales in the SOCAL Range Complex reported on by Falcone and Schorr (2012, 2014) indicates year-round prolonged use of the Navy's training and testing area by these beaked whales and has documented movements in excess of hundreds of kilometers by some of those animals. Given that some of these animals may routinely move hundreds of kilometers as part of their normal pattern, leaving an area where sonar or other anthropogenic sound is present may have little, if any, cost to such

an animal. Photo identification studies in the SOCAL Range Complex, a Navy range that is utilized for training and testing more frequently than the MITT Study Area, have identified approximately 100 Cuvier's beaked whale individuals with 40 percent having been seen in one or more prior years, with re-sightings up to seven years apart (Falcone and Schorr, 2014). These results indicate long-term residency by individuals in an intensively used Navy training and testing area, which may also suggest a lack of long-term consequences as a result of exposure to Navy training and testing activities. Finally, results from passive acoustic monitoring estimated regional Cuvier's beaked whale densities were higher than indicated by the NMFS's broad scale visual surveys for the U.S. west coast (Hildebrand and McDonald, 2009). Based on the findings above, it is clear that the Navy's long-term ongoing use of sonar and other active acoustic sources has not precluded beaked whales from also continuing to inhabit those areas.

In summary, based on the best available science, the Navy and NMFS believe that beaked whales that exhibit a significant TTS or behavioral reaction due to sonar and other active acoustic testing activities would generally not have long-term consequences for individuals or populations. Claridge (2013) speculates that sonar use in a Bahamas range could have "a possible population-level effect" on beaked whales based on lower abundance in comparison to control sites. However, the study suffers from several shortcomings and incorrectly assumes that the Navy range and control sites were identical. The author also acknowledged that "information currently available cannot provide a quantitative answer to whether frequent sonar use at [the Bahamas range] is causing stress to resident beaked whales," and cautioned that the outcome of ongoing studies "is a critical component to understanding if there are population-level effects." Moore and Barlow (2013) have noted a decline in beaked whale populations in a broad area of the Pacific Ocean area out to 300 nm from the coast and extending from the Canadian-U.S.

border to the tip of Baja Mexico. There are scientific caveats and limitations to the data used for that analysis, as well as oceanographic and species assemblage changes on the U.S. Pacific coast not thoroughly addressed. Interestingly, however, in the small portion of that area overlapping the Navy's SOCAL Range Complex, long-term residency by individual Cuvier's beaked whales and higher densities provide indications that the proposed decline noted elsewhere is not apparent where the Navy has been intensively training and testing with sonar and other systems for decades.

There is no direct evidence that routine Navy training and testing spanning decades has negatively impacted marine mammal populations at any Navy range complex. In at least three decades of similar activities, only one instance of injury to marine mammals (March 4, 2011; three long-beaked common dolphin at Silver Strand Training Complex) has been documented as a result of training or testing using an impulse source (underwater explosion) and the Navy implemented more stringent mitigation measures as a result of this incident. Stranding events coincident with Navy MFAS use in which exposure to sonar is believed to have been a contributing factor were detailed in the Stranding and Mortality section of the proposed rule (FR 79 15437). However, for some of these stranding events, a causal relationship between sonar exposure and the stranding could not be clearly established (Cox *et al.*, 2006). In other instances, sonar was considered only one of several factors that, in their aggregate, may have contributed to the stranding event (Freitas, 2004; Cox *et al.*, 2006). On March 24, 2015, a Cuvier's beaked whale stranded, and eventually died, near Bile Bay, Merizo Guam. The Navy confirmed that non-MTE sonar exercises took place in the MIRC from March 23-27, 2015. A necropsy was performed by the Guam Department of Agriculture, Division of Aquatics and

Wildlife with assistance from NOAA. Results of the necropsy have yet to be released and no causal relationship between the stranding and Navy activities has been determined at this time.

Because of the association between tactical MFA sonar use and a small number of marine mammal strandings, the Navy and NMFS have been considering and addressing the potential for strandings in association with Navy activities for years. In addition to a suite of mitigation measures intended to more broadly minimize impacts to marine mammals, the Navy and NMFS have a detailed Stranding Response Plan that outlines reporting, communication, and response protocols intended both to minimize the impacts of, and enhance the analysis of, any potential stranding in areas where the Navy operates.

The MITT training and testing activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors for beaked whales. The degree of predicted Level B harassment is expected to be mild, and no beaked whales are predicted in the acoustic analysis to be exposed to sound levels associated with PTS, other injury, or mortality. Consequently, the activities are not expected to adversely impact rates of recruitment or survival of beaked whales.

Social Pelagic Species (Small Whales) - The Navy's acoustic analysis predicts that the following numbers of Level B behavioral harassments of the associated species will occur annually: 84 killer whales; 555 false killer whales; 105 pygmy killer whales; 1,815 short-finned pilot whales; and 2,085 melon-headed whales; including the following numbers of TTS, respectively: 15, 101, 19, 334, and 448. These estimates represent 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. Behavioral responses of social pelagic small whales can range from a mild orienting response, or a shifting of attention, to flight and panic

(Richardson, 1995; Nowacek, 2007; Southall *et al.*, 2007; Finneran and Jenkins, 2012). No injurious takes from active acoustic stressors or explosives are requested or proposed for authorization.

Although NMFS has designated Pacific stocks for killer whales, false killer whales, pygmy killer whales, short-finned pilot whales, and melon-headed whales (Carretta *et al.*, 2014; Allen and Angliss, 2014), little is known about the stock structure for these species in the MITT Study Area and NMFS currently has not designated any stocks for these species specific to the MITT Study Area.

As mentioned previously, TTS from MFAS is anticipated to occur primarily in the 2–20 kHz range. If any individuals of these species were to experience TTS from MFAS/HFAS, the TTS would likely overlap with some of the vocalizations of conspecifics, and not with others. 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. Recovery from a threshold shift (TTS) can take a few minutes to a few days, depending on the exposure duration, sound exposure level, and the magnitude of the initial shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran *et al.*, 2005; Finneran and Schlundt, 2010; Mooney *et al.*, 2009a; Mooney *et al.*, 2009b). However, large threshold shifts are not anticipated for these activities because of the unlikelihood that animals will remain within the ensonified area (due to the short duration of the majority of exercises, the speed of the vessels, and the short distance within which the animal would need to approach the sound source) at high levels for the duration necessary to induce larger threshold shifts. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal's hearing of biologically relevant sounds.

Controlled exposure experiments in 2007 and 2008 in the Bahamas recorded responses of false killer whales, short-finned pilot whales, and melon-headed whales to simulated MFA sonar (De Ruiter *et al.*, 2013). The responses to exposures between species were variable. After hearing each MFAS signal, false killer whales were found to “increase their whistle production rate and made more-MFAS-like whistles” (De Ruiter *et al.*, 2013). In contrast, melon-headed whales had “minor transient silencing” after each MFAS signal, while pilot whales had no apparent response.

Pilot whales or false killer whales in the Bahamas showed an avoidance response to controlled exposure playbacks (Southall *et al.*, 2009). Consistent with the findings of other previous research (see, for example Southall *et al.*, 2007), De Ruiter *et al.*, (2013b) found the responses were variable by species and with the context of the sound exposure. The assumption is that odontocete species in general, including those in the MITT Study Area, would have similar variable responses.

Research and observations show that if killer whales are exposed to sonar or other active acoustic sources they may react in a number of ways depending on their experience with the sound source and what activity they are engaged in at the time of the acoustic exposure. Killer whales may not react at all until the sound source is approaching within a few hundred meters to within a few kilometers depending on the environmental conditions and species. Killer whales that are exposed to activities that involve the use of sonar and other active acoustic sources may alert, ignore the stimulus, change their behaviors or vocalizations, avoid the sound source by swimming away or diving, or be attracted to the sound source. Research has demonstrated that killer whales may routinely move over long large distances (Andrews and Matkin, 2014; Fearnbach *et al.*, 2013). In a similar documented long-distance movement, an Eastern North

Pacific Offshore stock killer whale tagged off San Clemente Island, California, moved (over a period of 147 days) to waters off northern Mexico, then north to Cook Inlet, Alaska, and finally (when the tag ceased transmitting) to coastal waters off Southeast Alaska (Falcone and Schorr, 2014). Given these findings, temporary displacement due to avoidance of training and testing activities are therefore unlikely to have biological significance to individual animals. Long-term consequences to individual killer whales or populations are not likely due to exposure to sonar or other active acoustic sources. Population-level consequences are not expected.

The MITT activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors for social pelagic species. Consequently, the activities are not expected to adversely impact rates of recruitment or survival of these species.

Dolphins - The Navy's acoustic analysis predicts the following numbers of Level B harassment annually: 741 bottlenose dolphin; 12,811 pantropical spotted dolphin; 3,298 striped dolphin; 589 spinner dolphin; 1,819 rough toothed dolphin; 2,572 Fraser's dolphin; and 505 Risso's dolphin. These estimates represent 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. The majority of takes are anticipated to be by non-TTS behavioral harassment in the form of milder responses (low received levels and of a short duration) to sonar and other active acoustic sources. No injurious takes of dolphins from active acoustic stressors or explosives are requested or proposed for authorization. Behavioral responses can range from alerting, to changing their behavior or vocalizations, to avoiding the sound source by swimming away or diving (Richardson, 1995; Nowacek, 2007; Southall *et al.*, 2007).

Of the Level B takes, 150 bottlenose dolphin; 2,584 pantropical spotted dolphin; 612 striped dolphin; 119 spinner dolphin; 377 rough toothed dolphin; 493 Fraser's dolphin; and 84 Risso's dolphin takes are predicted to be in the form of generally mild TTS from sonar and other active acoustic sources. Though the group size and behavior of these species makes it likely that Navy lookouts would detect them and implement shutdown if appropriate, the 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. As mentioned above, many of the recorded dolphin vocalizations overlap with the MFAS/HFAS TTS frequency range (2–20 kHz), however, as noted above, NMFS does not anticipate TTS of a serious degree or extended duration to occur. Recovery from a threshold shift (TTS) can take a few minutes to a few days, depending on the exposure duration, sound exposure level, and the magnitude of the initial shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran *et al.*, 2005; Finneran and Schlundt, 2010; Mooney *et al.*, 2009a; Mooney *et al.*, 2009b). However, large threshold shifts are not anticipated for these activities because of the unlikelihood that animals will remain within the ensonified area (due to the short duration of the majority of exercises, the speed of the vessels, and the short distance within which the animal would need to approach the sound source) at high levels for the duration necessary to induce larger threshold shifts. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal's hearing of biologically relevant sounds.

One Level B take each for Fraser's dolphin and pantropical spotted dolphin is predicted to be in the form of non-injurious TTS from impulsive sound sources (explosive detonations). Research and observations suggest that if delphinids are exposed to impulse sound sources, they

may react by alerting, ignoring the stimulus, changing their behavior or vocalizations, or avoiding the area by swimming away or diving (Richardson, 1995; Finneran, 2002; Madsen *et al.*, 2006; Weir, 2008; and Miller *et al.*, 2009).

Although NMFS has designated Pacific stocks for bottlenose, pantropical spotted, striped, spinner, rough toothed, Fraser's, and Risso's dolphins (Carretta *et al.*, 2014), little is known about the stock structure for these species in the MITT Study Area and NMFS currently has not designated any stocks for these species specific to the MITT Study Area.

The MITT activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors for dolphins. Consequently, the activities are not expected to adversely impact rates of recruitment or survival of these species.

Long-Term Consequences

The best assessment of long-term consequences from training and testing activities will be to monitor the populations over time within a given Navy range complex. A U.S. workshop on Marine Mammals and Sound (Fitch *et al.*, 2011) indicated a critical need for baseline biological data on marine mammal abundance, distribution, habitat, and behavior over sufficient time and space to evaluate impacts from human-generated activities on long-term population survival. The Navy has developed monitoring plans for protected marine mammals occurring on Navy ranges with the goal of assessing the impacts of training and testing activities on marine species and the effectiveness of the Navy's current mitigation practices. Continued monitoring efforts over time will be necessary to completely evaluate the long-term consequences of exposure to noise sources.

Since 2006 across all Navy range complexes (in the Atlantic, Gulf of Mexico, and the Pacific), there have been more than 80 reports; Major Exercise Reports, Annual Exercise

Reports, and Monitoring Reports. For the Pacific since 2011, there have been 29 monitoring and exercise reports submitted to NMFS to further research goals aimed at understanding the Navy's impact on the environment as it carries out its mission to train and test (www.navy.marinespeciesmonitoring.us).

In addition to this multi-year record of reports from across the Navy, there have also been ongoing Behavioral Response Study research efforts (in Southern California and the Bahamas) specifically focused on determining the potential effects from Navy mid-frequency sonar (Southall *et al.*, 2011, 2012; Tyack *et al.*, 2011; DeRuiter *et al.*, 2013b; Goldbogen *et al.*, 2013; Moretti *et al.*, 2014). This multi-year compendium of monitoring, observation, study, and broad scientific research is informative with regard to assessing the effects of Navy training and testing in general. Given that this record involves many of the same Navy training and testing activities being considered for the Study Area and because it includes all the marine mammal taxonomic families and many of the same species, this compendium of Navy reporting is directly applicable to assessing locations such as the Mariana Islands.

In the Hawaii and Southern California Navy training and testing ranges from 2009 to 2012, Navy-funded marine mammal monitoring research completed over 5,000 hours of visual survey effort covering over 65,000 nautical miles, sighted over 256,000 individual marine mammals, took over 45,600 digital photos and 36 hours of digital video, attached 70 satellite tracking tags to individual marine mammals, and collected over 40,000 hours of passive acoustic recordings. In Hawaii alone between 2006 and 2012, there were 21 scientific marine mammal surveys conducted before, during, or after major exercises.

Based on monitoring conducted before, during, and after Navy training and testing events since 2006, the NMFS' assessment is that it is unlikely there will be impacts having any long-

term consequences to populations of marine mammals as a result of the proposed continuation of training and testing in the ocean areas historically used by the Navy including the MITT Study Area. This assessment of likelihood is based on four indicators from areas in the Pacific where Navy training and testing has been ongoing for decades: (1) evidence suggesting or documenting increases in the numbers of marine mammals present (Calambokidis and Barlow, 2004; Falcone *et al.*, 2009; Hildebrand and McDonald, 2009; Falcone and Shorr, 2012; Calambokidis *et al.*, 2009a; Berman-Kowalewski *et al.*, 2010; Moore and Barlow, 2011; Barlow *et al.* 2011; Kerosky *et al.*, 2012; Smultea *et al.*, 2013), or evidence suggesting populations have reached carrying capacity (Monnahan *et al.*, 2014;), (2) examples of documented presence and site fidelity of species and long-term residence by individual animals of some species (Hooker *et al.*, 2002; McSweeney *et al.*, 2007; McSweeney *et al.*, 2009; McSweeney *et al.*, 2010; Martin and Kok, 2011; Baumann-Pickering *et al.*, 2012; Falcone and Schorr, 2014), (3) use of training and testing areas for breeding and nursing activities (Littnan, 2010), and (4) eight years of comprehensive monitoring data indicating a lack of any observable effects to marine mammal populations as a result of Navy training and testing activities.

To summarize, while the evidence covers most marine mammal taxonomic suborders, it is limited to a few species and only suggestive of the general viability of those species in intensively used Navy training and testing areas (Barlow *et al.*, 2011; Calambokidis *et al.*, 2009b; Falcone *et al.*, 2009; Littnan, 2011; Martin and Kok, 2011; McCarthy *et al.*, 2011; McSweeney *et al.*, 2007; McSweeney *et al.*, 2009; Moore and Barlow, 2011; Tyack *et al.*, 2011; Southall *et al.*, 2012a; Melcon, 2012; Goldbogen, 2013; Baird *et al.*, 2013). However, there is no direct evidence that routine Navy training and testing spanning decades has negatively impacted marine mammal populations at any Navy range complex. Although there have been a few

strandings associated with use of sonar in other locations (see U.S. Department of the Navy, 2013b), Ketten (2012) has recently summarized, “to date, there has been no demonstrable evidence of acute, traumatic, disruptive, or profound auditory damage in any marine mammal as the result of anthropogenic noise exposures, including sonar.” Therefore, based on the best available science (McSweeney *et al.*, 2007; Falcone *et al.*, 2009; McSweeney *et al.*, 2009; Littnan, 2010; Barlow *et al.*, 2011; Martin and Kok, 2011; McCarthy *et al.*, 2011; Moore and Barlow, 2011; Tyack *et al.*, 2011; Southall *et al.*, 2012a; Manzano-Roth *et al.*, 2013; DeRuiter *et al.*, 2013; Goldbogen *et al.*, 2013; Moretti *et al.*, 2014; Smultea and Jefferson, 2014), including data developed in the series of reports submitted to NMFS, we believe that long-term consequences for individuals or populations are unlikely to result from Navy training and testing activities in the Study Area.

Final Determination

NMFS concludes that training and testing activities proposed in the MITT Study Area could result in Level B and Level A takes, as summarized in Table 11. Based on best available science NMFS concludes that exposures to marine mammal species due to MITT activities would result in primarily short-term (temporary and short in duration) and relatively infrequent effects to most individuals, and not of the type or severity that would be expected to be additive for the portion of the stocks and species likely to be exposed. Marine mammal takes from Navy activities are not expected to impact annual rates of recruitment or survival and will therefore not result in population-level impacts for the following reasons:

- Most acoustic harassments (greater than 99 percent) are within the non-injurious TTS or behavioral effects zones (Level B harassment consisting of generally temporary modifications in behavior) and none of the estimated exposures result in mortality.

- As mentioned earlier, 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 animal. For low frequency cetaceans (mysticetes) in the Study Area, most Level B exposures will occur at received levels less than 156 dB (Table 22). The majority of estimated odontocete takes from MFAS/HFAS (at least for hull-mounted sonar, which is responsible for most of the sonar-related takes) also result from exposures to received levels less than 156 dB (Table 22). Therefore, the majority of Level B takes are expected to be in the form of milder responses (i.e., lower-level exposures that still rise to the level of a take, but would likely be less severe in the range of responses that qualify as a take) and are not expected to have deleterious impacts on the fitness of any individuals.
- Acoustic disturbances caused by Navy sonar and explosives are short-term, intermittent, and (in the case of sonar) transitory, even during major training exercises. Navy activities are generally unit level. Unit level events occur over a small spatial scale (one to a few 10s of square miles) and with few participants (usually one or two). Single-unit level training would typically involve a few hours of sonar use, with a typical nominal ping of every 50 seconds (duty cycle). Even though an animal's exposure to active sonar may be more than one time, the intermittent nature of the sonar signal, its low duty cycle, and the fact that both the vessel and animal are moving provide a very small chance that exposure to active sonar for individual animals and stocks would be repeated over extended periods of time. Consequently, we would not expect the Navy's activities to create conditions of long-term, continuous underwater noise leading to habitat abandonment or long-term hormonal or physiological stress responses in marine mammals.

- Years of monitoring of Navy activities (since 2006) have documented hundreds of thousands of marine mammals on the range complexes and there are only two instances of overt behavioral change that have been observed.
- Years of monitoring of Navy activities have documented no instances of injury to marine mammals as a direct result of non-impulse acoustic sources.
- In at least three decades of similar activities, only one instance of injury to marine mammals (March 2011; three long-beaked common dolphin off Southern California) has been documented as a result of training or testing using an impulse source (underwater explosion).
- Range complexes where intensive training and testing have been occurring for decades have populations of multiple species with strong site fidelity (including highly sensitive resident beaked whales at some locations) and increases in the number of some species. Populations of beaked whales and other odontocetes in the Bahamas, and other Navy fixed ranges that have been operating for tens of years, appear to be stable.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, which includes consideration of the materials provided in the Navy's LOA application and MITT FEIS/OEIS, and dependent upon the implementation of the mitigation and monitoring measures, NMFS finds that the total marine mammal take from the Navy's training and testing activities in the MITT Study Area will have a negligible impact on the affected marine mammal species or stocks. NMFS has issued regulations for these activities that prescribe the means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat and set forth requirements pertaining to the monitoring and reporting of that taking.

Impact on Availability of Affected Species for Taking for Subsistence Uses

NMFS has determined that the issuance of regulations and subsequent LOA for Navy training and testing activities in the MITT Study Area would not have an unmitigable adverse impact on the availability of species or stocks for subsistence use, since there are no such uses in the specified area.

Endangered Species Act (ESA)

There are five marine mammal species under NMFS' jurisdiction that are listed as endangered or threatened under the ESA with confirmed or possible occurrence in the Study Area: blue whale, humpback whale, fin whale, sei whale, and sperm whale. The Navy consulted with NMFS pursuant to section 7 of the ESA, and NMFS also consulted internally on the issuance of an LOA under section 101(a)(5)(A) of the MMPA for MITT activities. NMFS issued a Biological Opinion concluding that the issuance of the rule and subsequent LOA are likely to adversely affect, but are not likely to jeopardize, the continued existence of the threatened and endangered species (and species proposed for listing) under NMFS' jurisdiction and are not likely to result in the destruction or adverse modification of critical habitat in the MITT Study Area. The Biological Opinion for this action is available on NMFS' website (<http://www.nmfs.noaa.gov/pr/permits/incidental/>).

National Environmental Policy Act (NEPA)

NMFS participated as a cooperating agency on the MITT FEIS/OEIS, which was published on May 22, 2015 and is available on the Navy's website: <http://www.mitt-eis.com>. NMFS determined that the MITT FEIS/OEIS is adequate and appropriate to meet our responsibilities under NEPA for the issuance of regulations and LOA and adopted the Navy's MITT FEIS/OEIS.

Classification

The Office of Management and Budget has determined that this rule is not significant for purposes of Executive Order 12866.

Pursuant to the Regulatory Flexibility Act (RFA), 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 RFA 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. 605 (b), that the action will not have a significant economic impact on a substantial number of small entities. The Navy is the sole entity that would be affected by this rulemaking, and the Navy is not a small governmental jurisdiction, small organization, or small business, as defined by the RFA. Any requirements imposed by an LOA issued pursuant to these regulations, and any monitoring or reporting requirements imposed by these regulations, would be applicable only to the Navy. NMFS does not expect the issuance of these regulations or the associated LOA to result in any impacts to small entities pursuant to the RFA. 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.

The Assistant Administrator for Fisheries has determined that there is good cause under the Administrative Procedure Act (5 U.S.C 553(d)(3)) to waive the 30-day delay in the effective date of the measures contained in the final rule. The Navy is the only entity subject to the regulations, and it has informed NMFS that it requests that this final rule take effect by August 3, 2015, when the regulations issued by NMFS to govern the unintentional taking of marine

mammals incidental to the Navy's activities in the MIRC study area from 2010 to 2015 expire. Any delay of enacting the final rule would result in either: (1) A suspension of planned naval training, which would disrupt vital training essential to national security; or (2) the Navy's procedural non-compliance with the MMPA (should the Navy conduct training without an LOA), thereby resulting in the potential for unauthorized takes of marine mammals. Moreover, the Navy is ready to implement the rule immediately. For these reasons, the Assistant Administrator finds good cause to waive the 30-day delay in the effective date.

List of Subjects in 50 CFR Part 218

Exports, Fish, Imports, Incidental take, Indians, Labeling, Marine mammals, Navy, Penalties, Reporting and recordkeeping requirements, Seafood, Sonar, Transportation.

Dated: July 24, 2015

Paul N. Doremus,
Deputy Assistant Administrator for Operations,
National Marine Fisheries Service.

For reasons set forth in the preamble, 50 CFR part 218 is amended as follows:

PART 218—REGULATIONS GOVERNING THE TAKING AND IMPORTING OF MARINE MAMMALS

1. The authority citation for part 218 continues to read as follow:

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

2. Subpart J is added to part 218 to read as follows:

**Subpart J – Taking and Importing Marine Mammals; U.S. Navy’s Mariana Islands
Training and Testing (MITT)**

Sec.

218.90 Specified activity and specified geographical region.

218.91 Effective dates and definitions.

218.92 Permissible methods of taking.

218.93 Prohibitions.

218.94 Mitigation.

218.95 Requirements for monitoring and reporting.

218.96 Applications for Letters of Authorization

218.97 Letter of Authorization.

218.98 Renewal and modifications of Letters of Authorization.

**Subpart J – Taking and Importing Marine Mammals; U.S. Navy’s Mariana Islands
Training and Testing (MITT)**

§ 218.90 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 occurs 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 MITT Study Area, which includes the Mariana Islands Range Complex (MIRC) and areas to the north and west. The Study Area includes established ranges, operating areas, warning areas, and special use airspace in the region of the Mariana Islands that are part of the MIRC, its

surrounding seas, and a transit corridor to the Hawaii Range Complex. The Study Area also includes Navy pierside locations where sonar maintenance and testing may occur.

(c) The taking of marine mammals by the Navy is only authorized if it occurs incidental to the following activities within the designated amounts of use:

(1) Non-impulsive Sources Used During Training and Testing:

(i) Low-frequency (LF) Source Classes:

(A) LF4 – an average of 123 hours per year.

(B) LF5 – an average of 11 hours per year.

(C) LF6 – an average of 40 hours per year.

(ii) Mid-frequency (MF) Source Classes:

(A) MF1 – an average of 1,872 hours per year.

(B) MF2 – an average of 625 hours per year.

(C) MF3 – an average of 192 hours per year.

(D) MF4 – an average of 214 hours per year.

(E) MF5 – an average of 2,588 items per year.

(F) MF6 – an average of 33 items per year.

(G) MF8 – an average of 123 hours per year.

(H) MF9 – an average of 47 hours per year.

(I) MF10 – an average of 231 hours per year.

(J) MF11 – an average of 324 hours per year.

(K) MF12 – an average of 656 hours per year.

(iii) High-frequency (HF) and Very High-frequency (VHF) Source Classes:

(A) HF1 – an average of 113 hours per year.

- (B) HF4 – an average of 1,060 hours per year.
- (C) HF5 – an average of 336 hours per year.
- (D) HF6 – an average of 1,173 hours per year.
- (iv) Anti-Submarine Warfare (ASW) Source Classes:
 - (A) ASW1 – an average of 144 hours per year.
 - (B) ASW2 – an average of 660 items per year.
 - (C) ASW3 – an average of 3,935 hours per year.
 - (D) ASW4 – an average of 32 items per year.
- (v) Torpedoes (TORP) Source Classes:
 - (A) TORP1 – an average of 115 items per year.
 - (B) TORP2 – an average of 62 items per year.
- (vi) Acoustic Modems (M):
 - (A) M3 – an average of 112 hours per year.
 - (B) [Reserved]
- (vii) Swimmer Detection Sonar (SD):
 - (A) SD1 – an average 2,341 hours per year.
 - (B) [Reserved]
- (2) Impulsive Source Detonations During Training and Testing:
 - (i) Explosive Classes:
 - (A) E1 (0.1 to 0.25 lb NEW) – an average of 10,140 detonations per year.
 - (B) E2 (0.26 to 0.5 lb NEW) – an average of 106 detonations per year.
 - (C) E3 (>0.5 to 2.5 lb NEW) – an average of 932 detonations per year.
 - (D) E4 (>2.5 to 5 lb NEW) – an average of 420 detonations per year.

- (E) E5 (>5 to 10 lb NEW) – an average of 684 detonations per year.
- (F) E6 (>10 to 20 lb NEW) – an average of 76 detonations per year.
- (G) E8 (>60 to 100 lb NEW) – an average of 16 detonations per year.
- (H) E9 (>100 to 250 lb NEW) – an average of 4 detonations per year.
- (I) E10 (>250 to 500 lb NEW) – an average of 12 detonations per year.
- (J) E11 (>500 to 650 lb NEW) – an average of 6 detonations per year.
- (K) E12 (>650 to 2,000 lb NEW) – an average of 184 detonations per year.
- (ii) [Reserved]

§ 218.91 Effective dates and definitions.

- (a) Regulations in this subpart are effective August 3, 2015 through August 3, 2020.
- (b) The following definitions are utilized in these regulations:
 - (1) *Uncommon Stranding Event (USE)* – A stranding event that takes place within an OPAREA where a Major Training Exercise (MTE) occurs and involves any one of the following:
 - (i) Two or more individuals of any cetacean species (not including mother/calf pairs, unless of species of concern listed in paragraph (b)(1)(ii) of this section) found dead or live on shore within a 2-day period and occurring within 30 miles of one another.
 - (ii) A single individual or mother/calf pair of any of the following marine mammal species of concern: beaked whale of any species, *Kogia* spp., Risso’s dolphin, melon-headed whale, pilot whale, humpback whale, sperm whale, blue whale, fin whale, or sei whale.
 - (iii) A group of two or more cetaceans of any species exhibiting indicators of distress.
 - (2) *Shutdown* – The cessation of active sonar operation or detonation of explosives within 14 nautical miles of any live, in the water, animal involved in a USE.

§ 218.92 Permissible methods of taking.

(a) Under a Letter of Authorization (LOA) issued pursuant to § 218.97, the Holder of the Letter of Authorization may incidentally, but not intentionally, take marine mammals within the area described in § 218.90, provided the activity is in compliance with all terms, conditions, and requirements of these regulations and the appropriate LOA.

(b) The activities identified in § 218.90(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 § 218.90(c) is limited to the following species, by the identified method of take:

(1) Level B Harassment for all Training and Testing Activities:

(i) Mysticetes:

(A) Blue whale (*Balaenoptera musculus*) – 140 (an average of 28 annually)

(B) Bryde's whale (*Balaenoptera edeni*) – 1,990 (an average of 398 annually)

(C) Fin whale (*Balaenoptera physalus*) - 140 (an average of 28 annually)

(D) Humpback whale (*Megaptera novaeangliae*) – 4,300 (an average of 860 annually)

(E) Minke whale (*Balaenoptera acutorostrata*) – 505 (an average of 101 annually)

(F) Sei whale (*Balaenoptera borealis*) – 1,595 (an average of 319 annually)

(G) Omura's whale (*Balaenoptera omurai*) - 515 (an average of 103 annually)

(ii) Odontocetes:

(A) Blainville's beaked whale (*Mesoplodon densirostris*) – 22,130 (an average of 4,426 annually)

(B) Bottlenose dolphin (*Tursiops truncatus*) – 3,705 (an average of 741 annually)

- (C) Cuvier's beaked whale (*Ziphius cavirostris*) – 112,705 (an average of 22,541 annually)
- (D) Dwarf sperm whale (*Kogia sima*) – 71,085 (an average of 14,217 annually)
- (E) False killer whale (*Pseudorca crassidens*) – 2,775 (an average of 555 annually)
- (F) Fraser's dolphin (*Lagenodelphis hosei*) – 12,860 (an average of 2,572 annually)
- (G) Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*) – 19,485 (an average of 3,897 annually)
- (H) Killer whale (*Orcinus orca*) – 420 (an average of 84 annually)
- (I) Longman's beaked whale (*Indopacetus pacificus*) – 9,620 (an average of 1,924 annually)
- (J) Melon-headed whale (*Peponocephala electra*) – 10,425 (an average of 2,085 annually)
- (K) Pantropical spotted dolphin (*Stenella attenuata*) – 64,055 (an average of 12,811 annually)
- (L) Pygmy killer whale (*Feresa attenuata*) – 525 (an average of 105 annually)
- (M) Pygmy sperm whale (*Kogia breviceps*) – 27,895 (an average of 5,579 annually)
- (N) Risso's dolphin (*Grampus griseus*) – 2,525 (an average of 505 annually)
- (O) Rough-toothed dolphin (*Steno bredanensis*) – 9,095 (an average of 1,819 annually)
- (P) Short-finned pilot whale (*Globicephala macrorhynchus*) – 9,075 (an average of 1,815 annually)
- (Q) Sperm whale (*Physeter macrocephalus*) – 2,530 (an average of 506 annually)
- (R) Spinner dolphin (*Stenella longirostris*) – 2,945 (an average of 589 annually)
- (S) Striped dolphin (*Stenella coerulealba*) – 16,490 (an average of 3,298 annually)

(2) Level A Harassment for all Training and Testing Activities:

(i) Odontocetes:

(A) Dwarf sperm whale (*Kogia sima*) – 205 (an average of 41 annually)

(B) Pygmy sperm whale (*Kogia breviceps*) – 75 (an average of 15 annually)

(ii) [Reserved]

§ 218.93 Prohibitions.

Notwithstanding takings contemplated in § 218.92 and authorized by an LOA issued under §§ 216.106 and 218.97 of this chapter, no person in connection with the activities described in § 218.90 may:

(a) Take any marine mammal not specified in § 218.92(c);

(b) Take any marine mammal specified in § 218.92(c) other than by incidental take as specified in § 218.92(c);

(c) Take a marine mammal specified in § 218.92(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 an LOA issued under §§ 216.106 and 218.97.

§ 218.94 Mitigation.

(a) When conducting training and testing activities, as identified in § 218.90, the mitigation measures contained in the LOA issued under §§ 216.106 and 218.97 of this chapter must be implemented. These mitigation measures include, but are not limited to:

(1) *Lookouts*. The following are protective measures concerning the use of lookouts.

(i) Lookouts positioned on surface ships will be dedicated solely to diligent observation of the air and surface of the water. Their observation objectives will include, but are not limited

to, detecting the presence of biological resources and recreational or fishing boats, observing mitigation zones, and monitoring for vessel and personnel safety concerns.

(ii) Lookouts positioned in aircraft or on boats will, to the maximum extent practicable and consistent with aircraft and boat safety and training and testing requirements, comply with the observation objectives described in paragraph (a)(1)(i) of this section.

(iii) Lookout measures for non-impulse sound:

(A) With the exception of vessels less than 65 ft (20 m) in length and ships that are minimally manned, ships using low-frequency or hull-mounted mid-frequency active sonar sources associated with anti-submarine warfare and mine warfare activities at sea will have two lookouts at the forward position. For the purposes of this rule, low-frequency active sonar does not include surface towed array surveillance system low-frequency active sonar.

(B) While using low-frequency or hull-mounted mid-frequency active sonar sources associated with anti-submarine warfare and mine warfare activities at sea, ships less than 65 ft (20 m) in length and ships that are minimally manned will have one lookout at the forward position of the vessel due to space and manning restrictions.

(C) Ships conducting active sonar activities while moored or at anchor (including pierside testing or maintenance) will maintain one lookout.

(D) Surface ships or aircraft conducting high-frequency or non-hull mounted mid-frequency active sonar activities associated with anti-submarine warfare and mine warfare activities at sea will have one lookout.

(iv) Lookout measures for explosives and impulse sound:

(A) Aircraft conducting IEER sonobuoy activities and explosive sonobuoy exercises will have one lookout.

(B) Surface vessels conducting anti-swimmer grenade activities will have one lookout.

(C) During general mine countermeasure and neutralization activities using up to a 20-lb net explosive weight detonation (bin E6 and below), vessels greater than 200 ft (61 m) will have two lookouts, while vessels less than 200 ft (61 m) or aircraft will have one lookout.

(D) Mine neutralization activities involving positive control diver-placed charges using up to a 20-lb net explosive weight detonation will have two lookouts. The divers placing the charges on mines will report all marine mammal sightings to their supporting small boat or Range Safety Officer.

(E) When mine neutralization activities using diver-placed charges with up to a 20-lb net explosive weight detonation are conducted with a time-delay firing device, four lookouts will be used. Two lookouts will be positioned in each of two small rigid hull inflatable boats. When aircraft are used, the pilot or member of the aircrew will serve as an additional lookout. The divers placing the charges on mines will report all marine mammal sightings to their supporting small boat or Range Safety Officer.

(F) Surface vessels or aircraft conducting small- or medium-caliber gunnery exercises against a surface target will have one lookout.

(G) Aircraft conducting missile exercises (including rockets) against surface targets will have one lookout.

(H) Aircraft conducting bombing exercises will have one lookout.

(I) During explosive torpedo testing, one lookout will be used and positioned in an aircraft.

(J) During sinking exercises, two lookouts will be used. One lookout will be positioned in an aircraft and one on a surface vessel.

(K) Surface vessels conducting explosive and non-explosive large-caliber gunnery exercises will have one lookout.

(v) Lookout measures for physical strike and disturbance:

(A) While underway, surface ships will have at least one lookout.

(B) During activities using towed in-water devices, that are towed from a manned platform, one lookout will be used.

(C) Non-explosive small-, medium-, and large-caliber gunnery exercises using a surface target will have one lookout.

(D) Non-explosive bombing exercises will have one lookout.

(2) *Mitigation zones*. The following are protective measures concerning the implementation of mitigation zones.

(i) Mitigation zones will be measured as the radius from a source and represent a distance to be monitored.

(ii) Visual detections of marine mammals within a mitigation zone will be communicated immediately to a watch station for information dissemination and appropriate action.

(iii) Mitigation zones for non-impulse sound:

(A) When marine mammals are visually detected, the Navy shall ensure that low-frequency and hull-mounted mid-frequency active sonar transmission levels are limited to at least 6 dB below normal operating levels (for sources that can be powered down during the activity) if any visually detected marine mammals are within 1,000 yd (914 m) of the source (i.e., the bow).

(B) The Navy shall ensure that low-frequency and hull-mounted mid-frequency active sonar transmissions are limited to at least 10 dB below the equipment's normal operating level

(for sources that can be powered down during the activity) if any detected marine mammals are sighted within 500 yd (457 m) of the source.

(C) The Navy shall ensure that low-frequency and hull-mounted mid-frequency active sonar transmissions (for sources that can be turned off during the activity) are ceased if any visually detected marine mammals are within 200 yd (183 m) of the sonar dome. Active transmission will recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone; the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source; the mitigation zone has been clear from any additional sightings for a period of 30 minutes; the ship has transited more than 2,000 yd. (1.8 kilometers [km]) beyond the location of the last sighting; or the ship concludes that dolphins are deliberately closing in on the ship to ride the ship's bow wave (and there are no other marine mammal sightings within the mitigation zone).

(D) If the source is not able to be powered down during the activity (e.g., low-frequency sources within bins LF4 and LF5), mitigation will involve ceasing active transmission if a marine mammal is sighted within 200 yd. (183 m). Active transmission will recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone; the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source; the mitigation zone has been clear from any additional sightings for a period of 30 minutes; or the ship has transited more than 400 yd. (366 m) beyond the location of the last sighting.

(E) With the exception of activities involving platforms operating at high altitudes, when marine mammals are visually detected, the Navy shall ensure that high-frequency and non-hull-

mounted mid-frequency active sonar transmission (for sources that can be turned off during the activity) is ceased if any visually detected marine mammals are within 200 yd (183 m) of the source. Active transmission will recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, the mitigation zone has been clear from any additional sightings for a period of 10 minutes for an aircraft-deployed source, the mitigation zone has been clear from any additional sightings for a period of 30 minutes for a vessel-deployed source, the vessel or aircraft has repositioned itself more than 400 yd. (366 m) away from the location of the last sighting, or the vessel concludes that dolphins are deliberately closing in to ride the vessel's bow wave (and there are no other marine mammal sightings within the mitigation zone).

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

(G) Generally, the Navy shall operate sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives.

(iv) Mitigation zones for explosive and impulse sound:

(A)(I) A mitigation zone with a radius of 600 yd (549 m) shall be established for IEER sonobuoys (bin E4). Mitigation would include pre-exercise aerial observation and passive acoustic monitoring, which would begin 30 minutes before the first source/receiver pair detonation and continue throughout the duration of the exercise. The pre-exercise aerial observation would include the time it takes to deploy the sonobuoy pattern (deployment is conducted by aircraft dropping sonobuoys in the water). Explosive detonations would cease if a marine mammal is sighted within the mitigation zone. Detonations would recommence if any

one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, or the mitigation zone has been clear from any additional sightings for a period of 30 minutes.

(2) Passive acoustic monitoring would be conducted with Navy assets, such as sonobuoys, already participating in the activity. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to lookouts posted in aircraft and on vessels in order to increase vigilance of their visual observation.

(B)(I) A mitigation zone with a radius of 350 yd (320 m) shall be established for explosive sonobuoys using 0.5-2.5 lb net explosive weight (bin E3). Mitigation would include pre-exercise aerial monitoring during deployment of the field of sonobuoy pairs (typically up to 20 minutes) and continuing throughout the duration of the exercise within a mitigation zone of 350 yd (320 m) around an explosive sonobuoy. Explosive detonations would cease if a marine mammal is sighted within the mitigation zone. Detonations would recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, or the mitigation zone has been clear from any additional sightings for a period of 10 minutes.

(2) Passive acoustic monitoring would also be conducted with Navy assets, such as sonobuoys, already participating in the activity. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic

detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to lookouts posted in aircraft in order to increase vigilance of their visual observation.

(C) A mitigation zone with a radius of 200 yd (183 m) shall be established for anti-swimmer grenades (bin E2). Mitigation would include visual observation from a small boat immediately before and during the exercise within a mitigation zone of 200 yd (183 m) around an anti-swimmer grenade. Explosive detonations would cease if a marine mammal is sighted within the mitigation zone. Detonations would recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, the mitigation zone has been clear from any additional sightings for a period of 30 minutes, or the activity has been repositioned more than 400 yd (366 m) away from the location of the last sighting.

(D) A mitigation zone ranging from 350 yd (320 m) to 800 yd (732 m), dependent on charge size and if the activity involves the use of diver-placed charges, shall be established for mine countermeasure and neutralization activities using positive control firing devices.

Mitigation zone distances are specified for charge size in the following table. .

Charge Size	General Mine Countermeasure and				Mine Countermeasure and Neutralization			
Net Explosive Weight (Bins)	Neutralization Activities Using Positive Control Firing Devices ¹				Activities Using Diver Placed Charges under Positive Control ²			
	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone
2.5–5 lb. (1.2-2.3 kg) (E4)	434 yd.	197 yd.	563 yd.	600 yd.	545 yd.	169 yd.	301 yd.	350 yd.
	(474 m)	(180 m)	(515 m)	(549 m)	(498 m)	(155 m)	(275 m)	(320 m)
5–10 lb. (2.7-4.5 kg)	525 yd.	204 yd.	649 yd.	800 yd.	587 yd.	203 yd.	464 yd.	500 yd.

(E5)	(480 m)	(187 m)	(593 m)	(732 m)	(537 m)	(185 m)	(424 m)	(457 m)
>10–20 lb. (5-9.1 kg) (E6)	766 yd.	288 yd.	648 yd.	800 yd.	647 yd.	232 yd.	469 yd.	500 yd.
	(700 m)	(263 m)	(593 m)	(732 m)	(592 m)	(212 m)	(429 m)	(457 m)
PTS: permanent threshold shift; TTS: temporary threshold shift ¹ These mitigation zones are applicable to all mine countermeasure and neutralization activities conducted in all locations specified in Chapter 2 of the Navy's LOA application. ² These mitigation zones are only applicable to mine countermeasure and neutralization activities involving the use of diver placed charges. These activities are conducted in shallow-water and the mitigation zones are based only on the functional hearing groups with species that occur in these areas (mid-frequency cetaceans and sea turtles).								

(1) During general mine countermeasure and neutralization activities, mitigation would include visual observation from one or more small boats or aircraft beginning 30 minutes before, during, and 30 minutes after (when helicopters are not involved in the activity) or 10 minutes before, during, and 10 minutes after (when helicopters are involved in the activity) the completion of the exercise within the mitigation zones around the detonation site.

(2) For activities involving diver-placed charges, visual observation would be conducted by either two small boats, or one small boat in combination with one helicopter. Boats would position themselves near the mid-point of the mitigation zone radius (but always outside the detonation plume radius and human safety zone) and travel in a circular pattern around the detonation location. When using two boats, each boat would be positioned on opposite sides of the detonation location, separated by 180 degrees. If used, helicopters would travel in a circular pattern around the detonation location.

(3) For both general and diver-placed positive control mine countermeasure and neutralization activities, explosive detonations will cease if a marine mammal is sighted within the mitigation zone. Detonations will recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the

mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, the mitigation zone has been clear from any additional sightings for a period of 30 minutes, when helicopters are not involved in the activity or the mitigation zone has been clear from any additional sightings for a period of 10 minutes when helicopters are involved in the activity.

(E) A mitigation zone with a radius of 1,000 yd (914 m) shall be established for mine countermeasure and neutralization activities using diver-placed time-delay firing devices (bin E6). Mine neutralization activities involving diver-placed charges would not include time-delay longer than 10 minutes. Mitigation would include visual observation from small boats or aircraft commencing 30 minutes before, during, and until 30 minutes after the completion of the exercise within a mitigation zone of 1,000 yd (914 m) around the detonation site. During activities using time-delay firing devices involving up to a 20 lb net explosive weight charge, visual observation will take place using two small boats. Fuse initiation would recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, or the mitigation zone has been clear from any additional sightings for a period of 30 minutes.

(I) Survey boats would position themselves near the mid-point of the mitigation zone radius (but always outside the detonation plume radius/human safety zone) and travel in a circular pattern around the detonation location. One lookout from each boat would look inward toward the detonation site and the other lookout would look outward away from the detonation site. When using two small boats, each boat would be positioned on opposite sides of the

detonation location, separated by 180 degrees. If available for use, helicopters would travel in a circular pattern around the detonation location.

(2) [Reserved]

(F) A mitigation zone with a radius of 200 yd (183 m) shall be established for small- and medium-caliber gunnery exercises with a surface target (bin E2). Mitigation would include visual observation from a vessel or aircraft immediately before and during the exercise within a mitigation zone of 200 yd (183 m) around the intended impact location. Vessels would observe the mitigation zone from the firing position. When aircraft are firing, the aircrew would maintain visual watch of the mitigation zone during the activity. Firing would cease if a marine mammal is sighted within the mitigation zone. Firing would recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, the mitigation zone has been clear from any additional sightings for a period of 10 minutes for a firing aircraft, the mitigation zone has been clear from any additional sightings for a period of 30 minutes for a firing vessel, or the intended target location has been repositioned more than 400 yd (366 m) away from the location of the last sighting.

(G) A mitigation zone with a radius of 600 yd (549 m) shall be established for large-caliber gunnery exercises with a surface target (bin E5). Mitigation would include visual observation from a ship immediately before and during the exercise within a mitigation zone of 600 yd (549 m) around the intended impact location. Ships would observe the mitigation zone from the firing position. Firing would cease if a marine mammal is sighted within the mitigation zone. Firing would recommence if any one of the following conditions is met: the animal is

observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, or the mitigation zone has been clear from any additional sightings for a period of 30 minutes.

(H) A mitigation zone with a radius of 900 yd (823 m) around the deployed target shall be established for missile exercises involving aircraft firing up to 250 lb net explosive weight using and a surface target (bin E9). When aircraft are firing, mitigation would include visual observation by the aircrew or supporting aircraft prior to commencement of the activity within a mitigation zone of 900 yd (823 m) around the deployed target. Firing would recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, or the mitigation zone has been clear from any additional sightings for a period of 10 minutes or 30 minutes (depending on aircraft type).

(I) A mitigation zone with a radius of 2,000 yd (1.8 km) shall be established for missile exercises involving aircraft firing >250 to 500 lb net explosive weight using and a surface target (bin E10). When aircraft are firing, mitigation would include visual observation by the aircrew prior to commencement of the activity within a mitigation zone of 2,000 yd (1.8 km) around the intended impact location. Firing would cease if a marine mammal is sighted within the mitigation zone. Firing would recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, or the mitigation zone has been clear from any additional sightings for a period of 10 minutes or 30 minutes (depending on aircraft type).

(J) A mitigation zone with a radius of 2,500 yd (2.3 km) shall be established for bombing exercises (bin E12). Mitigation would include visual observation from the aircraft immediately before the exercise and during target approach within a mitigation zone of 2,500 yd (2.3 km) around the intended impact location. Bombing would cease if a marine mammal is sighted within the mitigation zone. Bombing would recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, or the mitigation zone has been clear from any additional sightings for a period of 10 minutes.

(K)(I) A mitigation zone with a radius of 2,100 yd (1.9 km) shall be established for torpedo (explosive) testing (except for aircraft operating at high altitudes) (bin E11). Mitigation would include visual observation by aircraft immediately before, during, and after the exercise within a mitigation zone of 2,100 yd (1.9 km) around the intended impact location. Firing would cease if a marine mammal is sighted within the mitigation zone. Firing would recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, or the mitigation zone has been clear from any additional sightings for a period of 10 minutes or 30 minutes (depending on aircraft type).

(2) In addition to visual observation, passive acoustic monitoring would be conducted with Navy assets, such as passive ships sonar systems or sonobuoys, already participating in the activity. Passive acoustic observation would be accomplished through the use of remote acoustic sensors or expendable sonobuoys, or via passive acoustic sensors on submarines when they participate in the proposed action. These assets would only detect vocalizing marine mammals

within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to the lookout posted in the aircraft in order to increase vigilance of the visual observation and to the person in control of the activity for their consideration in determining when the mitigation zone is free of visible marine mammals.

(L) A mitigation zone with a radius of 2.5 nautical miles around the target ship hulk shall be established for sinking exercises (bin E12). Mitigation would include aerial observation beginning 90 minutes before the first firing, visual observations from vessels throughout the duration of the exercise, and both aerial and vessel observation immediately after any planned or unplanned breaks in weapons firing of longer than 2 hours. Prior to conducting the exercise, the Navy would review remotely sensed sea surface temperature and sea surface height maps to aid in deciding where to release the target ship hulk.

(I) The Navy would also monitor using passive acoustics during the exercise. Passive acoustic monitoring would be conducted with Navy assets, such as passive ships sonar systems or sonobuoys, already participating in the activity. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to lookouts posted in aircraft and on vessels in order to increase vigilance of their visual observation. Lookouts will also increase observation vigilance before the use of torpedoes or unguided ordnance with a net explosive weight of 500 lb or greater, or if the Beaufort sea state is a 4 or above.

(2) The exercise would cease if a marine mammal is sighted within the mitigation zone. The exercise would recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, or the mitigation zone has been clear from any additional sightings for a period of 30 minutes. Upon sinking the vessel, the Navy would conduct post-exercise visual observation of the mitigation zone for 2 hours (or until sunset, whichever comes first).

(M) A mitigation zone with a radius of 70 yd (64 m) within 30 degrees on either side of the gun target line on the firing side of the vessel for explosive and non-explosive large-caliber gunnery exercises conducted from a ship. Firing would cease if a marine mammal is sighted within the mitigation zone. Firing would recommence if any one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, the mitigation zone has been clear from any additional sightings for a period of 30 minutes, or the vessel has repositioned itself more than 140 yd (128 m) away from the location of the last sighting.

(v) Mitigation zones for vessels and in-water devices:

(A) A mitigation zone of 500 yd (457 m) for observed whales and 200 yd (183 m) for all other marine mammals (except bow riding dolphins) shall be established for all vessel movement, providing it is safe to do so.

(B) A mitigation zone of 250 yd (229 m) shall be established for all towed in-water devices that are towed from a manned platform, providing it is safe to do so.

(vi) Mitigation zones for non-explosive practice munitions:

(A) A mitigation zone of 200 yd (183 m) shall be established for non-explosive small-, medium-, and large-caliber gunnery exercises using a surface target. Mitigation would include visual observation immediately before and during the exercise within a mitigation zone of 200 m around the intended impact location. Firing would cease if a marine mammal is visually detected within the mitigation zone. Firing would recommence if any one of the following conditions are met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, the mitigation zone has been clear from any additional sightings for a period of 10 minutes for a firing aircraft, the mitigation zone has been clear from any additional sightings for a period of 30 minutes for a firing vessel, or the intended target location has been repositioned more than 400 yd (366 m) away from the location of the last sighting and the animal's estimated course direction.

(B) A mitigation zone of 1,000 yd (914 m) shall be established for non-explosive bombing exercises. Mitigation would include visual observation from the aircraft immediately before the exercise and during target approach within a mitigation zone of 1000 yd (914 m) around the intended impact location. Bombing would cease if a marine mammal is visually detected within the mitigation zone. Bombing would recommence if any one of the following conditions are met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on its course and speed and the relative motion between the animal and the source, or the mitigation zone has been clear from any additional sightings for a period of 10 minutes.

(3) Stranding Response Plan:

(i) The Navy shall abide by the letter of the “Stranding Response Plan for Major Navy Training Exercises in the MITT Study Area,” to include the following measures:

(A) Shutdown Procedures – When an Uncommon Stranding Event (USE - defined in § 218.91) occurs during a Major Training Exercise (MTE) in the MITT Study Area, the Navy shall implement the procedures described below.

(1) The Navy shall implement a shutdown (as defined § 218.91) when advised by a NMFS Office of Protected Resources Headquarters Senior Official designated in the MITT Study Area 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 the Navy will maintain a dialogue, 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 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 behavior (if alive), and photo or video (if available). Based on the information provided, NFMS will determine if, and advise the Navy whether a modified shutdown is appropriate on a case-by-case basis.

(4) In the event, following a USE, that qualified individuals are attempting to herd animals back out to the open ocean and animals are not willing to leave, or animals are seen

repeatedly heading for the open ocean but turning back to shore, NMFS and the Navy shall coordinate (including an investigation of other potential anthropogenic stressors in the area) to determine if the proximity of mid-frequency active sonar training activities or explosive detonations, though farther than 14 nautical miles from the distressed animal(s), is likely contributing to the animals' refusal to return to the open water. If so, NMFS and the Navy will further coordinate to determine what measures are necessary to improve the probability that the animals will return to open water and implement those measures as appropriate.

(5) Within 72 hours of NMFS notifying the Navy of the presence of a USE, the Navy shall provide available information to NMFS (per the MITT Study Area Communication Protocol) regarding the location, number and types of acoustic/explosive sources, direction and speed of units using mid-frequency active sonar, and marine mammal sightings information associated with training activities occurring within 80 nautical miles (148 km) and 72 hours prior to the USE event. Information not initially available regarding the 80-nautical miles (148-km), 72-hour period prior to the event will be provided as soon as it becomes available. The Navy will provide NMFS investigative teams with additional relevant unclassified information as requested, if available.

(b) [Reserved]

§ 218.95 Requirements for monitoring and reporting.

(a) As outlined in the MITT Study Area Stranding Communication Plan, the Holder of the Authorization must notify NMFS immediately (or as soon as operational security considerations allow) if the specified activity identified in § 218.90 is thought to have resulted in the mortality or injury of any marine mammals, or in any take of marine mammals not identified in § 218.91.

(b) The Holder of the LOA must conduct all monitoring and required reporting under the LOA, including abiding by the MITT Monitoring Project Description.

(c) General notification of injured or dead marine mammals. Navy personnel shall ensure that NMFS (regional stranding coordinator) is notified immediately (or as soon as operational security considerations allow) if an injured or dead marine mammal is found during or shortly after, and in the vicinity of, an Navy training or testing activity utilizing mid- or high-frequency active sonar, or underwater explosive detonations. 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 is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available). The Navy shall consult the Stranding Response Plan to obtain more specific reporting requirements for specific circumstances.

(d) Vessel strike. In the event that a Navy vessel strikes a whale, the Navy shall do the following:

(1) Immediately report to NMFS (pursuant to the established Communication Protocol)

the:

(i) Species identification if known;

(ii) Location (latitude/longitude) of the animal (or location of the strike if the animal has disappeared);

(iii) Whether the animal is alive or dead (or unknown); and

(iv) The time of the strike.

(2) As soon as feasible, the Navy shall report to or provide to NMFS, the:

(i) Size, length, and description (critical if species is not known) of animal;

(ii) An estimate of the injury status (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared, etc.);

(iii) Description of the behavior of the whale during event, immediately after the strike, and following the strike (until the report is made or the animal is no long sighted);

(iv) Vessel class/type and operation status;

(v) Vessel length

(vi) Vessel speed and heading; and

(vii) To the best extent possible, obtain

(3) Within 2 weeks of the strike, provide NMFS:

(i) A detailed description of the specific actions of the vessel in the 30-minute timeframe immediately preceding the strike, during the event, and immediately after the strike (e.g., the speed and changes in speed, the direction and changes in the direction, other maneuvers, sonar use, etc., if not classified); and

(ii) A narrative description of marine mammal sightings during the event and immediately after, and any information as to sightings prior to the strike, if available; and

(iii) Use established Navy shipboard procedures to make a camera available to attempt to capture photographs following a ship strike.

(e) Annual MITT monitoring program report. (1) The Navy shall submit an annual report describing the implementation and results of the MITT Monitoring Program, described in § 218.95. Data standards will be consistent to the extent appropriate across range complexes and study areas to allow for comparison in different geographic locations. Although additional information will be gathered, the protected species observers collecting marine mammal data

pursuant to the MITT Monitoring Program shall, at a minimum, provide the same marine mammal observation data required in this section.

(2) As an alternative, the Navy may submit a multi-range complex annual monitoring plan report to fulfill this requirement. Such a report would describe progress of knowledge made with respect to monitoring plan study questions across multiple Navy ranges associated with the ICMP. Similar study questions shall be treated together so that progress on each topic shall be summarized across all Navy ranges. The report need not include analyses and content that does not provide direct assessment of cumulative progress on the monitoring plan study questions. The report shall be submitted either 90 days after the calendar year, or 90 days after the conclusion of the monitoring year date to be determined by the Adaptive Management process.

(f) Sonar exercise notification. The Navy shall submit to NMFS (specific contact information to be provided in the LOA) either an electronic (preferably) or verbal report within 15 calendar days after the completion of any major exercise indicating:

- (1) Location of the exercise.
- (2) Beginning and end dates of the exercise.
- (3) Type of exercise.

(g) Annual MITT exercise and testing report. The Navy shall submit preliminary reports detailing the status of authorized sound sources within 21 days after the anniversary of the date of issuance of the LOA. The Navy shall submit a detailed report 3 months after the anniversary of the date of issuance of the LOA. The detailed annual report shall contain information on Major Training Exercises (MTE), Sinking Exercise (SINKEX) events, and a summary of sound sources used, as described below. The analysis in the detailed report will be based on the

accumulation of data from the current year's report and data collected from previous reports.

The detailed report shall contain information identified in § 218.95 (e)(1) and (2).

(1) Major Training Exercises/SINKEX:

(i) This section shall contain the reporting requirements for Coordinated and Strike Group exercises and SINKEX. Coordinated and Strike Group Major Training Exercises include:

(A) Joint Multi-Strike Group Exercise (Valiant Shield).

(B) Joint Expeditionary Exercise

(ii) Exercise information for each MTE:

(A) Exercise designator.

(B) Date that exercise began and ended.

(C) Location (operating area).

(D) Number of items or hours (per the LOA) of each sound source bin (impulsive and non-impulsive) used in the exercise.

(E) Number and types of vessels, aircraft, etc., participating in exercise.

(F) Individual marine mammal sighting info for each sighting during each MTE:

(1) Date/time/location of sighting.

(2) Species (if not possible, indication of whale/dolphin).

(3) Number of individuals.

(4) Initial detection sensor.

(5) Indication of specific type of platform the observation was made from (including, for example, what type of surface vessel or testing platform).

(6) Length of time observers maintained visual contact with marine mammal(s).

(7) Sea state.

(8) Visibility.

(9) Sound source in use at the time of sighting.

(10) Indication of whether animal is <200 yd, 200 to 500 yd, 500 to 1,000 yd, 1,000 to 2,000 yd, or >2,000 yd from sound source.

(11) Mitigation Implementation – Whether operation of sonar sensor was delayed, or sonar was powered or shut down, and how long the delay was; or whether navigation was changed or delayed.

(12) If source in use is a hull-mounted sonar, relative bearing of animal from ship, and estimation of animal's motion relative to ship (opening, closing, parallel).

(13) Observed behavior – Watchstanders shall report, in plain language and without trying to categorize in any way, the observed behavior of the animal(s) (such as animal closing to bow ride, paralleling course/speed, floating on surface and not swimming, etc.) and if any calves present.

(iii) An evaluation (based on data gathered during all of the MTEs) of the effectiveness of mitigation measures designed to minimize the received level to which marine mammals may be exposed. This evaluation shall identify the specific observations that support any conclusions the Navy reaches about the effectiveness of the mitigation.

(iv) Exercise information for each SINKEX:

(A) List of the vessels and aircraft involved in the SINKEX.

(B) Location (operating area).

(C) Chronological list of events with times, including time of sunrise and sunset, start and stop time of all marine species surveys that occur before, during, and after the SINKEX, and ordnance used.

(D) Visibility and/or weather conditions, wind speed, cloud cover, etc. throughout exercise if it changes.

(E) Aircraft used in the surveys, flight altitude, and flight speed and the area covered by each of the surveys, given in coordinates, map, or square miles.

(F) Passive acoustic monitoring details (number of sonobuoys, area, detections of biologic activity, etc.).

(G) Individual marine mammal sighting info for each sighting that required mitigation to be implemented:

(1) Date/time/location of sighting.

(2) Species (if not possible, indication of whale/dolphin).

(3) Number of individuals.

(4) Initial detection sensor.

(5) Indication of specific type of platform the observation was made from (including, for example, what type of surface vessel or platform).

(6) Length of time observers maintained visual contact with marine mammal(s).

(7) Sea state.

(8) Visibility.

(9) Indication of whether animal is <200 yd, 200-500 yd, 500-1,000 yd, 1,000-2,000 yd, or >2,000 yd from the target.

(10) Mitigation implementation – Whether the SINKEX was stopped or delayed and length of delay.

(11) Observed behavior – Watchstanders shall report, in plain language and without trying to categorize in any way, the observed behavior of the animals (such as animal closing to

bow ride, paralleling course/speed, floating on surface and not swimming, etc.), and if any calves present.

(H) List of the ordnance used throughout the SINKEX and net explosive weight (NEW) of each weapon and the combined NEW.

(2) Summary of sources used. (i) This section shall include the following information summarized from the authorized sound sources used in all training and testing events:

(A) Total annual or quantity (per the LOA) of each bin of sonar or other non-impulsive source;

(B) Total annual expended/detonated rounds (missiles, bombs, etc.) for each explosive bin; and

(C) Improved Extended Echo-Ranging System (IEER)/sonobuoy summary, including:

(1) Total expended/detonated rounds (buoys).

(2) Total number of self-scuttled IEER rounds.

(3) Geographic information presentation. The reports shall present an annual (and seasonal, where practical) depiction of training exercises and testing bin usage geographically across the Study Area.

(h) Five-year close-out exercise and testing report.— This report will be included as part of the 2020 annual exercise or testing report. This report will provide the annual totals for each sound source bin with a comparison to the annual allowance and the 5-year total for each sound source bin with a comparison to the 5-year allowance. Additionally, if there were any changes to the sound source allowance, this report will include a discussion of why the change was made and include the analysis to support how the change did or did not result in a change in the FEIS and final rule determinations. The report will be submitted 3 months after the expiration of the

rule. NMFS will submit comments on the draft close-out report, if any, within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or 3 months after the submittal of the draft if NMFS does not provide comments.

§ 218.96 Applications for Letters of Authorization.

To incidentally take marine mammals pursuant to the regulations in this subpart, the U.S. citizen (as defined by § 216.106 of this chapter) conducting the activity identified in § 218.90(c) (the U.S. Navy) must apply for and obtain either an initial LOA in accordance with § 218.97 or a renewal under § 218.98.

§ 218.97 Letters of Authorization.

(a) An LOA, unless suspended or revoked, will be valid for a period of time not to exceed the period of validity of this subpart.

(b) The LOA will set forth:

(1) Permissible methods and extent 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 of the LOA will 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).

§ 218.98 Renewals and modifications of Letters of Authorization.

(a) A Letter of Authorization issued under §§ 216.106 and 218.97 of this chapter for the activity identified in § 218.90(c) will be renewed or modified upon request of the applicant, provided that:

(1) The proposed specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are within the scope of those described and analyzed for these regulations (excluding changes made pursuant to the adaptive management provision of this chapter), and;

(2) NMFS determines that the mitigation, monitoring, and reporting measures required by the previous LOA under these regulations were implemented.

(b) For LOA modification or renewal requests by the applicant that include changes to the activity or the mitigation, monitoring, or reporting (excluding changes made pursuant to the adaptive management provision of this chapter) that do not change the findings made for the regulations or result in no more than a minor change in the total estimated number of takes (or distribution by species or years). NMFS may publish a notice of proposed LOA in the **Federal Register**, including the associated analysis illustrating the change, and solicit public comment before issuing the LOA.

(c) An LOA issued under §§ 216.106 and 218.97 of this chapter for the activity identified in § 218.94 of this chapter may be modified by NMFS under the following circumstances:

(1) Adaptive management. NMFS may modify (including augmenting, changing, or reducing) the existing mitigation, monitoring, or reporting measures (after consulting with the Navy regarding the practicability of the modifications) if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring.

(i) Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, and reporting measures in an LOA:

(A) Results from Navy's monitoring from the previous year(s);

(B) Results from other marine mammal and/or sound research or studies; or

(C) Any information that reveals marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOA.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, NMFS would publish a notice of proposed LOA in the **Federal Register** and solicit public comment.

(2) Emergencies. If NMFS determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in § 218.92(c), an LOA may be modified without prior notification and an opportunity for public comment. Notification would be published in the **Federal Register** within 30 days of the action.

[FR Doc. 2015-18633 Filed: 7/31/2015 08:45 am; Publication Date: 8/3/2015]