DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

I.D. 062806A

Small Takes of Marine Mammals Incidental to Specified Activities; Rim of the Pacific Antisubmarine Warfare Exercise Training Events Within the Hawaiian Islands Operating Area

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

ACTION: Notice; issuance of IHA.

SUMMARY: In accordance with the provisions of the Marine Mammal Protection Act (MMPA) as amended, notification is hereby given that NMFS has issued an Incidental Harassment Authorization (IHA) to the U.S. Navy (Navy) to take marine mammals, by incidental Level B harassment only, while conducting Rim of the Pacific (RIMPAC) anti-submarine (ASW) training events, in which submarines, surface ships, and aircraft from the United States and multiple foreign nations participate in ASW training exercises, utilizing mid-frequency sonar (1 kilohertz (kHz) to 10 kHz), in the U.S. Navy's Hawaiian Operating Area (OpArea) during July, 2006.

DATES: Effective June 27, 2006, through August 15, 2006.

ADDRESSES: A copy of the IHA and the application are available by writing to Michael Payne, Chief, Permits, Conservation, and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225, or by telephoning the contact listed here. A copy of the application containing a list of references used in this document may be obtained by writing to this address, by telephoning the contact listed here (see **FOR FURTHER INFORMATION CONTACT**) or online at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*. Documents cited in this notice may be viewed, by appointment, during regular business hours, at the aforementioned address.

FOR FURTHER INFORMATION CONTACT: Donna Wieting, Office of Protected Resources, NMFS, (301) 713–2289.

SUPPLEMENTARY INFORMATION:

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 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 shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and that 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.''

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. The National Defense Authorization Act of 2004 (NDAA) (Public Law 108–136) removed the ''small numbers'' limitation and amended the definition of ''harassment'' as it applies to a ''military readiness activity'' to read as follows:

> (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]

Section 101(a)(5)(D) establishes a 45-day time limit for NMFS review of an application followed by a 30-day public notice and comment period on any proposed authorizations for the incidental harassment of marine mammals. Within 45 days of the close of the comment period, NMFS must either issue or deny issuance of the authorization.

Summary of Request

On March 16, 2006, NMFS received an application from the Navy for the taking, by harassment, of several species of marine mammals incidental to conducting RIMPAC ASW training events, in which submarines, surface ships, and aircraft from the United States and multiple foreign nations participate in ASW training exercises, in the OpArea, in the summer of 2006. The RIMPAC ASW exercises are considered a military readiness activity.

NMFS may not authorize the take of marine mammals by non-U.S. citizens; however, all foreign vessels participating in RIMPAC 2006 will be under the Operational Control (OPCON) of Commander, U.S. THIRD Fleet in his capacity as Officer Conducting the Exercise (OCE) and Commander, Combined Task Force (CCTF) RIMPAC (i.e., the Navy can require that a foreign vessel cease sonar operations). Additionally, all forces assigned, including foreign vessels, are required to comply with the environmental mitigation measures spelled out in the Navy's Annex L [Environmental], which will include all of the measures in the IHA, as a condition of participating in the exercise. This is part of the description of the activity.

Description of the Activity

RIMPAC 2006 ASW activities are scheduled to take place from June 26, 2006, to about July 28, 2006, with ASW training events planned on 21 days. The OpArea is approximately 210,000 square nautical miles (nm), however, the majority of RIMPAC ASW training would occur in the six areas delineated in Figure 2–1 in the Navy's application (approximate 46,000 square nm). ASW events typically rotate between these six modeled areas. These six areas were used for analysis as being representative of the marine mammal habitats and the bathymetric, seabed, wind speed, and sound velocity profile conditions within the entire OpArea. For purposes of this analysis, all likely RIMPAC ASW events were modeled as occurring in these six areas.

As a combined force during the exercises, submarines, surface ships, and aircraft will conduct ASW against opposition submarine targets. Submarine targets include real submarines, target drones that simulate the operations of an actual submarine, and virtual submarines interjected into the training events by exercise controllers. ASW training events are complex and highly variable. For RIMPAC, the primary event involves a Surface Action Group (SAG), consisting of one to five surface ships equipped with sonar, with one or more helicopters, and a P–3 aircraft searching for one or more submarines. There will be approximately four SAGs for RIMPAC 2006. For the purposes of analysis, each event in which a SAG

participates is counted as an ASW operation. There will be approximately 44 ASW operations during RIMPAC with an average event length of approximately 12 hours.

One or more ASW events may occur simultaneously within the OpArea. Each event was identified and modeled separately. If a break of more than 1 hour in ASW operations occurred, then the subsequent event was modeled as a separate event. Training event durations ranged from 2 hours to 24 hours. A total of 532 training hours were modeled for RIMPAC acoustic exposures. This total includes all potential ASW training that is expected to occur during RIMPAC.

Active Acoustic Sources

Tactical military sonars are designed to search for, detect, localize, classify, and track submarines. There are two types of sonars, passive and active. Passive sonars only listen to incoming sounds and, since they do not emit sound energy in the water, lack the potential to acoustically affect the environment. Active sonars generate and emit acoustic energy specifically for the purpose of obtaining information concerning a distant object from the sound energy reflected back from that object.

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

The tactical military sonars to be deployed in RIMPAC are designed to detect submarines in tactical operational scenarios. This task requires the use of the sonar mid-frequency (MF) range (1 kilohertz [kHz] to 10 kHz) predominantly.

The types of tactical acoustic sources that would be used in training events during RIMPAC are discussed in the following paragraphs. For more information regarding how the Navy's determined which sources should not be included in their analysis, see the Estimates of Take Section later in this document.

Surface Ship Sonars–A variety of surface ships participate in RIMPAC, including guided missile cruisers, destroyers, guided missile destroyers, and frigates. Some ships (e.g., aircraft carriers) do not have any onboard active sonar systems, other than fathometers. Others, like guided missile cruisers, are equipped with active as well as passive sonars for submarine detection and tracking. For purposes of the analysis, all surface ship sonars were modeled as equivalent to SQS–53 having the nominal source level of 235 decibels (dB) re 1mPa^2–s (SEL). Since the SQS–53 hull mounted sonar is the U.S. Navy's most powerful surface ship hull mounted sonar, modeling this source is a conservative assumption tending towards an overestimation of potential effects (although, the conservativeness is offset some by the fact that the Navy did not model for any of the times (though brief and infrequent) that they may use a source level higher than 235 dB). Sonar ping transmission durations were modeled as lasting 1 second per ping and directional with a footprint that was 240 degrees wide, which is a conservative assumption that overestimates potential exposures, since actual ping durations will be less than 1 second. The SQS–53 hull mounted sonar transmits at center frequencies of 2.6 kHz and 3.3 kHz.

Submarine Sonars–Submarine sonars can be used to detect and target enemy submarines and surface ships. However, submarine active sonar use is very rare in the planned RIMPAC exercises, and, when used, very brief. Therefore, use of active sonar by submarines is unlikely to have any effect on marine mammals, and it was not modeled for RIMPAC 2006.

Aircraft Sonar Systems–Aircraft sonar systems that would operate during RIMPAC include sonobuoys and dipping sonar. Sonobuoys may be deployed by P–3 aircraft or helicopters; dipping sonars are used by carrier-based helicopters. A sonobuoy is an expendable device used by aircraft for the detection of underwater acoustic energy and for conducting vertical water column temperature measurements. Most sonobuoys are passive, but some can generate active acoustic signals as well. Dipping sonar is an active or passive sonar device lowered on cable by helicopters to detect or maintain contact with underwater targets. During RIMPAC, these systems active modes are only used briefly for localization of contacts and are not used in primary search capacity. Because active mode dipping sonar use is very brief, it is extremely unlikely its use would have any effect on marine mammals. The AN/AQS 13 (dipping sonar) used by carrier based helicopters was determined in the Environmental Assessment/Overseas Environmental Assessment of the SH–60R Helicopter/ALFS Test Program, October 1999, not to be problematic due to its limited use and very short pulse length. Therefore, the aircraft sonar systems were not modeled for RIMPAC 2006.

Torpedoes–Torpedoes are the primary ASW weapon used by surface ships, aircraft, and submarines. The guidance systems of these weapons can be autonomous or electronically controlled from the launching platform through an attached wire. The autonomous guidance systems are acoustically based. They operate either passively, exploiting the emitted sound energy by the target, or actively, ensonifying the target and using the received echoes for guidance. All torpedoes used for ASW during RIMPAC would be located in the range area managed by Pacific Missile Range Facility (PMRF) and would be non-explosive and recovered after use.

Acoustic Device Countermeasures (ADC)–ADCs are, in effect, submarine simulators that make noise to act as decoys to avert localization and/or torpedo attacks. Previous classified analysis has shown that, based on the operational characteristics (source output level and/or frequency) of these acoustic sources, the potential to affect marine mammals was unlikely, and therefore they were not modeled for RIMPAC 2006.

Training Targets–ASW training targets are used to simulate target submarines. They are equipped with one or a combination of the following devices: (1) acoustic projectors emanating sounds to simulate submarine acoustic signatures; (2) echo repeaters to simulate the characteristics of the echo of a particular sonar signal reflected from a specific type of submarine; and (3) magnetic sources to trigger magnetic detectors. Based on the operational characteristics (source output level and/or frequency) of these acoustic sources, the potential to affect marine mammals is unlikely, and therefore they were not modeled for RIMPAC 2006.

Range Sources–Range pingers are active acoustic devices that allow each of the in-water platforms on the range (e.g., ships, submarines, target simulators, and exercise torpedoes) to be tracked by the range transducer nodes. In addition to passively tracking the pinger signal from each range participant, the range transducer nodes also are capable of transmitting acoustic signals for a limited set of functions. These functions include submarine warning signals, acoustic commands to submarine target simulators (acoustic command link), and occasional voice or

data communications (received by participating ships and submarines on range). Based on the operational characteristics (source output level and/or frequency) of these acoustic sources, the potential to affect marine mammals is unlikely, and therefore they were not modeled for RIMPAC 2006.

For detailed information regarding the proposed activity, please see the Navy's application and the associated Environmental Assessment (EA) (see **ADDRESSES**).

Description of Marine Mammals Potentially Affected by the Activity

There are 27 marine mammal species with possible or confirmed occurrence in the Navy's OpArea (Table 1): 25 cetacean species (whales, dolphins, and porpoises) and 2 pinnipeds (seals). In addition, five species of sea turtles are known to occur in the OpArea.

The most abundant marine mammals are rough-toothed dolphins, dwarf sperm whales, and Fraser's dolphins. The most abundant large whales are sperm whales. There are three seasonally migrating baleen whale species that winter in Hawaiian waters: minke, fin, and humpback whales. Humpback whales utilize Hawaiian waters as a major breeding ground during winter and spring (November through April), but should not be present during the RIMPAC exercise, which takes place in July. Because definitive information on the other two migrating species is lacking, their possible presence during the July timeframe is assumed, although it is considered unlikely. Seven marine mammal species listed as federally endangered under the Endangered Species Act (ESA) occur in the area: the humpback whale, North Pacific right whale, sei whale, fin whale, blue whale, sperm whale, and Hawaiian monk seal.

The Navy has used data compiled from available sighting records, literature, satellite tracking, and stranding and bycatch data to identify the species of marine mammals present in the OpArea. A combination of inshore survey data (within 25 nm (46 km); Mobley *et al.*, 2000) and offshore data (from 25 nm (46 km) offshore out to the U.S. Exclusive Economic Zone (EEZ) (200 nm (370 km) (, Barlow 2003) was used to estimate the density and abundance of marine mammals within the OpArea (Table 1). Additional information regarding the status and distribution of the 27 marine mammal species that occur in the OpArea may be found in the Navy's application and the associated EA (see **ADDRESSES**) and in NMFS' Stock Assessment Reports, which are available at: *http://www.nmfs.noaa.gov/pr/PR2/Stock__Assessment __Program/ individual__sars.html*.

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	Scientific Name	Occurs[1]	Group Size[2]	Overall Abund.	Animals/km2 Offshore	Animals/km2 Inshore	Estimated Takes tts	Estimated Takes sub-tts	Estimated Takes UnID'd	Estimated Takes total
Order Cetacea										
Suborder Mysticeti (baleen whales)										
North Pacific right whale*	*Eubalaena japonica*	Rare			-	-			0	
Humpback whale*	*Megaptera novaeangliae*	Regular			-	-	0	0	0	0
Minke whale	*Balaenoptera acutorostrata*	Rare			-	-	0	0	0	0
Sei whale*	*Balaenoptera borealis*	Rare	3.4	77	0	-	1	27	0	28
Fin whale*	*Balaenoptera physalus*	Rare	2.6	174	0.0001	-	3	61	0	64
Blue whale*	*Balaenoptera musculus*	Rare					0	0	0	0
Bryde's whale	*Balaenoptera edini/brydei**	Regular	1.5	493	0.0002	-	0	96	1	97
Suborder Odontoceti (toothed whales)										
Sperm whale*	*Physeter macrocephalus*	Regular	7.8	7,082	0.0029	0.001	34	1,417	0	1,451
Pygmy sperm whale	*Kogia breviceps*	Regular	1	7,251	0.003	-	14	1,367	1	1,382
Dwarf sperm whale	*Kogia sima*	Regular	2.3	19,172	0.0078	-	48	3,898	1	3,947
Cuvier's beaked whale	*Ziphius cavirostris*	Regular	2	12,728	0.0052	0.0006	29	2,428	61	2,518
Blainville's beaked whale	*Mesoplodon densirostris*	Regular	2.3	2,138	0.0009	0.0009	3	443	11	457
Longman's beaked whale	*Indopacetus pacificus*	Regular	17.8	766	0.0003	-	0	140	5	145
Rough-toothed dolphin	*Steno bredanensis*	Regular	14.8	19,904	0.0081	0.0017	49	3,809	205	4,063
Common bottlenose dolphin	*Tursiops truncatus*	Regular	9.5	3,263	0.0013	0.0103	11	1,137	35	1,183
Pantropical spotted dolphin	*Stenella attenuata*	Regular	60	10,260	0.0042	0.0407	52	4,129	288	4,469
Spinner dolphin	*Stenella longirostris*	Regular	29.5	2,804	0.0011	0.0443	37	2,776	80	2,893
Striped dolphin	*Stenella coeruleoalba*	Regular	37.3	10,385	0.0042	0.0016	26	2,438	292	2,756
Risso's dolphin	*Grampus griseus*	Regular	15.4	2,351	0.001	-	3	443	25	471
Melon-headed whale	*Peponocephala electra*	Regular	89.2	2,947	0.0012	0.0021	4	621	1	626
Fraser's dolphin	*Lagenodelphis hosei*	Rare	286.3	16,836	0.0069	-	41	3,212	174	3,427
Pygmy killer whale	*Feresa attenuata*	Regular	14.4	817	0.0003	-	0	140	1	141
False killer whale	*Pseudorca crassidens*	Regular	10.3	268	0.0001	0.0017	0	137	1	138
Killer whale	*Orcinus orca*	Regular	6.5	430	0.0002	-	0	96	1	97
Short-finned pilot whale	*Globicephala macrorhynchus*	Regular	22.3	8,846	0.0036	0.0237	37	2,938	1	2,976
Order Carnivora										
Suborder Pinnipedia (seals, sea lions, walruses)										
Family Phocidae (true seals)										
Hawaiian monk seal*	*Monachus scauinslandi*	Regular					0	0		0
Northern elephant seal	*Mirounga angustirostris*	Rare								

Table 1. Estimated Abundance and Take of Animals in OpArea During RIMPAC ASW exercises

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Potential Effects on Marine Mammals

NMFS has issued an IHA to the Navy for the take, by harassment, of marine mammals incidental to RIMPAC ASW exercises in the OpArea. Section 101(a)(5)(D) of the MMPA, the section pursuant to which IHAs are issued, may not be used to authorize mortality or serious injury leading to mortality. The Navy's analysis of the RIMPAC ASW exercises concluded that no mortality or serious injury leading to mortality would result from the proposed activities. However, NMFS believes, based on our interpretation of the limited available data bearing on this point, that some marine mammals may react to mid-frequency sonar, at received levels lower than those thought to cause direct physical harm, with behaviors that may, in some circumstances, lead to physiological harm, stranding, or, potentially, death. Therefore, NMFS has required additional mitigation and monitoring measures that were not originally proposed in the Navy's application, which are intended to ensure (in addition to the standard statutory requirement to effect the ''least practicable adverse impact upon the affected species or stock'') that mortality or serious injury leading to mortality does not result from the proposed activities.

Below, NMFS describes the potential effects on marine mammals of exposure to tactical sonar.

Metrics Used in Acoustic Effect Discussions

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

SPL

Sound pressure is the sound force per unit area, and is usually measured in micropascals (mPa), where 1 Pa is the pressure resulting from a force of one newton exerted over an area of one square meter.

The sound levels to which most mammals are sensitive extend over many orders of magnitude and, for this reason, it is convenient to use a logarithmic scale (the decibel (dB) scale) when measuring sound. SPL is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in underwater acoustics is 1 mPa, and the units for SPLs are dB re: 1 mPa.

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

SPL is an instantaneous measurement and can be expressed as the peak, the peak-peak, or the root mean square (rms). Root mean square, which is the square root of the arithmetic average of the squared instantaneous pressure values, is typically used in discussions of the effects of sounds on vertebrates. SPL does not take the duration of a sound into account.

SEL

In this proposed authorization, effect thresholds are expressed in terms of sound exposure level SEL. SEL is an energy metric that integrates the squared instantaneous sound pressure over a stated time interval. The units for SEL are dB re: 1 mPa^2–s.

SEL = SPL + 10log(duration)

As applied to tactical sonar, the SEL includes both the ping SPL and the duration. Longer-duration pings and/or higher-SPL pings will have a higher SEL.

If an animal is exposed to multiple pings, the SEL in each individual ping is summed to calculate the total SEL. Since mammalian threshold shift (TS) data show less effect from intermittent exposures compared to continuous exposures with the same energy (Ward, 1997), basing the effect thresholds on the total received SEL may be a conservative approach for treating multiple pings; as some recovery may occur between pings and lessen the effect of a particular exposure.

The total SEL depends on the SPL, duration, and number of pings received. The acoustic effects on hearing that result in temporary threshold shift (TTS) and permanent threshold shift (PTS), do not imply any specific SPL, duration, or number of pings. The SPL and duration of each received ping are used to calculate the total SEL and determine whether the received SEL meets or exceeds the effect thresholds. For example, the sub-TTS behavioral effects threshold of 173 dB SEL would be reached through any of the following exposures:

A single ping with SPL = 173 dB re 1 mPa and duration = 1 second.A single ping with SPL = 170 dB re 1 mPa and duration = 2 seconds.Two pings with SPL = 170 dB re 1 mPa and duration = 1 second.Two pings with SPL = 167 dB re 1 mPa and duration = 2 seconds.

Potential Physiological Effects

Physiological function is any of a collection of processes ranging from biochemical reactions to mechanical interaction and operation of organs and tissues within an animal. A physiological effect may range from the most significant of impacts (i.e., mortality and serious injury) to lesser effects that would define the lower end of the physiological impact range, such as non-injurious short-term impacts to auditory tissues.

Exposure to some types of noise may cause a variety of physiological effects in mammals. For example, exposure to very high sound levels may affect the function of the visual system, vestibular system, and internal organs (Ward, 1997). Exposure to high-intensity sounds of sufficient duration may cause injury to the lungs and intestines (e.g., Dalecki *et al.*, 2002). Sudden, intense sounds may elicit a ''startle'' response and may be followed by an orienting reflex (Ward, 1997; Jansen, 1998). The primary physiological effects of sound, however, are on the auditory system (Ward, 1997).

Hearing Threshold Shift

In mammals, high-intensity sound may rupture the eardrum, damage the small bones in the middle ear, or over-stimulate the electromechanical hair cells that convert the fluid motions caused by sound into neural impulses that are sent to the brain. Lower level exposures may cause hearing loss, which is called a threshold shift (TS) (Miller, 1974). Incidence of TS may be either permanent, in which case it is called a permanent threshold shift (PTS), or temporary, in which case it is called a temporary threshold shift (TTS). PTS consists of non-recoverable physical damage to the sound receptors in the ear, which can include total or partial deafness, or an impaired ability to hear sounds in specific frequency ranges. TTS is recoverable and is considered to result from temporary, non-injurious impacts to hearing-related tissues. Hearing loss may affect an animal's ability to react normally to the sounds around it.

The amplitude, duration, frequency, and temporal pattern of sound exposure all affect the amount of associated TS. As amplitude and duration of sound exposure increase, so, generally, does the amount of TS. For continuous sounds, exposures of equal energy will lead to approximately equal effects (Ward, 1997). For intermittent sounds, less TS will occur than from a continuous exposure with the same energy (some recovery will occur between exposures) (Kryter *et al.*, 1966; Ward, 1997). Additionally, though TTS is temporary, very prolonged exposure to sound strong enough to elicit TTS, or shorter-term exposure to sound levels well above the TTS threshold, can cause

PTS, at least in terrestrial mammals (Kryter, 1985).

Additional detailed information regarding threshold shifts may be viewed in the Navy's RIMPAC application and in the USWTR DEIS.

Acoustically Mediated Bubble Growth

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

It is unlikely that the short duration of sonar pings would be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis has also been suggested: stable bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. In such a scenario the marine mammal would need to be in a gas-supersaturated state for a long enough period of time for bubbles to become of a problematic size. Yet another hypothesis 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). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. Collectively, these hypotheses can be referred to as ''hypotheses of acoustically mediated bubble growth.''

Although theoretical predictions suggest the possibility for acoustically mediated bubble growth, there is considerable disagreement among scientists as to its likelihood (Piantadosi and Thalmann, 2004; Evans and Miller, 2003). To date, Energy Levels (ELs) predicted to cause *in vivo* bubble formation within diving cetaceans have not been evaluated (NOAA, 2002b). Further, 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. Because evidence supporting the potential for acoustically mediated bubble growth is debatable, this proposed IHA does not give it any special treatment. Additionally, the required mitigation measures, which are designed to avoid behavioral disruptions that could result in abnormal vertical movement by whales through the water column, should also reduce the potential for creating circumstances that theoretically contribute to harmful bubble growth.

Additional information on the physiological effects of sound on marine mammals may be found in the Navy's IHA application and associated Environmental Assessment, the USWTR DEIS, and on the Ocean Acoustic Program section of the NMFS website (see **ADDRESSES**).

Stress Responses

In addition to PTS and TTS, exposure to mid-frequency sonar is likely to result in other physiological changes that have other consequences for the health and ecological fitness of marine mammals. There is mounting evidence that wild animals respond to human disturbance in the same way that they respond to predators (Beale and Monaghan, 2004; Frid, 2003; Frid and Dill, 2002; Gill *et al.*, 2000; Gill and Sutherland, 2001; Harrington and Veitch, 1992; Lima, 1998; Romero, 2004). These responses manifest themselves as interruptions of essential behavioral or physiological events, alteration of an animal's time or energy budget, or stress responses in which an animal perceives human activity as a potential threat and undergoes physiological changes to prepare for a flight or fight response or more serious physiological changes with chronic exposure to stressors (Frid and Dill, 2002; Romero, 2004; Sapolsky *et al.*, 2000; Walker *et al.*, 2005).

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 (Sapolsky *et al.*, 2005; Seyle, 1950). Once an animal's central nervous system perceives a threat, it develops a biological response or defense that consists of a combination of the four general biological defense responses: behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune response.

The physiological mechanisms behind stress responses involving the hypothalamus-pituitary-adrenal glands have been well-established through controlled experiment in the laboratory and natural settings (Korte *et al.* 2005; McEwen and Seeman, 2000; Moberg, 1985; 2000; Sapolsky *et al.*, 2005). Relationships between these physiological processes, animal behavior, neuroendocrine responses, immune responses, inhibition of reproduction (by suppression of pre-ovulatory luteinizing hormones), and the costs of stress responses have also been documented through controlled experiment 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; Tilbrook *et al.*, 2000).

The available evidence suggests that: with the exception of unrelieved pain or extreme environmental conditions, in most animals (including humans) chronic stress results from exposure to a series of acute stressors whose cumulative biotic costs produce a pathological or pre-pathological state in an animal. The biotic costs can result from exposure to an acute stressor or from the accumulation of a series of different stressors acting in concert before the animal has a chance to recover.

Although these responses have not been explicitly identified in marine mammals, they have been identified in other vertebrate animals and every vertebrate mammal that has been studied, including humans. Because of the physiological similarities between marine mammals and other mammal species, NMFS believes that acoustic energy sufficient to trigger onset PTS or TTS is likely to initiate physiological stress responses. More importantly, NMFS believes that marine mammals might experience stress responses at received levels lower than those necessary to trigger onset TTS.

Potential Behavioral Effects

For a military readiness activity, Level B Harassment is defined as ''any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing,

breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered.''

As discussed above, TTS consists of temporary, short-term impacts to auditory tissue that alter physiological function, but that are fully recoverable without the requirement for tissue replacement or regeneration. An animal that experiences a temporary reduction in hearing sensitivity suffers no permanent injury to its auditory system, but, for an initial time post-exposure, may not perceive some sounds due to the reduction in sensitivity. As a result, the animal may not respond to sounds that would normally produce a behavioral reaction (such as a predator or the social calls of conspecifics, which play important roles in mother-calf relations, reproduction, foraging, and warning of danger). This lack of response qualifies as a temporary disruption of normal behavioral patterns - the animal is impeded from responding in a normal manner to an acoustic stimulus.

NMFS also considers disruption of the behavior of marine mammals that can result from sound levels lower than those considered necessary for TTS to occur (often referred to as sub-TTS behavioral disruption). Though few studies have specifically documented the effects of tactical mid-frequency sonar on the behavior of marine mammals in the wild, many studies have reported the effects of a wide range of intense anthropogenic acoustic stimuli on specific facets of marine mammal behavior, including migration (Malme *et al.*, 1984; Ljungblad *et al.*, 1988; Richardson *et al.*, 1999), feeding (Malme *et al.*, 1988), and surfacing (Nowachek et al., 2004). Below, NMFS summarizes the results of two studies and one after-the-fact investigation wherein the natural behavior patterns of marine mammals exposed to levels of tactical mid-frequency sonar, or sounds similar to mid-frequency sonar, lower than those thought to induce TTS were disrupted to the point where it was abandoned or significantly altered:

(1) Finneran and Schlundt (2004) analyzed behavioral observations from related TTS studies (Schlundt et al., 2000; Finneran et al., 2001; 2003) to calculate cetacean behavioral reactions as a function of known noise exposure. During the TTS experiments, four dolphins and two white whales were exposed during a total of 224 sessions to 1–s pulses between 160 and 204 dB re 1 mPa (root-mean-square sound pressure level (SPL)), at 0.4, 3, 10, 20, and 75 kHz. Finneran and Schlundt (2004) evaluated the behavioral observations in each session and determined whether a ''behavioral alteration'' (ranging from modifications of response behavior during hearing sessions to attacking the experimental equipment) occurred. For each frequency, the percentage of sessions in which behavioral alterations occurred was calculated as a function of received noise SPL. By pooling data across individuals and test frequencies, respective SPL levels coincident with responses by 25, 50, and 75 percent behavioral alteration were documented. 190 dB re 1 mPa (SPL) is the point at which 50 percent of the animals exposed to 3, 10, and 20 kHz tones were deemed to respond with some behavioral alteration, and the threshold that the Navy originally proposed for sub-TTS behavioral disturbance.

(2) Nowacek *et al.* (2004) conducted controlled exposure experiments on North Atlantic right whales using ship noise, social sounds of con-specifics, and an alerting stimulus (frequency modulated tonal signals between 500 Hz and 4.5 kHz). Animals were tagged with acoustic sensors (D-tags) that simultaneously measured movement in three dimensions. Whales reacted strongly to alert signals at received levels of 133–148 dB SPL, mildly to conspecific signals, and not at all to ship sounds or actual vessels. The alert stimulus caused whales to immediately cease foraging behavior and swim rapidly to the surface. Although SEL values were not directly reported, based on received exposure durations, approximate received values were on the order of 160 dB re: 1 mPa^2–s.

(3) NMFS (2005) evaluated the acoustic exposures and coincident behavioral reactions of killer whales in the presence of tactical mid-frequency sonar. In this case, none of the animals were directly fitted with acoustic dosimeters. However, based on a Naval Research Laboratory (NRL) analysis that took advantage of the fact that calibrated measurements of the sonar signals were made in situ and using advanced modeling to bound likely received exposures, estimates of received sonar signals by the killer whales were possible. Received SPL values ranged from 121 to 175 dB re: 1 mPa. The most probable SEL values were 169.1 to 187.4 dB re: 1 mPa^2–s; worst-case estimates ranged from 177.7 to 195.8 dB re: 1 mPa^2–s. Researchers observing the animals during the course of sonar exposure reported unusual alterations in swimming, breathing, and diving behavior.

For more detailed information regarding how marine mammals may respond to sound, see the Navy's IHA application, the Navy's associated EA, Richardson's Marine Mammals and Noise (1995), or the references cited on NMFS' Ocean Acoustic Program website (see **ADDRESSES**)

Harassment Thresholds

For the purposes of this IHA, NMFS recognizes three levels of take; Level A Harassment (Injury), Level B Harasssment (Behavioral Disruption), and mortality (or serious injury that may lead to mortality) (Table 2). Mortality, or serious injury leading to mortality, may not be authorized with an IHA.

NMFS has determined that for acoustic effects, acoustic thresholds are the most effective way to consistently both apply measures to avoid or minimize the impacts of an action and to quantitatively estimate the effects of an action. Thresholds are commonly used in two ways: (1) To establish a shut-down or power down zone, i.e., if an animal enters an area calculated to be ensonified above the level of an established threshold, a sound source is powered down or shut down; and (2) to calculate take, for example, if the Level A Harassment threshold is 215 dB, a model may be used to calculate the area around the sound source that will be ensonified to that level or above, then, based on the estimated density of animals and the distance that the sound source moves, NMFS can estimate the number of marine mammals exposed to 215 dB. The rationale behind the acoustic thresholds proposed for this authorization are discussed below.

TABLE 2. THE THREE LEVELS OF TAKE ADDRESSED IN THE MMPA, HOW NMFS MEASURES THEM IN REGARD TO ACOUSTIC EFFECTS, AND THE PROPOSED THRESHOLDS FOR THIS AUTHORIZATION

Levels of Take Pursuant to the MMPA	Basis of Threshold	Proposed Threshold
Level A Harassment (Injury)	Permanent Threshold Shift (PTS)	215 dB (SEL).
Level B Harassment (Behavioral Effects)	Temporary Threshold Shift (TTS)	195 dB (SEL)
	Sub–TTS Behavioral Effects	173 dB (SEL).

TABLE 2. THE THREE LEVELS OF TAKE ADDRESSED IN THE MMPA, HOW NMFS MEASURES THEM IN REGARD TO ACOUSTIC EFFECTS, AND THE PROPOSED THRESHOLDS FOR THIS AUTHORIZATION—Continued

Levels of Take Pursuant to the MMPA	Basis of Threshold	Proposed Threshold
Mortality, or Serious Injury That May Lead to Mortality (Stranding)	Not enough information for quantitative threshold	May not be authorized with an IHA.

TTS

Because it is non-injurious, NMFS considers TTS as Level B harassment (behavioral disruption) that is mediated by physiological effects on the auditory system. The smallest measurable amount of TTS (onset-TTS) is taken as the best indicator for slight temporary sensory impairment. However, as mentioned earlier, NMFS believes that behavioral disruptions may result from received levels of tactical sonar lower than those thought to induce TTS and, therefore, NMFS does not consider onset TTS to be the lowest level at which Level B Harassment may occur. NMFS considers the threshold for Level B Harasment as the received levels from which sub-TTS behavioral disruptions are likely to result (discussed in Sub-TTS sub-section). However, the threshold for Level A Harassment (PTS) is derived from the threshold for TTS and, therefore, it is necessary to describe how the TTS threshold was developed.

The proposed TTS threshold is primarily based on the cetacean TTS data from Schlundt *et al.* (2000). These tests used short-duration tones similar to sonar pings, and they are the most directly relevant data for the establishing TTS criteria. The mean exposure EL required to produce onset-TTS in these tests was 195 dB re 1 mPa^2–s. This result is corroborated by the short-duration tone data of Finneran *et al.* (2000, 2003) and the long-duration noise data from Nachtigall *et al.* (2003a,b). Together, these data demonstrate that TTS in cetaceans is correlated with the received EL and that onset-TTS exposures are fit well by an equal-energy line passing through 195 dB re 1 mPa^2–s.

The justification for establishing the 195 dB acoustic criteria for TTS is described in detail in both the Navy's RIMPAC IHA application and the USWTR DEIS (see **ADDRESSES**).

PTS

PTS consists of non-recoverable physical damage to the sound receptors in the ear and is, therefore, classified as Level A harassment under the MMPA. For acoustic effects, because the tissues of the ear appear to be the most susceptible to the physiological effects of sound, and because threshold shifts (TSs) tend to occur at lower exposures than other more serious auditory effects, NMFS has determined that permanent threshold shift (PTS) is the best indicator for the smallest degree of injury that can be measured. Therefore, the acoustic exposure associated with onset-PTS is used to define the lower limit of the Level A harassment.

PTS data do not currently exist for marine mammals and are unlikely to be obtained due to ethical concerns. However, PTS levels for these animals may be estimated using TTS data and relationships between TTS and PTS. NMFS proposes the use of 215 dB re 1 mPa^2–s as the acoustic threshold for PTS. This threshold is based on a 20 dB increase in exposure EL over that required for onset-TTS (195 dB). Extrapolations from terrestrial mammal data indicate that PTS occurs at 40 dB or more of TS, and that TS growth occurs at a rate of approximately 1.6 dB TS per dB increase in EL. There is a 34–dB TS difference between onset-TTS (6 dB) and onset-PTS (40 dB). Therefore, an animal would require approximately 20dB of additional exposure (34 dB divided by 1.6 dB) above onset-TTS to reach PTS.

The justification for establishing the 215–dB acoustic criteria for PTS is described in detail in both the Navy's RIMPAC IHA application and the Undersea Warfare Training Range USWTR DEIS.

Sub-TTS Behavioral Disruption

NMFS believes that behavioral disruption of marine mammals may result from received levels of mid-frequency sonar lower than those believed necessary to induce TTS, and further, that the lower limit of Level B Harassment may be defined by the received sound levels associated with these sub-TTS behavioral disruptions. As of yet, no controlled exposure experiments have been conducted wherein wild cetaceans are deliberately exposed to tactical mid-frequency sonar and their reactions carefully observed. However, NMFS believes that in the absence of controlled exposure experiments, the following investigations and reports (described previously in the Behavioral Effects section) constitute the best available scientific information for establishing an appropriate acoustic threshold for sub-TTS behavioral disruption: (1) Finneran and Schlundt (2004), in which behavioral observations from TTS studies of captive bottlenose dophins and beluga whales are analyzed as a function of known noise exposure; (2) Nowachek *et al.* (2004), in which controlled exposure experiments were conducted on North Atlantic right whales using ship noise, social sounds of con-specifics, and an alerting stimulus; and (3) NMFS (2005), in which the behavioral reactions of killer whales in the presence of tactical mid-frequency sonar were observed, and analyzed after the fact. Based on these three studies, NMFS has set the sub-TTS behavioral disruption threshold at 173 dB re 1 mPa^2–s (SEL).

The Finneran and Schlundt (2004) analysis is an important piece in the development of an appropriate acoustic threshold for sub-TTS behavioral disruption because: (1) researchers had superior control over and ability to quantify noise exposure conditions; (2) behavioral patterns of exposed marine mammals were readily observable and definable; and, (3) fatiguing noise consisted of tonal noise exposures with frequencies contained in the tactical mid-frequency sonar bandwidth. In Finneran and Schlundt (2004) 190 dB re 1 mPa (SPL) is the point at which 50 percent of the animals exposed to 3, 10, and 20 kHz tones were deemed to respond with some behavioral alteration. This 50 percent behavior alteration level (190 dB SPL) may be converted to an SEL criterion of 190 dB re 1 mPa^2–s (the numerical values are identical because exposure durations were 1–s), which provides consistency with the Level A (PTS) effects threshold, which are also expressed in SEL. The Navy proposed 190 dB (SEL) as the acoustic threshold for sub-TTS behavioral disruption in the first IHA application they submitted to NMFS.

NMFS acknowledges the advantages arising from the use of behavioral observations in controlled laboratory conditions; however, there is considerable uncertainty regarding the

validity of applying data collected from trained captives conditioned to not respond to noise exposure in establishing thresholds for behavioral reactions of naive wild individuals to a sound source that apparently evokes strong reactions in some marine mammals. Although wide-ranging in terms of sound sources, context, and type/extent of observations reported, the large and growing body of literature regarding behavioral reactions of wild, naive marine mammals to anthropogenic exposure generally suggests that wild animals are behaviorally affected at significantly lower levels than those determined for captive animals by Finneran and Schlundt (2004). For instance, some cetaceans exposed to human noise sound sources, such as seismic airgun sounds and low frequency sonar signals, have been shown to exhibit avoidance behavior when the animals are exposed to noise levels of 140–160 dB re: 1 mPa under certain conditions (Malme *et al.*, 1983; 1984; 1988; Ljungblad *et al.*, 1988; Tyack and Clark, 1998). Richardson *et al.* (1995) reviewed the behavioral response data for many marine mammal species and a wide range of human sound sources.

Two specific situations for which exposure conditions and behavioral reactions of free-ranging marine mammals exposed to sounds very similar to those proposed for use in RIMPAC are considered by Nowacek *et al.* (2004) and NMFS (2005) (described previously in Behavioral Effects subsection). In the Nowacek *et al.* (2004) study, North Atlantic right whales reacted strongly to alert signals at received levels of 133–148 dB SPL, which, based on received exposure durations, is approximately equivalent to 160 dB re: 1 mPa^2–s (SEL). In the NMFS (2005) report, unusual alterations in swimming, breathing, and diving behaviors of killer whales observed by researchers in Haro Strait were correlated, after the fact, with the presence of estimated received sound levels between 169.1and 187.4 dB re: 1 mPa^2–s (SEL).

While acknowledging the limitations of all three of these studies and noting that they may not necessarily be predictive of how wild cetaceans might react to mid-frequency sonar signals in the OpArea, NMFS believes that these three studies are the best available science to support the selection of an acoustic sub-TTS behavioral disturbance threshold at this time. Taking into account all three studies, NMFS has established 173 dB re: 1 mPa^2 (SEL) as the threshold for sub-TTS behavioral disturbance.

Stranding and Mortality

Over the past 10 years, there have been four stranding events coincident with military mid-frequency sonar use that are believed to most likely have been caused by exposure to the sonar. These occurred in Greece (1996), the Bahamas (2000), Madeira (2000) and Canary Islands (2002). In 2004, during the RIMPAC exercises, between 150–200 usually pelagic melon-headed whales occupied the shallow waters of the Hanalei Bay, Kaua'i, Hawaii for over 28 hours. NMFS determined that the mid-frequency sonar was, a plausible, if not likely, contributing factor in what may have been a confluence of events that led to the Hanalei Bay stranding. A number of other stranding events coincident with the operation of mid-frequency sonar and resulting in the death of beaked whales or other species (minke whales, dwarf sperm whales, pilot whales) have been reported, though the majority have not been investigated to the level of the Bahamas stranding and, therefore, other causes cannot be ruled out.

Greece, Madeira, and Canary Islands

Twelve Cuvier's beaked whales stranded along the western coast of Greece in 1996. The test of a low- and mid-frequency active sonar system conducted by NATO was correlated with the strandings by an analysis published in Nature. A subsequent NATO investigation found the strandings to be closely related, in time, to the movements of the sonar vessel, and ruled out other physical factors as a cause.

In 2000, four beaked whales stranded in Madeira while several NATO ships were conducting an exercise near shore. Scientists investigating the stranding found that the injuries, which included blood in and around the eyes, kidney lesions, and pleural hemorrhage, as well as the pattern of the stranding suggested that a similar pressure event precipitated or contributed to strandings in both Madeira and Bahamas (see Bahamas sub-section).

In 2002, at least 14 beaked whales of three different species stranded in the Canary Islands while a naval exercise including Spanish vessels, U.S. vessels, and at least one vessel equipped with mid-frequency sonar was conducted in the vicinity. Four more beaked whales stranded over the next several days. The subsequent investigation, which was reported in both Nature and Veterinary Pathology, revealed a variety of traumas, including emboli and lesions suggestive of decompression sickness.

Bahamas

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 active mid-frequency sonar as they passed through the Northeast and Northwest Providence Channels. Of the 17 cetaceans that stranded (Cuvier's beaked whales, Blainsville's beaked whales, Minke whales, and a spotted dolphin), seven animals died on the beach (5 Cuvier's beaked whales, 1 Blainsville's beaked whale, and the spotted dolphin) and the other 10 were returned to the water alive (though their fate is unknown). A comprehensive investigation was conducted and all possible causes of the stranding event were considered, whether they seemed likely at the outset or not. The only possible contributory cause to the strandings and cause of the lesions that could not be ruled out was intense acoustic signals (the dolphin necropsy revealed a disease and the death is considered unrelated to the others).

Based on the way in which the strandings coincided with ongoing naval activity involving tactical mid-frequency sonar 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 mid-frequency sonars aboard U.S. Navy ships that were in use during the sonar exercise in question were the most plausible source of this acoustic or impulse trauma. This sound source was active in a complex environment that included the presence of a surface duct, unusual and steep bathymentry, a constricted channel with limited egress, intensive use of multiple, active sonar units over an extended period of time, and the presence of beaked whales that appear to be sensitive to the frequencies produced by these sonars. The investigation team concluded that the cause of this stranding event was the confluence of the Navy mid-frequency sonar and these contributory factors working together, and further recommended that the Navy avoid operating mid-frequency sonar 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 presence of surface ducts, steep bathymetry, and/or constricted channels added to the operation of mid-frequency

sonar in the presence of cetaceans (especially beaked whales and, potentially, deep divers) may increase the likelihood of producing a sound field with the potential to cause cetaceans to strand, and therefore, necessitates caution.

Hanalei Bay

On July 3–4, 2004, between 150–200 melon-headed whales occupied the shallow waters of the Hanalei Bay, Kaua'i, Hawaii for over 28 hours. 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 (on July 5, 2004) 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. On July 7, 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. Although cause of death could not be definitively determined, it is likely that maternal separation, poor nutritional condition, and dehydration contributed to the final demise of the animal. Although we do not know when the calf was separated from its mother, the movement into the Bay, the milling and re-grouping may have contributed to the separation or lack of nursing especially if the maternal bond was weak or this was a primiparous 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 United States. 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 or occurrence of predator or prey species, or unusual harmful algal blooms. Weather patterns and bathymetry that have been associated with mass strandings elsewhere were not found to occur in this instance.

This 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, the six naval surface vessels transiting to the operational area on July 2 intermittently transmitted active sonar (for approximately 9 hours total from 1:15 p.m. to 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, 2004. 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 suggest 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, 2004. 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, we 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: (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 Kaua'i; (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.

Beaked Whales

Recent beaked whale strandings have prompted inquiry into the relationship between mid-frequency active sonar and the cause of those strandings. A review of world-wide cetacean mass stranding data reveals that beaked whales have been the most common taxa involved in stranding events (approximately 67 percent of all strandings include beaked whales), with Cuvier's beaked whales accounting for about 90 percent of the individual beaked whales. Although the confluence of Navy mid-frequency active tactical sonar 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 are not understood, and there is uncertainty regarding the ordering of effects that led to the stranding. It is uncertain whether beaked whales were directly injured by sound (a physiological effect) prior to stranding or whether a behavioral response to sound occurred that ultimately caused the beaked whales to strand and be injured.

Several potential physiological outcomes caused by behavioral responses to high-intensity sounds have been suggested by Cox *et al.* (in press). These include: gas bubble formation caused by excessively fast surfacing; remaining at the surface too long when tissues are supersaturated with nitrogen; or diving prematurely when extended time at the surface is necessary to eliminate excess nitrogen. 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 Blainsville'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).

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

Estimated Take by Incidental Harassment

In order to estimate acoustic exposures from the RIMPAC ASW operations, acoustic sources to be used were examined with regard to their operational characteristics. Systems with acoustic source levels below 205 dB re 1 mPa were not included in the analysis given that at this source level (205 dB re 1 mPa) or below, a 1-second ping would attenuate below the Level B Harassment behavioral disturbance threshold of 173 dB at a distance of about 100 meters, which is well within the required shutdown zone. Also, animals are expected to avoid the exercises by a distance greater than that and their detectibility is higher at that distance. In addition, systems with an operating frequency greater than 100 kHz were not analyzed in the detailed modeling, as these signals attenuate rapidly, resulting in very short propagation distances. Acoustic countermeasures were previously examined and found not to be problematic. The AN/AQS 13 (dipping sonar) used by carrier based helicopters was determined in the Environmental Assessment/Overseas Environmental Assessment of the SH–60R Helicopter/ALFS Test Program, October 1999, not to be problematic due to its limited use and very short pulse length (2 to 5 pulses of 3.5 to 700 msec). Since 1999, during the time of the test program, there have been over 500 hours of operation, with no environmental effects observed. The Directional Command Activated Sonobuoy System (DICASS) sonobuoy was determined not to be problematic, having a source level of 201 dB re 1 mPa. These acoustic sources, therefore, did not require further examination in this analysis.

Based on the information above, only hull mounted mid-frequency active tactical sonar was determined to have the potential to affect marine mammals during RIMPAC ASW training events.

Model

An analysis was conducted for RIMPAC 2006, modeling the potential interaction of hull mounted mid-frequency active tactical sonar with marine mammals in the OpArea. The model incorporates site-specific bathymetric data, time-of-year-specific sound speed information, the sound source's frequency and vertical beam pattern, and multipath pressure information as a function of range, depth and bearing. Results were calculated based on the typical ASW activities planned for RIMPAC 2006. Acoustic propagation and mammal population and density data were analyzed for the July timeframe since RIMPAC occurs in July. The modeling occurred in five broad steps, listed below.

Step 1. Perform a propagation analysis for the area ensonified using spherical spreading loss and the Navy's CASS/GRAB program, respectively.

Step 2. Convert the propagation data into a two-dimensional acoustic footprint for the acoustic sources engaged in each training event as they move through the six acoustic exposure model areas.

Step 3. Calculate the total energy flux density level for each ensonified area summing the accumulated energy of all received pings.

Step 4. Compare the total energy flux density to the thresholds and determine the area at or above the threshold to arrive at a predicted marine mammal exposure area.

Step 5. Multiply the exposure areas by the corresponding mammal population density estimates. Sum the products to produce species sound exposure rate. Analyze this rate based on the annual number of events for each exercise scenario to produce annual acoustic exposure estimates.

Based on the modeled estimate, NMFS anticipates take of 21 cetaceans and no pinnipeds. The results of the model (estimated Level B Harassment takes) are presented in Table 1. The model actually estimated potential take of 1 Hawaiian monk seal, however, because of the anticipated effectiveness of the mitigation measures and distance of the majority of the exercises from land, NMFS does not anticipate any take of monk seals, and it is not authorized.

When analyzing the results of the acoustic exposure modeling to provide an estimate of effects, it is important to understand that there are limitations to the ecological data used in the model, and that the model results must be interpreted within the context of a given species' ecology and biology.

NMFS believes that the model take estimates may be overestimates for the following reasons:

(1) The implementation of the extensive mitigation and monitoring that will be required by the IHA (Including large power-down/shut-down zones, geographic restrictions, and monitors that will almost certainly sight groups of animals, if not individuals, in time to avoid/minimize impacts) have not been taken into account.

(2) In the model the Navy used to estimate take, marine mammals remain stationary as the sound source passes by and their immediate area is ensonified. NMFS believes that some, if not the majority of animals, will move away from the sound to some degree, thus receiving a lower level of energy than estimated by the model.

(3) In the Navy's model, sound levels were calculated for every 5 m (16 ft) wide by 5 m (16 ft) long by 2 m (7 ft) deep section within the ensonified area. Then, for each 5 m (16 ft) by 5 m (16 ft) column of the ocean, the sound level through that entire water column was assumed to be whatever the sound level was in the loudest 2 m (7 ft) deep section of that water column.

(4) NMFS interprets the results of the Navy's model as the number of times marine mammals might be exposed to particular received levels of sound. However, NMFS believes it would be unrealistic, considering the fast-paced, multi-vessel nature of the exercise and the fact that the exercise continues over the course of a month in an area with resident populations of cetaceans, to assume that each exposure involves a different whale; some whales are likely to be exposed once, while others are likely to be exposed more than once.Some elements of the Navy's modeling, such as its calculation of received levels without regard to where

animals occur in the water column, are conservative. Other elements, such as its evaluation of some but not all acoustic sources that would be used during the exercise, may not be conservative. It is NMFS view that an extensive set of mitigation and monitoring requirements like those set forth in this notice would ensure that impacts on species and stocks are negligible. This conclusion would not necessarily apply to other naval acoustic activities whose operational and environmental parameters may differ.

Potential Effects on Habitat

The primary source of marine mammal habitat impact is acoustic exposures resulting from ASW activities. However, the exposures do not constitute a long term physical alteration of the water column or bottom topography, as the occurrences are of limited duration and are intermittent in time. Surface vessels associated with the activities are present in limited duration and are intermittent as well.

Potential Effects on Subsistence Harvest of Marine Mammals

There is no known legal subsistence hunting for marine mammals in or near the survey area, so the proposed activities will not have any impact on the availability of the species or stocks for subsistence users.

Comments and Responses

On April 24, 2006 (71 FR 20987), NMFS published a notice of a proposed IHA for the Navy's request to take marine mammals incidental to the RIMPAC ASW exercises and requested comments, information and suggestions concerning the request. During the 30-day public comment period, NMFS received approximately 125 comments from private citizens and several sets of comments from non-governmental organizations, including the Marine Mammal Commission (MMC), the Natural Resources Defense Council (which commented on behalf of the International Fund for Animal Welfare, Cetacean Society International, the League for Coastal Protection, Ocean Futures Society, Jean-Michel Cousteau, the Humane Society of the United States, the Center for Biological Diversity, and Oceana) (NRDC *et al.*), the Cascadia Research Collective (CRC), Seaflow, the Animal Welfare Institute (AWI), the Pacific Whale Foundation (PWF), the Whale and Dolphin Conservation Society (WDCS), and the Center for Regulatory Effectiveness (CRE). The comments have been sorted into general topic areas and are addressed below.

Mitigation Measures

Comment 1: The coastal exclusion zone recommended in the proposed IHA (25 km (13.5 nm) is not large enough to adequately protect island associated populations of odontocetes from significant impacts, as aerial surveys indicate that short-finned pilot whales, spotted dolphins, spinner dolphins, and bottlenose dolphins occur in greater densities within 25 nm (46 km) of shore. Additionally, the comments point out, during the Hanalei stranding in 2004, signals from ships in the PMRF, some 40–50 km (21–26 nm) away, peaked above 150 dB re 1 miPa at the mouth of Hanalei Bay.

Response: The main reasons behind requiring the Navy to maintain a 25 km coastal exclusion zone around the 200 m (656 ft) isobath were to avoid the confluence of the factors that we know contributed to the stranding in the Bahamas (see Strandings section), to avoid driving deep-diving animals up onto the shelf-break where they might become disoriented, and to minimize impacts to island associated animals. In an effort to reduce the possibility of a repeat of the circumstances present during the Hanalei event (and to generally better avoid the confluence of the five Bahamas factors), NMFS did propose an additional mitigation measure that would require a 25–nm (46–km) (plus 2–nm (3.7–buffer) coastal exclusion zone. Following is an explanation from the Navy explaining why the 25–nm (46–km) buffer is impracticable:

Littoral waterspace is where the enemy will operate. The littoral waterspace is also the most challenging area to operate in due to a diverse acoustic environment found there. It is not realistic to refrain from training in the areas that are the most challenging and operationally unavoidable. The [25 nm (46 km) buffer] would remove realism from precursor operations and tactical development culminating in choke point transits. The proposal would remove ASW operations from the AMPHIB phase of the training, which is arguably the highest period of risk for our forces.

NMFS must balance protective measures with practicability and we believe that the 25 km (13.5 nm) buffer effectively reduces the effects to island associated cetaceans while allowing the Navy to effectively carry out their mission.

Comment 2: Two commenters recommended that NMFS implement a sonar exclusion zone around sea mounts, where species associated with steep, sloping areas may be exposed, and cyclonic eddies, which can result in significant increases in primary productivity and have been linked to significant increases in higher trophic species.

Response: In regard to cyclonic eddies, NMFS believes that the impracticability to the Navy of avoiding these features outweighs the potential conservation gain. Though many species may congregate near cyclonic eddies, cyclonic eddies are very large, and, so restricting access to the full extent of these features to avoid animals that may congregate in a small subset of the total areas is not practicable. NMFS proposed a mitigation measure that would require the Navy to avoid seamounts, however, the Navy informed NMFS that this restriction would be impracticable because of the following operational impacts of having to steer clear of seamounts:

Submarine tracking is a long and complicated tactical procedure. The training value of these procedures would be lost if operations were terminated when nearing seamounts prior to reaching the training objectives. Seamounts impact the way sound travels in water as well as our ability to search and track submarines. If we do not train near seamounts and understand how they affect our ability to search and track a submarine, we will be unable to do so when required against an actual threat. Submarine search planning is a detailed process that requires flexibility and large operating areas. If we avoided searching or tracking submarines near sea mounts, ASW operators will be severely limited in their ability to execute effective plans.

Comment 3: One commenter points out that pursuant to Executive Order (E.O.) 13158, NMFS must consider and ''to the maximum extent practicable'' avoid harm to the protected natural and cultural resources of all Federal and State-designated protected areas (Marine Protected Areas (MPAs)) including, but not limited to, the Hawaiian Islands Humpback Whale National Marine Sanctuary.

Response: Both the Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS) and the newly designated Northwestern Hawaiian Islands Marine National Monument fall within in the Navy's Hawaiian Islands OpArea, and at times during RIMPAC exercises portions of their waters may be ensonified. Though the HIHWNMS is an important breeding area for Humpback whales during the winter and spring, the exercises will be

conducted in July when no humpback whales are expected to be present.

The Northwestern Hawaiian Islands Marine National Monument proclamation contains the following language ''The prohibitions required by this proclamation shall not apply to activities and exercises of the Armed Forces (including those carried out by the United States Coast Guard) that are consistent with applicable laws.''

As mentioned above, the effects of this action are temporary and acoustic in nature, and NMFS does not expect them to result in harm to the protected natural and cultural resources of these areas.

Comment 4: One commenter suggested NMFS should not authorize sonar use during ship transits between exercises, as this is the same activity (same levels, same area), according to the NMFS Hanalei Bay Stranding Report, that was a ''plausible, if not likely'' contributor to the 2004 mass stranding event of melon-headed whales in Hanalei Bay.

Response: According to the Navy, the sonar use that occurred prior to the Hanalei event was part of a designated exercise, not sonar use while in transit between exercises. Though the Navy could potentially operate sonar in the same place and manner it did during RIMPAC 2004, it does not necessarily mean that the other contributing factors to the stranding would be in place again. Also, unlike 2004, NMFS has included in the IHA a specific set of shutdown criteria that require the Navy cease operating sonar as soon as a ''milling out of habitat'' event involving a group of ten or more animals (such as in Hanalei) is verified.

Comment 5: Several commenters noted that the Navy plans not to operate sonar over 235 dB except for occasional, short periods of time. These commenters further assert that the Navy did not model marine mammal take at levels above 235 dB and, therefore, NMFS has failed to assess all reasonably foreseeable impacts as required by National Environmental Policy Act (NEPA) and the MMPA. One commenter thought that the Navy should define what ''occasional short periods'' are and identify the higher source level while another commenter recommended limiting sonar output to 235 dB throughout the exercise.

Response: NMFS proposed an additional mitigation measure that would have required the Navy not operate sonar over 235 dB, however, the Navy informed us that they could not implement the measure because it is impracticable for the following reasons:

This measure limits tactical options and the specific reasons that it should not be agreed to are classified. Generally, however, realistic training requires flexibility to operate sonar as fits the tactical scenario and environment encountered. Sonar configuration and operation is dependent upon the environment. These conditions cannot be predicted a month in advance and a ship may find it necessary to transmit at power levels above 235 dB to address a situation as they would during a real world ASW event. To place an artificial requirement as requested decreases the training value and does not allow our sailors to train as we expect them to fight.

In a ''classified'' document, the Navy provided information to the appropriate recipients at NMFS that discusses when and under what circumstances the source level above 235 dB is used. After reviewing the document, NMFS determined that the occasional operation of sonar above 235 dB does not affect our conclusions pursuant to NEPA, ESA, or MMPA.

NMFS proposed an additional mitigation measure that would have required the Navy not operate sonar over 235 dB, however, the Navy informed us that they could not implement the measure because it is impracticable for the following reasons:

This measure limits tactical options and the specific reasons that it should not be agreed to are classified. Generally, however, realistic training requires flexibility to operate sonar as fits the tactical scenario and environment encountered. Sonar configuration and operation is dependent upon the environment. These conditions cannot be predicted a month in advance and a ship may find it necessary to transmit at power levels above 235 dB to address a situation as they would during a real world ASW event. To place an artificial requirement as requested decreases the training value and does not allow our sailors to train as we expect them to fight.

Comment 6: One commenter suggests that because of the considerable reduction in the range of effects gained by a reduction in source level, NMFS must consider requiring the Navy to operate at source levels below 235 dB throughout the exercise or at least in some circumstances.Response: NMFS is requiring the Navy to operate sonar at lower levels under some circumstances through monitoring of safety zones, and with larger safety zones in surface duct conditions and low visibility situations.

Comment 7: NMFS received several comments regarding the proposed safety zones. One commenter suggested that the proposed outer safety zones (1000 m (3280 ft), or 2000 m (6561 ft) in special circumstances) are inadequate because they are inconsistent with NMFS 173 dB threshold. They further suggested that the distances are arbitrary and capricious.

Response: NMFS marine mammal incidental take authorizations typically require a shutdown zone that corresponds to the isopleth associated with the Level A harassment threshold. NMFS does not require shutdown at the threshold associated with the onset of Level B Harassment (173 dB in this case), as that would effectively be an avoidance of take, which would render a take authorization unnecessary. In the case of RIMPAC, the 1000 m safety zone (at which powerdown begins) is estimated as corresponding to the more conservative (than typical PTS shutdown threshold) TTS threshold (195 SEL), and as such, is neither arbitrary nor inadequate.

Comment 8: One commenter suggested that the proposed safety zones fail to meet the ''least practicable impact'' standard because the Australian Navy uses a 4000–m (2.2 nm) safety zone for sonar systems operating below 235 dB

Response: NMFS has implemented a 1000–m (3280 ft) safety zone under normal conditions, a 2000 m (6561 ft) safety zone in low visibility conditions and surface-ducting conditions, and a 2000 m (6561 ft) ''clear zone'' prior to startup in a chokepoint exercise. NMFS believes that these zones will effectively minimize take of marine mammals to the maximum extent practicable through this type of measure. Once the safety zones are enlarged past this point, NMFS believes detectability decreases notably and impracticability increases notably. The Navy observers will still be looking beyond the safety zone and will use the information to help implement the current safety zone measures.

Comment 9: One commenter suggested that NMFS require sonar shutdown at 1000 m (3280 ft), instead of powerdown, and that the Navy not be authorized to operate sonar at all in strong surface-ducting conditions.

Response: Powering down when an animal enters the 1000–m (3280 ft) safety zone ensures that a marine mammal will not be exposed to levels of sound above approximately 195 dB, the threshold established for TTS. Because the next powerdown is at 500 m (1640 ft), the animal would again not be exposed to levels above approximately 195 dB. If the animal were then to approach to 200 m (656 ft), it might be exposed to levels slightly above 195, but then sonar will shut down at 200 m (656 ft). NMFS believes that these shutdown zones are protective enough, especially when balanced against the impracticability of shutting down at 1000 m (3280 ft).

Comment 10: One commenter notes that the 6 dB powerdown requirement if

animals enter the 1000–m (3280–ft) safety zone still only lowers the sound produced to 229 dB, which is still significantly higher than the 145–150 dB level that caused the Bahamas and Hanalei Bay strandings.

Response: The 229 dB in this comment refers to the sound level at 1 m (3.3 ft) from the actual sound source, whereas the 145–150 dB level refers to a sound level that was modeled for a particular location where animals may have been, based on the known locations of the implicated sound sources. NMFS does not expected marine mammals to approach within several hundred meters, much less 1 m of the sonar dome. Additionally, neither of the reports concluded that the listed sound levels 'caused'' the stranding, in Hanalei, NMFS concluded that sonar was a plausible, if not likely, contributor to the event. In the Bahamas, the Department of Defense and Department of Commerce found that sonar was the only possible contributory cause that could not be ruled out.

Comment 11: One commenter recommended that after a shutdown the Navy wait 45 minutes, instead of 30, before reinitiating sonar operations to account for deep-diving animals.

Response: NMFS believes that because of the fast-moving nature of the exercise, the vessel will have moved a significant distance from where the animal was seen, and, therefore, we did not include that measure.

Comment 12: One commenter notes that shutdown is required by NMFS, in normal conditions, at 200 m. The commenter further suggests that within that distance of the sonar dome, the animal would have likely received noise levels of such intensity that mortality is almost certain. Additionally, the commenter notes, if the animal has gotten that close, the observation mitigation has obviously failed.

Response: As noted in an above comment, if an animal were to approach and be detected (visually or otherwise) successive powerdowns would precede the shutdown, and this would prevent exposure to levels above those thought to potentially cause TTS. If an animal were first detected right at 200 m, it could potentially be exposed to levels approaching those thought capable of causing PTS. NMFS does not believe that detection of marine mammals will be 100 percent in the RIMPAC exercises, however because most animals will avoid the noise and activities surrounding the exercises, we do not anticipate animals approaching within 200 m of any hull-mounted sonar.

Comment 13: One commenter recommends a mitigation measure wherein the Navy would be required to shut down or relocate if they detected beaked whales or aggregations anywhere within their sight (not just within the safety zone zone). They noted that NMFS recently required the U.S. Air Force to relocate its ordnance exercises offshore the Eglin Air Force Base should its fixed-wing aircraft spot any marine mammals or sea turtles within its orbit cycle (9.3 km).

Response: A measure that is practicable for one activity is not necessarily practicable or appropriate for another. First, NMFS does not believe that observers will be able to recognize beaked whales versus another species beyond the distance of the safety zone. Second, NMFS believes that the required safety zones are adequate for minimizing take and the Navy will easily be able to implement the appropriate powerdowns (or avoid the animals, if preferable) in the presence of aggregations. RIMPAC is a highly complex and coordinated exercise, and shutting down or relocating in response to animals detected outside the safety zones is impracticable.

Comment 14: Several commenters recommended that the Navy not operate sonar at night-time because animals cannot be detected as far out as the safety zone.

Response: NMFS proposed a mitigation measure that would have required the Navy to refrain from conducting chokepoint exercises at night. The Navy informed NMFS that it would be unable to comply with that measure for the following reasons:

Operating at night is a warfighting requirement. Night time conduct of ASW events is required for at least the following reasons:

-Exercise realism: ASW is as much an art as a technical application. Commanders must learn how best to effectively employ the assets available. There is not a universal solution applicable across the board. ASW is very much dependent upon the geography, water conditions, available assets, time available for mission accomplishment and many other factors. Training for this complicated warfighting skill must be conducted in a variety of locations, situations and environmental conditions. ASW can occur at any time of day or night and requires that ships and aircraft be adept at operating in close proximity to each other in darkness and low visibility.

-ASW is a lengthy and involved process. It can take many hours for the tactical situation to develop. It is impractical to halt a complicated scenario at sunset.

-Exercise safety of other major events. Other events (e.g. gunnery and missile exercises) requiring more stringent safety measures are conducted in daylight, affording the best visibility for range observance. Scheduling within a relatively short exercise period requires ASW to take place in twilight or night conditions.

-Darkness provides the enemy one of his greatest tactical advantages and therefore the need to train 24 hours a day is a necessary requirement to prepare U.S. forces to defend our country. There may be an additional risk to mammals at night, only insofar as there are no aerial surveys available, but that is a necessary risk in support of national defense.

Comment 15: Several commenters made recommendations regarding the limitation of sonar activities during low visibility conditions, surface-ducting conditions, or chokepoint exercises including operating sonar at 6 dB down or shutting down sonar.

Response: NMFS proposed a mitigation measure in which the Navy would be required to cease operating sonar during strong surface-ducting conditions during the chokepoint exercises. However, the Navy was unable to accept that measure for the following reason:

We already have mitigations imposed for significant surface ducting conditions. Our Sailors need to practice warfighting in all conditions. The enemy uses choke points to his tactical advantage, and this is the reason we need to train in a restricted water environment. The confluence of currents and sea state conditions in the Hawaiian channels make it less likely that these conditions will be present in the channels.

NMFS' IHA requires the Navy to powerdown sonar by 6 dB if they cannot detect marine mammals out to the prescribed safety zone and in strong surface-ducting conditions.

Monitoring

Comment 16: The monitoring for non-choke-point exercises is inadequate, in that it consists of nothing more than a single, non-dedicated observer, watching for marine mammals while performing other duties on deck. It is well-established that single, non-dedicated observers-even if well-trained-spot only a fraction of the marine mammals that multiple, dedicated observers do. Additionally, another commenter notes that observations should be made from all platforms, day and night.

Response: Though the observers on Navy vessels are not dedicated marine mammal observers, they are dedicated observers and do not have other duties on the deck. Additionally, people on all of the vessels, aircraft, etc. involved in the exercise have been briefed on marine mammals and instructed to alert the commanding officer if one is spotted.

Comment 17: One commenter suggests that monitors should be specifically trained in marine mammal observation, extensive theoretical training (underwater acoustics, etc.),

and should have vision tests and be well rested. Another commenter added that observers should be independent non-Navy personnel.

Response: At least one watchstander who has recieved training from a NMFS-approved instructor will be on duty at all times during the operation of hull-mounted tactical sonar, and all RIMPAC participants will be briefed on marine mammals, see an associated training video, and be instructed to alert the commanding officer if a marine mammal is sighted. Watchstanders are professional observers, and NMFS will assume that, due to the importance of their job, the Navy ensures that watchstanders are well-rested and cared for as it relates to their vision. NMFS does not believe that instruction in the fundamentals of underwater acoustics is necessary to be an effective observer, and therefore does not require it of observers.

Comment 18: Several commenters note that effectiveness of vessel-based marine mammal monitoring is low (Navy document indicates approximately 5 percent) and that the chance of a trained observer seeing a beaked whale on an ideal day for observations is approximately 2 percent. Additionally, some commenters believe that cetaceans cannot be reliably detected out to the extent of the 2000–m (6561–ft) safety zone, especially in low visibility conditions.

Response: NMFS acknowledges the limitations of vessel-based monitoring and has instituted other methods of detection in low visibility conditions and during chokepoint exercises. NMFS also requires a powerdown in low visibility conditions.

Comment 19: Some commenters pointed out the fact that passive acoustic monitoring is not very effective (Navy estimates 5 percent) and has significant drawbacks such as the fact that it cannot detect non-vocalizing animals and cannot detect the distance or location of the animals. Another commenter suggested that passive acoustic monitoring should be used throughout the exercise, not just before, that the technology should be further developed to increase localization and range-finding abilities, and that specific Passive Acoustic Monitoring guidelines should be established.

Response: NMFS acknowledges that passive acoustics has limitations, however it also adds a dimension of detection to the monitoring and NMFS believes that it adds value to the monitoring. Though some standard passive acoustic systems cannot localize or determine the distance to a source, NMFS notes that with towed arrays, instrumented ranges, active sonar, or other passive acoustic systems, better detection and localization of marine mammals is possible. NMFS proposed a mitigation measure that required the Navy to implement additional passive (or active) acoustic measures to use to improve detection rates during the RIMPAC exercises, however, the Navy was unable to comply for the following reasons:

The Navy has no additional measures for detection of marine mammals. Passive detection will only serve to cue lookouts to more vigilance since localization via passive detection is not possible. We will use all measures available to us, including passive monitoring, but passive monitoring would be difficult while actively transmitting as the outgoing signal blanks some receive capability.

The High Frequency Marine Mammal Monitoring System (HF/M3) measure is drawn from SURTASS LFA mitigation measures. SURTASS is very slow moving, is a very different design, and is deployed very differently from surface combatant vessels. The SURTASS LFA and Mid-Frequency Antisubmarine Sonar (MFAS) are two different systems, deployed and operated differently with very different capabilities.

Comment 20: Several odontocetes (beaked whales, Kogia sp., and others) will have a very low probability of being detected through aerial overflights due to their long dive times. The commenter cites ''the effective search width for beaked whales is typically only 250–500 m (820–1640 ft) on each side of the aircraft for aerial observers searching by naked eye in good to excellent sighting conditions''. The high winds typically present in the channels in which the chokepoint exercises will be conducted will reduce detection rates further.

Response: NMFS acknowledges the limitations in detecting cryptic species by aerial reconnaissance and have taken them into consideration in our conclusions.

Comment 21: Land-based monitoring in the Alenuihaha Channel during the chokepoint exercise is not adequate (monitoring will occur along 2 km (1.1 nm) of shore, but the border of chokepoint exercise is 28 km (15 nm) long). Additionally, the area is gently sloping and less than 200–m (656 ft) deep, and the animals that are thought to be more susceptible to high-intensity sound are not found in these areas.

Response: Though the entire border of the exercise will not be monitored, NMFS believes that this mitigation adds to the detectability of injured or dead animals and even though it is not an area where the species susceptible to strandings would usually be present, if they were responding to sonar in the way we are concerned about, they could potentially go into areas we do not usually see them (milling out of habitat). NMFS does not believe that it would be practicable to ask the Navy to monitor 28 km (15 nm) of shore.

Comment 22: The Navy should establish a public hotline for strandings during RIMPAC.

Response: NMFS has established stranding response procedures, including a hotline, and does not want the Navy to establish another line, as it could only confound the response.

Comment 23: Longterm monitoring should be conducted to assess the affects of RIMPAC on resident populations.

Response: The Navy is currently coordinating long monitoring of the marine mammal populations within the OpArea (see Conservation Measures (Research), in Mitigation section, below)

Comment 24: No information is presented on the statistical power of the monitoring and mitigation plan. Based on the level of monitoring outlined, the density of marine mammals in Hawaii, and the low likelihood of detecting long diving and cryptic species, the commenter concludes that the power to assess the presence of animals (especially beaked whales) to reduce impacts is low and the power to detect impacts if they occur is low. In addition, the prevailing direction of currents in Hawaii and the large number of sharks that scavenge carcasses makes the likelihood of dead animals stranding low.

Response: NMFS acknowledges the challenges in detecting animals in order to implement mitigation measures and in detecting injured or dead animals in order to assess effects. NMFS has implemented several measures intended to increase the detectability of impacts. Aerial or vessel surveys will be conducted 1–2 days after an exercise to look for dead or injured animals. NMFS has also implemented shutdown protocols to use in the event of a verified stranding during RIMPAC (see Mitigation).

Comment 25: One commenter recommended that NMFS require the Navy to conduct fewer ASW exercises to lessen the impacts.

Response: The Navy's purpose and need for the activity (for the EA) is to ''implement a selected set of exercises that is combined into a sea control/power projection fleet training exercise in a multi-threat environment''. NMFS interprets the action put forth in the IHA application as the ''selected set'' and did not discuss an alteration of the proposed action with the Navy. Instead, NMFS endeavored to minimize impacts by limiting exercises near features

associated with strandings, limiting sonar output during strong surface-ducting conditions, requiring additional monitoring during chokepoint exercises, and instituting specific shutdown criteria.

Comment 26: One commenter states that NMFS must clearly define the circumstances under which both the exercise and RIMPAC 2006 will be shut down. This commenter adds that it is particularly important that clear non-discretionary triggers are set for the suspension of RIMPAC.

Response: NMFS has developed and implemented within the IHA a set of shutdown criteria that include specific triggers for temporary sonar shutdown subsequent to the verification of an uncommon stranding event, and indicate the framework within which NMFS will make a determination regarding modification, suspension, or revocation of the Navy's IHA. The shutdown criteria are included in the Mitigation section of this document.

Impact Assessment

Comment 27: Much of the abundance data for the inshore populations (within 25 nm (46 km) of shore) of the main Hawaiian Islands marine mammals is based on the Mobley *et al.* (2000) aerial survey data, which underestimate the abundance of deep-diving/cryptic species. Mobley notes that the abundance estimates presented in the proposed IHA notice for beaked and sperm whales probably underestimate the true abundance by a factor of at least two to five. The commenter is concerned that this underestimate of abundance will be reflected in the take estimate.

Response: If the abundance of some of these species has been underestimated then NMFS also may have underestimated the number of animals taken; accordingly, within this mathematical adjustment the percent of the population affected would remain the same. Since the increase in numbers taken is not related to a biologically important area, this information does not affect NMFS' negligible impact determination.

Comment 28: In the case of spinner dolphins and bottlenose dolphins, there appears to be additional population structure within the main Hawaiian Islands, with genetic differentiation and no evidence of movements of individuals among the four main groups of islands. Response: The study cited for genetic differentiation of spinner dolphins discusses two different social systems of spinner dolphins, one in the main Hawaiian Islands and one in the northwestern atolls. The study further suggests that low diversity at a particular mDNA microsatellite is likely caused by geographic isolation of small populations that might experience some inbreeding. The study does not suggest different sub-populations within the main Hawaiian Islands or, therefore, within the Hawaiian OpArea. The cited bottlenose dolphin study revealed that there may be genetically differentiated populations stratified by both site fidelity to a particular island, and in one case, depth. Because the RIMPAC exercises are distributed throughout the islands and 2–24 hours in duration each, because the potentially genetically differentiated populations are not known to be limited to an area smaller than a whole island, and because of the high detectability of bottlenose dolphins (which increases mitigation effectiveness), NMFS does not expect this additional information to affect our negligible impact determination.

Comment 29: One commenter notes that several species are genetically differentiated between the Hawaiian Islands population and the tropical Pacific population

Response: As described, the Hawaiian populations extend to an unknown distance beyond the EEZ, so this observation does not affect the negligible effect determination.

Comment 30: The additional mitigation measures do not take into account the cumulative and synergistic effects of multiple noise sources being employed at any one time or over time. Such effects should be addressed before any authorization is issued.

Response: The Navy's model sums the received energy from multiple sources and calculates the SEL around the sonar sources. This SEL, which is an energy metric, does take into account the effects of multiple sources over time. The Navy's model does incorporate synergism to some degree, as conditions in the model are based on nominal conditions calculated from a generalized digitalized monthly average, which includes surface-ducting conditions. Though synergistic possibilities exist that are not addressed by the model, the Navy has incorporated several conservative features into the model that help balance other inadequacies of the model (such as the fact that animals are assumed to remain stationary in the presence of the ASW activities and the fact that animals are assumed to be located at the loudest depth within the water column).

Comment 31: Most of the papers cited to support the evaluation of the Level B harassment behavioral threshold involved either sinusoidal tones or impulses. When developing thresholds for mid-frequency sonar, NMFS should use studies that employ complex, sonar-like signals.

Response: In this regard, NMFS is constrained by the available science. The one known incident (Haro Strait, see Sub-TTS Behavioral Threshold section) in which cetaceans were actually exposed to mid-frequency tactical sonar signals from naval vessels, and scientists, having some information about exposure conditions (including duration) were able to estimate their received level in terms of sound exposure level has been included in our development of the 173–dB threshold.

Comment 32: Regarding the estimation of PTS onset relative to TTS levels used in the development of the Level A Harassment threshold, the Navy incorporates the maximum recoverable TTS that humans (and cats, in one study) can recover from without permanently damaging their hearing. The commenter points out that both humans and cats are highly visually adapted species (though cats less so than humans), and from the relationship between their different recoverable TTS levels he deduces that animals that are more dependent on sound cues are less able to recover from extreme TTS. The commenter further asserts that it might easily follow that cetaceans that rely almost exclusively on acoustical cues would be even less likely to recover from extreme TTS. Through further alternative interpretations of the data that the Navy used to estimate the onset of PTS, the commenter suggests that PTS onset could be estimated at 210 dB or as low as 200 dB.

Response: The extrapolation that the Navy uses to estimate PTS onset from known TTS levels consists of several discrete steps, and in each of these separate calculations the Navy has built in conservative approximations to help offset the lack of taxa-specific data and other data gaps, such as that which the commenter highlights. Additionally, Navy researchers have exposed captive dolphins to sound levels in certain conditions to exposures exceeding 220 dB peak and 200 dB SEL and been unable to elicit TTS, much less PTS.

Comment 33: Several commenters note different sound levels (145–165 SPL, 174 SEL) cited in the Bahamas and Hanalei Bay Stranding reports and assert that NMFS should base our Level B Harassment behavioral threshold on these numbers.

Response: The sound levels cited in these reports are, for the most part, the modeled received sound at a particular location, based on the known locations of different sound sources present near the time of the stranding event and the

best guess of the sound speed profile in the area based on available environmental data. While this information is valuable for many reasons, we do not know where any of the animals were actually located in relation to the known sound sources when the behavioral or physiological response that led to either of these strandings was triggered. The Level B Harassment behavioral threshold that NMFS has chosen is based primarily on two studies and one incident in which actual received levels were measured and/or we know the source level and the approximate distance of the animal from the sound source leading to relatively precise modeling estimates.

Comment 34: NMFS has not considered the full breadth of available information on bubble growth in its potential effects analysis. For example, some researchers suggest that gas bubbles could be activated in supersaturated marine mammal tissue on brief exposure to sounds of 150 dB (rms) re 1 miPa or lower and then grow significantly, causing injury as the animal rises to the surface. Further, the commenter mentions the investigation of the 2002 Canary Islands strandings, whose findings concerning fat and gas emboli were recently published, but not mentioned in our analysis.

Response: Though NMFS did not mention the specific results cited above in the discussion of bubble growth in the proposed IHA, adequate coverage of the topic was provided through a summary discussion of acoustically mediated bubble growth, which discussed the destabilization of stable bubbles by high-level sound exposures such that bubble growth occurs through static diffusion of gas out of the tissues, the evolution of nitrogen bubbles through rapid ascent to the surface, and rectified diffusion. Additionally, based on the available science, the exact mechanisms for bubble growth are unknown, and the predicted received levels to induce bubble growth are estimated to exceed those required to induce TTS. NMFS believes that the mitigation measures designed to avoid serious injury or mortality and effect the least practicable adverse impact also function to minimize the chances of bubble growth.

Comment 35: NMFS' injury threshold does not reflect non-auditory physiological impacts, as from stress and from chronic exposure during development.

Response: NMFS acknowledges the importance of potential physiological effects of mid-frequency tactical sonar on marine mammals and they are addressed in this document. However, information regarding the sound levels, frequencies, and duration/repetition conditions these types of effects result in is unavailable and, therefore, cannot contribute to the development of the injury threshold.

Comment 36: NMFS should use a dual threshold (SPL and SEL, not just SEL) for injury, as a 2003 Office of Naval Research report suggests that peak power may have more to do with the way beaked whales respond to sound (and potentially strand).

Response: Because of the equal energy line applied by Finneran (2002) to the TTS data of several researchers, NMFS believes that SEL can be effectively used to predict when TTS and PTS (from extrapolation) will occur in marine mammals. There is little data relating to mid-frequency tactical sonar in particular, however, the larger body of data related to high-intensity sound in general suggests that context and SPL are also important in how animals behaviorally react to sound. While SEL may not be the only metric important in predicting the response of marine mammals to sound, NMFS chose the behavioral threshold for this authorization based on three studies/events thought to be most closely representative of how mid-frequency sonar affects marine mammals for which SEL exposures are available. Additionally, the pulse length and signal types produced by RIMPAC are known (vs. explosions) and NMFS believes that in this particular case, SEL is an appropriate metric for the behavioral harassment threshold. NMFS is currently developing acoustic criteria, which may include dual critieria, but the wide-ranging evidence regarding at what levels marine mammals behaviorally respond to high-intensity sound has made the behavioral threshold part of that process difficult both in terms of metrics and absolute numbers.

Comment 37: For the SURTASS LFA sonar authorization, the Navy used a study that showed resonance damage to small mammals (submerged) at 205 dB to establish their proposed Level A injury threshold. Why was that threshold not used in this authorization?

Response: NMFS believes that extrapolation to PTS from the specific marine mammal TTS onset data is the more appropriate way to establish the threshold. The size and nature of the air spaces within small mammal ears may affect the way sound affects the tissues of the ear such that these results are not as applicable to marine mammals.

Comment 38: TTS is physiological damage that can last from minutes to days, and can increase the chances of being injured or killed. TTS should be considered Level A Harassment.

Response: TTS may be considered to be an adaptive process (analogous to the dark adaptation in visual systems) wherein sensory cells change their response patterns to sound. Tissues are not irreparably damaged with the onset of TTS, the effects are temporary (particularly for onset-TTS), and NMFS does not believe that this effect qualifies as an injury. Therefore TTS-onset is treated as the upper bound of Level B Harassment.

Comment 39: For the development of the TTS threshold, the Navy's extrapolation of data from bottlenose dolphins and belugas to all cetaceans is not justifiable because they do not have the most sensitive hearing of all cetaceans and some studies suggest that hearing sensitivity may be variable as a function of signal production and/or other parameters.

Response: The absolute hearing sensitivity at the frequency of tactical, mid-frequency sonar is similar for most odontocetes that have been tested. Additionally, onset-TTS values used for the calculation of PTS onset represent the most sensitive of the animals tested. Presumably, any modulation of sensitivity that served to protect the cetacean auditory system from overexposure to noise would be activated by intense noise exposure. It would be expected to operate, if it in fact exists, in captive marine mammals involved in the TTS studies as well as animals exposed to loud noise in the wild. There is no empirical comparative data on these phenomena with which to modify/adjust the TTS onset or growth estimates. Comment 40: The Finneran equal energy line applied to multiple TTS datasets was used to justify the 195 dB TTS threshold (and by extrapolation, the 215 PTS threshold) in this authorization. This line could have justifiably been drawn at 190 dB (without giving such weight to the single Natchtigall point), and would have been more conservative.

Response: While acknowledging the limitations of current data and the existing criticisms of an equal energy approach in the terrestrial mammalian literature at this time, NMFS believes that the 195–SEL equal energy line is a reasonable interpretation of the current data at this time. Both TTS onset and the estimation of PTS onset as a demarcation of physical injury have several precautions built into the assumptions. The equal-energy line through the existing cetacean TTS data is not a least-squares regression of the data but rather an expression of pressure

magnitude of exposure as a function of duration. That the long duration exposures from Nachtigall *et al.* fall so close to this line (they are not used to derive it) is one of a number of arguments in favor of the use of SEL as a means of comparing TTS-onset across extremely variable exposure conditions. Finally, the 195–dB SEL line was selected based on the empirical measures of TTS-onset for 195 dBrms 1–s exposures and extrapolated to other exposures of variable sound pressure magnitude and duration using the equal energy relationship.

Comment 41: Several commenters suggest that the animals used in the studies the Navy used to develop their proposed TTS threshold were old and test-habituated, and that studies involving younger, less test-habituated animals should be given more weight. Another commenter noted that the animals used in the TTS study may not adequately represent the range of variation within their own species.

Response: NMFS acknowledges that the test-animals may not fully represent the range of hearing responses across multiple taxa, within their own species, or in some cases even within individuals whose sensitivity may change over time however, we have used the best science available to develop these thresholds. Also, though NMFS believes that habituation to exposure may affect how animals respond to noises in a behavioral context, but that from a sensorineural point of view there is likely less dependence on exposure history. NMFS is aware of some data on terrestrial mammals indicating a ''toughening'' of auditory systems repeatedly exposed to noise, but notes that such data are generally unavailable for marine mammals but not indicated in the exposure sequences of subjects that have been tested. In fact, some data exist indicating a slight apparent improvement in the hearing sensitivity (lower thresholds over time) of marine mammals at a particular sound frequency for which TTS is tested, likely as a result of the increased relevance of those particular signals to the animals in the context of food-reward tasks.

Comment 42: Pinniped data should have been used in the development of the threshold.

Response: NMFS does not anticipate take of pinnipeds as a result of this action and, therefore, did not consider the incorporation of pinniped data into the thresholds (or the development of separate pinniped thresholds) necessary.

Comment 43: A recent study of threshold shift in pinnipeds found that the amount of hearing loss an animal experiences does not increase linearly with the energy it receives. As the energy intensifies, its rate of hearing loss increases, to such a degree that projections of permanent threshold shift according to traditional, linear models are likely to result in underestimates of harm. The Navy should lower its threshold.

Response: Kastak et al (2005) note the non-linear growth of TTS for relatively small magnitude shifts (< 6dB) and the innadequacy of a linear model using only these data in predicting the growth of TTS with exposure level for a wider range of exposures. It is well known that the TTS growth function is sigmoidal and thus it is misleading to describe it solely based on exposures that generate only small-magnitude TTS (where the slope of the growth function is relatively shallow). For a wide range of exposures, however, there is a steeper, linear portion of the sigmoidal function and a fairly consistent relationship between exposure magnitude and growth of TTS. The slope of this relationship is relatively well-known for humans (on the order of 1.6 dB TTS/dB noise (Ward *et al.*, 1958; 1959)). While it is not well-understood for marine mammals (because studies to date have yet to induce sufficiently large TTS values to properly assess it), the slope of this portion of the function predicted by the Kastak et al (2005) data fit with the curvilinear approximation (based on Maslen, 1981) was found to be comparable. Therefore, estimations of PTS from TTS onset that use a linear growth function with the steepest slope from a curvilinear function are very likely appropriate and in fact a conservative approximation, based on the information available at this time.

Comment 44: The 173–dB behavioral threshold is not supportable, as significant behavioral changes have been demonstrated in a controlled exposure experiment (Nowacek *et al.*, 2004) at 154 dB SEL. It is not appropriate to use the 25th percentile results of the Finneran study (173 dB), as the captive animals in that study cannot adequately represent the responses of wild animals. Alternatively, NMFS received one comment in support of the issuance of the IHA, but that commenter believed that the 190–dB behavioral threshold was supported, not the 190–dB threshold.

Response: As discussed in the text, NMFS used the three examples (Finneran and Schlundt, 2004, Nowacek *et al.*, 2004; and NMFS Haro Strait analysis) of cetacean responses to high intensity sound that we believe are the most predictive for marine mammal responses to tactical sonar to develop the threshold. Generally, NMFS interprets the received SELs in these studies as approximately 50 percent disturbance = 190 dB SEL (Finneran), approximately maximum SEL:160 dB (Nowacek), and approximately 165–175 dB SEL (Haro Strait). Where using a single threshold, instead of the likely more appropriate but currently unknown dose-response sigmoidal relationship, NMFS acknowledges that some animals exposed above the threshold may not be harassed by the sound and, conversely, some animals exposed to a sound below the threshold may be harassed. Therefore, NMFS believes that an appropriate threshold is a number somewhere between the lowest and highest mid-frequency signal exposure levels to which animals have demonstrated profound behavioral disturbance, which is why we chose 173 dB SEL for this authorization.

Comment 45: NMFS' analysis of effects should include more information on the avoidance behavior and behavioral response data of mysticetes to high-intensity sound.

Response: The majority of data addressing mysticete avoidance and behavioral responses to sound relates to low frequency sound. Because of differences in how animals react to these two different types of sound and differences in how these sounds propagate, the Navy and NMFS limited the analysis to primarily mid-frequency/tactical sonar-type data. However, one of three datum used to develop the behavioral harassment threshold was derived from right whale responses (Nowachek).

Comment 46: The model the Navy uses to calculate take is flawed because it does not take into consideration reverberation, surface-ducting, or sources above 205 dB.

Response: The model does indirectly incorporate surface-ducting, as conditions in the model are based on nominal conditions calculated from a generalized digitalized monthly average. Though the model does not consider reverberations, these effects are generally at received levels many orders of magnitude below those of direct exposures (as demonstrated in the Haro Strait analysis) and thus contribute essentially nothing to the cumulative SEL exposure. The Navy did not include sources below 205 dB in its model because sound is expected to attenuate to below 173 dB within 100 m (328 ft) around these sources (animals are expected to avoid the dynamic exercise

at that distance and/or monitors are largely expected to detect and shut down sonar (within 200 m (656 ft))) and because larger sources will usually be operating in the vicinity, adding to the likelihood of avoidance.

NEPA Compliance

Comment 47: The Navy should revise the EA based on the findings of the final Hanalei Bay report to reflect ''significant new information''.

Response: Though the final Hanalei report was not published when the Navy issued the April draft of its EA and the event was not discussed in the necessary detail in that draft, NMFS considered the event in more detail, as demonstrated in both this final IHA notice and the associated Finding of No Significant Impact (FONSI) .

Comment 48: The Navy suggests at points in the EA that its analysis of extraterritorial activities, those activities that would take place outside U.S. territorial waters, was prepared under the authority of Executive Order 12114 rather than under NEPA. The Navy's position on the scope of the review is inconsistent with the statute. For NMFS, adopting such a position is clearly insupportable, given that the Federal action to which its NEPA review applies, the decision to authorize RIMPAC, takes place entirely within the territory of the U.S. NMFS should indicate its derogation from the Navy's EA on this point.

Response: Pursuant to NOAA Administrative Order 216–6, NMFS applies NEPA in the EEZ, and has complied with NEPA for this action.

Comment 49: One commenter believes that the Navy's purpose and need is too narrow.

Response: The Navy's stated purpose is to ''implement a selected set of exercises that is combined into a sea control/power projection fleet training exercise in a multi-threat environment''. NMFS does not believe that this stated purpose is inherently too narrow.

Comment 50: The Navy does not do an adequate alternatives analysis. The alternatives consist of the preferred alternative, the no action alternative, and previously considered alternatives. The Navy does not consider alternate geographical locations or any other alternatives. NMFS should not adopt the EA.

Response: For the purposes of NMFS' federal action--the issuance of an MMPA authorization--the alternatives are adequate: no action, preferred action (ASW with added mitigation), and the previously considered alternative (ASW with no added mitigation).

Comment 51: An overarching concern is the blanket exclusion of fish and invertebrates from consideration [in the EA] in terms of acoustic impacts.

Response: The Navy provided a supplemental analysis of the effects of mid-frequency sonar on fish and NMFS has included it in the FONSI.

Comment 52: The Navy's EA did not adequately consider cumulative effects. NMFS must assess the potential for synergistic adverse effects, as from noise in combination with ship stripes, properly assess the cumulative impacts of holding biannual RIMPAC exercises in the same areas off Hawaii, and consider whether individual naval exercises in the Hawaiian Islands Operating Area and other activities could combine with RIMPAC to produce a significant effect.

Response: NMFS acknowledges the need for additional analysis of cumulative effects in the NEPA analysis and has addressed cumulative effects in the FONSI

Comment 53: With regard to noise-producing activities the Navy must describe source levels, frequency ranges, duty cycles, and other technical paramenters relevant to determining potential impacts on marine life.

Response: NMFS requested this information early in the process and the Navy informed NMFS that the majority of the information was ''classified''.

Comment 54: For Data Quality Act compliance, the models used in this analysis need to be available to the public.

Response: MatLab is a commercially available program. CASSGRAB is available to the public from the Federal Government through leasing arrangements. The other components of the Navy's model are not published and can be discussed with the Navy.

Comment 55: Several commenters were concerned that NMFS could not satisfy the criteria necessary to issue a Finding of No Significant Impact.

Response: NMFS issued a FONSI on June 27, 2006, addressing all the required criteria.

MMPA Compliance

Comment 56: Pursuant to the MMPA (16 U.S.C. 1371(a)(5)(D)(i)), an IHA can only be granted for harassment, not serious injury or mortality. NMFS cannot say with confidence that serious injury or mortality will not occur incidental to this action, especially during the chokepoint exercises, which present four of five conditions for heightened risk: (1) the use of tactical sonar, (2) in places where as many as three species of beaked whale may occur, (3) areas with steep bathymetry, and (4) areas that offer surface-ducting conditions.

Response: NMFS has required a suite of mitigation measures in the IHA that reduces the likelihood of a stranding resulting from the RIMPAC ASW activities. However, several points that were emphasized in the public comments (i.e., the difficulty (in ideal conditions) of detecting beaked whales, which have been among the species in most of the strandings associated with sonar, and the fact that choke-point exercises will be conducted both at night and in surface-ducting conditions) and the published conclusions of the Hanalei Bay melon-headed whale report do not allow NMFS to rule out the possibility of a stranding resulting from the RIMPAC ASW activities. Consequently, NMFS has included specific shutdown criteria (see Mitigation and Monitoring, above), which are intended to ensure MMPA compliance. These criteria require the Navy to temporarily cease operating sonar in a designated area when a stranding is verified during the RIMPAC ASW exercise. NMFS will then conduct an investigation, and if NMFS finds that the Navy's activities may have contributed to the stranding, NMFS will modify, revoke, or suspend the IHA.

Comment 57: NMFS can not reach a negligible impact determination for beaked whales as the activity is projected to affect over 16 percent of each population of beaked whales and the mitigation measures are know to be ineffective due to the low detectability of beaked whales.

Response: As discussed in more detail in the Negligible Impact Determination section, NMFS does not believe that over 16 percent of each beaked whale species will be harassed by these activities. NMFS believes that the initial take numbers generated by the Navy's model are overestimates, that the mitigation measures will reduce that percent somewhat (especially through measures that don't depend on detection, such as exclusion zones and circumstantial powerdowns), and that the beaked whale populations extend past the EEZ (make sure spelled out first time in document), which means that a smaller percent of the population will be affected by the activities within the EEZ that what was modeled. This, coupled with the temporary nature of the exercise and the implementation of the new shutdown criteria, leads NMFS to believe the activity will have a negligible impact on beaked whale populations.

Comment 58: NMFS cannot make negligible impact determinations for species other than beaked whales

because the portions of the populations affected by the activity are too high.

Response: As mentioned in the prior response and in the Negligible Impact Determination section, NMFS believes that the actual portion of the populations affected by the RIMPAC exercises is significantly smaller than modeled number of individuals taken divided by the estimated abundance in the EEZ. In addition to the reasons stated in the previous response, the percent of the population affected is even smaller for animals with significantly larger densities inshore than offshore (due to the 25–km (13.5–nm) exclusion zone) and for animals with large average group sizes or large body size (far more detectable through monitoring). Tables 3 and 4 discuss what factors were considered in the negligible impact determination.

Comment 59: NMFS must also consider other RIMPAC exercises that might impact marine mammals that are intertwined with anti-submarine warfare exercises, such as air-to-surface gunnery exercises, mine countermeasures, etc.

Response: The Navy applied for an authorization for take of marine mammals incidental to ASW exercises. As described in the application, the ASW exercises are discrete exercises.

Comment 60: NMFS' notice states that RIMPAC will not have an unmitigable adverse impact on the availability of the species or stocks for subsistence uses. The notice should clarify that only the subsistence hunting of marine mammals by Alaska natives is considered in the findings under either 101(a)(5)(A) or 101(a)(5)(D) of the MMPA.

Response: After reviewing the statute, NMFS believes the commenter is correct and has removed the reference to that finding from the appropriate documents.Other Comments

Comment 61: Foreign vessels and crews cannot avail themselves of an IHA for the harassment of marine mammals in the U.S. Exclusive Economic Zone because section 101(a)(5)(D) of the MMPA is available only to ''citizens of the United States.''

Response: This doesn't have an associated comment-think it belongs one or two pages up where there's no response to a comment on this issue. The U.S. Navy is the applicant for purposes of this IHA for RIMPAC 2006 exercises and qualifies as a U.S. citizen under NMFS regulations. NMFS has issued the IHA to the Navy, which is hosting the exercises. As the holder of the IHA, the Navy is responsible for implementing the terms and conditions of the IHA, which requires that all participants in RIMPAC ASW activities abide by the IHA's mitigation and monitoring requirements. The Navy has indicated that all foreign vessels participating in RIMPAC 2006 will be under the Operational Control (OPCON) of Commander, U.S. THIRD Fleet in his capacity as Officer Conducting the Exercise (OCE) and Commander, Combined Task Force (CCTF) RIMPAC. As such, all forces assigned, including foreign vessels and aircraft operating under CCTF RIMPAC OPCON, are required to comply with the environmental mitigation measures spelled out in Annex L to the RIMPAC 2006 OPORDER as a condition of participating in the exercise. Under Annex L and two other annexes, all vessels, including foreign ships, are required to make sonar use reports in the daily operational summary.

Comment 62: NMFS sets the injury threshold at 215 dB (for PTS); yet we say that ''some marine mammals may react to mid-frequency sonar, at received levels lower than those thought to cause direct physical harm, with behaviors that may, in some circumstances, lead to physiological harm, stranding, or, potentially, death''. If this is the case, the Level A harassment threshold should be lower.

Response: Thresholds represent sound levels at which NMFS predicts marine mammals are likely to be harassed in a certain way or to a certain level. The behavioral Level B harassment threshold represents the level at which NMFS believes marine mammals are likely behaviorally harassed. Within the range of potential behavioral responses rising to the level of harassment, a small subset of the animals exposed may respond behaviorally or physiologically in a way that leads to a stranding. Such an extreme reaction by some animals does not necessarily justify the establishment of a general threshold, but instead an awareness of the possibility of this response and implementation of mitigation measures to address it, such as those contained in this IHA (e.g., 25–km (13.5 nm) exclusion zone, extra monitoring, etc.). Additionally, the exact mechanisms that lead to a stranding are not well understood, and it is believed that there are often other (unknown) contributing factors involved. NMFS does not believe it is appropriate to use sound levels that represent the onset of the behavioral disturbance to also represent the onset of injury when other contributing factors may be necessary to get to injury from the initial behavioral disturbance.

Comment 63: The Navy should keep, and make available to NMFS if a stranding occurs, a detailed log of sonar use. The detailed report required to NMFS should be made available to NMFS within a given amount of time after RIMPAC is completed.

Response: The Navy keeps very specific records of when and where sonar is operated. The Navy will make both classified ''secret' and unclassified reports to NMFS after RIMPAC. In the event of a stranding, the Navy will coordinate with NMFS to provide the needed information regarding the positioning of the operating sonar within the OpArea. Unclassified reports from the Navy are immediately available to the public. Classified reports will be made available as they are unclassified.

Comment 64: The commenter is concerned that the RIMPAC proposal is using the Navy's draft EIS for the USWTR proposal even while the assumptions, methodologies, and substantiating information are still in draft and are still under review.

Response: Some of the information in the Navy's draft EIS for USWTR constitutes the best available science, even if it is still in review.

Comment 65: The commenter is troubled that conservation organizations need to continually expend their resources and energies attempting to stem the destruction of marine habitat by the U.S. Navy. The commenter states that the ''burden of proof'' falls upon those who are attempting to conserve marine mammal habitat, and not the U.S. Navy, who are proposing assaults and compromises to the environment.

Response: NMFS cannot address this issue.

Comment 66: NMFS received approximately 120 general comments of opposition within the comment period, and approximately 100 additional comments of general opposition after the comment period closed. Many of the commenters did not think that NMFS should authorize the Navy to injure or kill the animals and many expressed the thought that we should avoid impacts to marine mammals.

Response: NMFS appreciates the outpouring of concern for the well-being of the marine mammals around the Hawaiian Islands. As a clarification, NMFS has not authorized the injury or mortality of marine mammals and has including mitigation and monitoring measures to reduce the potential for injury or mortality, as well as instituting stranding shutdown protocols for use in the event of any stranding. Further, though NMFS does not ask for protective measures meant to entirely avoid disturbance of marine mammals, which would preclude the need for an authorization, we have included measures intended to affect the least

practicable adverse impact on the species.

Mitigation, Monitoring, and Reporting

The Navy has requested an IHA from NMFS for the take, by harassment, of marine mammals incidental to RIMPAC ASW exercises in the OpArea. Section 101(a)(5)(D) of the MMPA, the section pursuant to which IHAs are issued, may not be used to authorize mortality or serious injury leading to mortality. The Navy's analysis of the RIMPAC ASW exercises concluded that no mortality or serious injury leading to mortality would result from the proposed activities. However, NMFS believes that some marine mammals may react to mid-frequency sonar, at received levels lower than those thought to cause direct physical harm, with behaviors that may lead to physiological harm, stranding, or, potentially, death. Therefore, in processing the Navy's IHA request, NMFS has required additional mitigation and monitoring than originally proposed in the Navy's application, which is intended to ensure that mortality or serious injury leading to mortality does not result from the proposed activities.

In any IHA issued there is the requirement to supply the ''means of effecting the least practicable [adverse] impact upon the affected species.'' NMFS' determination of ''the least practicable adverse impact on the affected species'' includes consideration of personnel safety, practicality of implementation, and impact on the effectiveness of military readiness activities. While NMFS' proposed mitigation and monitoring requirements discussed below are intended to effect the ''least practicable adverse impact'', they are also designed to ensure that no mortality or serious injury leading to mortality occurs, so that an IHA may be legally issued under the MMPA.

Changes Made in the IHA Since the Proposed IHA was published in the FR

Three changes have occurred in the authorization since the proposed IHA was published in the **Federal Register**: (1) a mitigation measure was added wherein during chokepoint exercises the Navy must ensure that a 2000 m (6561 ft) (vs. 1000 m (3280 ft) in non-chokepoint exercises) radius is clear of marine mammals prior to startup of sonar; (2) stranding shutdown protocols were included in the IHA; and (3) the Navy requested they be allowed to conduct 6.5 hours of sonar operations within the part of the PMRF that falls within 25 km (13.5 nm) of the 200–m (656–ft) isobath, and NMFS subsequently made the requested modification to the IHA and added a mitigation measure that requires the Navy abide by the applicable existing chokepoint mitigation measures when conducting these activities. These changes are addressed in more detail in the ''Additional Mitigation, Monitoring, and Reporting Measures Required by NMFS'' section below.

Standard Operating Procedures Proposed in Navy Application

Navy shipboard lookout(s) are highly qualified and experienced observers of the marine environment. Their duties require that they report all objects sighted in the water to the Officer of the Deck (e.g., trash, a periscope, a marine mammal) and all disturbances (e.g., surface disturbance, discoloration) that may be indicative of a threat to the vessel and its crew. There are personnel serving as lookouts on station at all times (day and night) when a ship or surfaced submarine is moving through the water.

Navy lookouts undergo extensive training in order to qualify as a watchstander. This training includes on-the-job instruction under the supervision of an experienced watchstander, followed by completion of the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects). In addition to these requirements, many Fleet lookouts periodically undergo a 2-day refresher training course.

The Navy includes marine species awareness as part of its training for its bridge lookout personnel on ships and submarines. Marine species awareness training was updated in 2005 and the additional training materials are now included as required training for Navy lookouts. This training addresses the lookout's role in environmental protection, laws governing the protection of marine species, Navy stewardship commitments, and general observation information to aid in avoiding interactions with marine species. Marine species awareness and training is reemphasized by the following means:

Bridge personnel on ships and submarines–Personnel utilize marine species awareness training techniques as standard operating procedure, they have available the ''whale wheel'' identification aid when marine mammals are sighted, and they receive updates to the current marine species awareness training as appropriate.

Aviation units–All pilots and aircrew personnel, whose airborne duties during ASW operations include searching for submarine periscopes, report the presence of marine species in the vicinity of exercise participants.

Sonar personnel on ships, submarines, and ASW aircraft–Both passive and active sonar operators on ships, submarines, and aircraft utilize protective measures relative to their platform.

The Environmental Annex to the RIMPAC Operational Order mandates specific actions to be taken if a marine mammal is detected and these actions are standard operating procedure throughout the exercise.

Implementation of these protective measures is a requirement and involves the chain of command with supervision of the activities and consequences for failing to follow orders. Activities undertaken on a Navy vessel or aircraft are highly controlled. Very few actions are undertaken on a Navy vessel or aircraft without oversight by and knowledge of the chain of command. Failure to follow the orders of one's superior in the chain of command can result in disciplinary action.

Operating Procedures

The following procedures are implemented to maximize the ability of operators to recognize instances when marine mammals are close aboard and avoid adverse effects to listed species:

Visual detection/ships and submarines–Ships and surfaced submarines have personnel on lookout with binoculars at all times when the vessel is moving through the water. Standard operating procedure requires these lookouts maintain surveillance of the area visible around their vessel and to report the sighting of any marine species, disturbance to the water's surface, or object (unknown or otherwise) to the Officer in Command.

Visual detection/aircraft–Aircraft participating in RIMPAC ASW events will conduct and maintain, whenever possible, surveillance for marine species prior to and during the event. The ability to effectively perform visual searches by participating aircraft crew will be heavily dependent upon the primary duties assigned as well as weather, visibility, and sea conditions. Sightings would be immediately reported to ships in the vicinity of the event as appropriate.

Passive detection for submarines - Submarine sonar operators will review detection indicators of close-aboard marine mammals prior to the commencement of ASW operations involving active mid-frequency sonar.

When marine mammals are detected close aboard, all ships, submarines, and aircraft engaged in ASW would reduce

mid-frequency active sonar power levels in accordance with the following specific actions:

(1) Helicopters shall observe/survey the vicinity of an event location for 10 minutes before deploying active (dipping) sonar in the water. Helicopters shall not dip their sonar within 200 yards of a marine mammal and shall secure pinging if a marine mammal closes within 200 yards after pinging has begun.

(2) Note: Safety radii, power-down, and shut-down zones proposed by the Navy have been replaced with more conservative measures required by NMFS and are discussed in the next section.

The RIMPAC Operational Order Environmental includes specific measures, including the measures required by NMFS' IHA, that are to be followed by all exercise participants, including non-U.S. participants.

The Navy proposes that training be provided to exercise participants and NOAA officials before and during the in port phase of RIMPAC (26–30 Jun 06). This will consist of exercise participants (CO/XO/Ops) reviewing the C3F Marine Mammal Brief, available OPNAV N45 video presentations, and a NOAA brief presented by C3F on marine mammal issues in the Hawaiian Islands. The Navy will also provide the following training for RIMPAC participants:

(1) NUWC will train observers on marine mammal identification observation techniques

(2) Third fleet will brief all participants on marine mammal mitigation requirements

(3) Participants will receive video training on marine mammal awareness

(4) Navy offers NOAA/NMFS opportunity to send a representative to the ashore portion of the exercise to address participants and/or observe training.

Conservation Measures (Research)

The Navy will continue to fund ongoing marine mammal research in the Hawaiian Islands. Results of conservation efforts by the Navy in other locations will also be used to support efforts in the Hawaiian Islands. The Navy is coordinating long term monitoring/ studies of marine mammals on various established ranges and operating areas:

(1) Coordinating with NMFS to conduct surveys within the selected Hawaiian Islands Operating Area as part of a baseline monitoring program.

(2) Implementing a long-term monitoring program of marine mammal populations in the OpArea, including evaluation of trends.

(3) Continuing Navy research and Navy contribution to university/external research to improve the state of the science regarding marine species biology and acoustic effects.

(4) Sharing data with NMFS and the public, via the literature, for research and development efforts.

The Navy has contracted with a consortium of researchers from Duke University, University of North Carolina at Wilmington, University of St. Andrews, and the NMFS Northeast Fisheries Science Center to conduct a pilot study analysis and develop a survey and monitoring plan that lays out the recommended approach for surveys (aerial/shipboard, frequency, spatial extent, etc.) and data analysis (standard line-transect, spatial modeling, etc.) necessary to establish a baseline of protected species distribution and abundance and monitor for changes that might be attributed to ASW operations on the Atlantic Fleet Undersea Warfare Training Range. The Research Design for the project will be utilized in evaluating the potential for implementing similar programs in the Hawaiian Islands ASW operations areas. In addition, a Statement of Interest has been promulgated to initiate a similar research and monitoring project in the Hawaiian Islands and the remainder of the Pacific Fleet OPAREAs. The execution of funding to begin the resultant monitoring is planned for the fall of 2006.

Reporting

The RIMPAC Operational Order Environmental Annex (see example in Appendix A of the application) includes specific reporting requirements related to marine mammals.

Additional Proposed Mitigation, Monitoring, and Reporting Measures Required by NMFS

The following protective mitigation and monitoring measures will be implemented in addition to the standard operating procedures discussed in the previous section:

(1) The Navy will operate sonar at the lowest practicable level, not to exceed 235 dB, except for occasional short periods of time to meet tactical training objectives.

(2) Safety Zones - When marine mammals are detected by any means (aircraft, lookout, or acoustically) within 1000 m (3280 ft) of the sonar dome (the bow), the ship or submarine will limit active transmission levels to at least 6 dB below normal operating levels. Ships and submarines will continue to limit maximum ping levels by this 6–dB factor until the animal has been seen to leave the area, has not been seen for 30 minutes, or the vessel has transited more than 2000 m beyond the location of the sighting.

Should a marine mammal be detected within or closing to inside 500 m (1640 ft) of the sonar dome, active sonar transmissions will be limited to at least 10 dB below the equipment's normal operating level. Ships and submarines will continue to limit maximum ping levels by this 10–dB factor until the animal has been seen to leave the area, has not been seen for 30 minutes, or the vessel has transited more than 1500 m (4920 ft) beyond the location of the sighting.

Should the marine mammal be detected within or closing to inside 200 m (656 ft) of the sonar dome, active sonar transmissions will cease. Sonar will not resume until the animal has been seen to leave the area, has not been seen for 30 minutes, or the vessel has transited more than 1200 m beyond the location of the sighting.

If the Navy is operating sonar above 235 dB and any of the conditions necessitating a powerdown arise ((f), (g), or (h)), the Navy shall follow the requirements as though they were operating at 235 dB - the normal operating level (i.e., the first powerdown will be to 229 dB, regardless of at what level above 235 sonar was being operated).

(3) In strong surface ducting conditions, the Navy will enlarge the safety zones such that a 6–dB power-down will occur if a marine mammal enters the zone within a 2000 m (6561 ft) radius around the source, a 10–dB power-down will occur if an animal enters the 1000 m (3280 ft) zone, and shut down will occur when an animal closes within 500 m (1640 ft) of the sound source.

(4) In low visibility conditions (i.e., whenever the entire safety zone cannot be effectively monitored due to nighttime, high sea state, or other factors), the Navy will use additional detection measures, such as infrared (IR) or enhanced passive acoustic detection. If detection of marine mammals is not possible out to the prescribed safety zone, the Navy will power down sonar (per the safety zone criteria above) as if marine mammals are present immediately beyond the extent of detection. (For example, if detection of marine mammals is only possible out to 700 m (2296 ft), the Navy must implement a 6–dB powerdown, as though an animal is present at 701 m (2299 ft), which is inside the 1000–m (3280–ft) safety zone)

(5) With the exception of three specific choke-point exercises (special

measures outlined in item 8), the Navy will not conduct sonar activities in constricted channels or canyon-like areas.

(6) With the exception of three specific ''choke-point'' exercises (special measures outlined in item 8), and events occurring on range areas managed by PMRF, the Navy will not operate mid-frequency sonar within 25 km (13.5 nm) of the 200 m (656 ft) isobath.

(7) Navy watchstanders, the individuals responsible for detecting marine mammals in the Navy's standard operating procedures, will participate in marine mammal observer training by a NMFS-approved instructor (NMFS will work with Navy to develop appropriate format, potentially to be presented to Navy personnel during the port phase of RIMPAC, June 26–30). Training will focus on identification cues and behaviors that will assist in the detection of marine mammals and the recognition of behaviors potentially indicative of injury or stranding. Training will also include information aiding in the avoidance of marine mammals and the safe navigation of the vessel, as well as species identification review (with a focus on beaked whales and other species likely to strand). At least one individual who has received this training will be present, and on watch, at all times during operation of tactical mid-frequency sonar, on each vessel operating mid-frequency sonar.

(8) The Navy will conduct no more than three ''choke-point'' exercises. These exercises will occur in the Kaulakahi Channel (between Kauai and Niihau) and the Alenuihaha Channel (between Maui and Hawaii). These exercises fall outside of the requirements listed above in 5 and 6, i.e., to avoid canyon-like areas and to operate sonar farther than 25 km (13.5 nm) from the 200 m (656 ft) isobath. The additional measures required for these three choke-point exercises are as follows:

(a) The Navy will provide NMFS (Stranding Coordinator and Protected Resources, Headquarters) and the Hawaii marine patrol with information regarding the time and place for the choke-point exercises 24 hours in advance of the exercises.

(b) The Navy will have at least one dedicated Navy marine mammal observer who has received the NMFS-approved training mentioned above in 7, on board each ship and conducting observations during the operation of mid-frequency tactical sonar during the choke-point exercises. The Navy has also authorized the presence of two experienced marine mammal observers (non-Navy personnel) to embark on Navy ships for observation during the exercise.

(c) Prior to start up or restart of sonar, the Navy will ensure that a 2000–m (6561–ft) radius around the sound source is clear of marine mammals.

(d) The Navy will coordinate a focused monitoring effort around the choke-point exercises, to include pre-exercise monitoring (2 hours), during-exercise monitoring, and post-exercise monitoring (1–2 days). This monitoring effort will include at least one dedicated aircraft or one dedicated vessel for realtime monitoring from the pre- through post-monitoring time period, except at night. The vessel or airplane may be operated by either dedicated Navy personnel, or non-Navy scientists contracted by the Navy, who will be in regular communication with a Tactical Officer with the authority to shut-down, power-down, or delay the start-up of sonar operations. These monitors will communicate with this Officer to ensure the 2000–m (6561–ft) safety zone is clear prior to sonar start-up, to recommend power-down and shut-down during the exercise, and to extensively search for potentially injured or stranding animals in the area and down-current of the area post-exercise.

(e) The Navy will further contract an experienced cetacean researcher to conduct systematic aerial reconnaissance surveys and observations before, during, and after the choke-point exercises with the intent of closely examining local populations of marine mammals during the RIMPAC exercise.

(f) Along the Kaulakahi Channel (between Kauai and Niihau), shoreline reconnaissance and nearshore observations will be undertaken by a team of observers located at Kekaha (the approximate mid point of the Channel). Additional observations will be made on a daily basis by range vessels while enroute from Port Allen to the range at PMRF (a distance of approximately 16 nm (30 km) and upon their return at the end of each day's activities. Finally, surveillance of the beach shoreline and nearshore waters bounding PMRF will occur randomly around the clock a minimum four times in each 24 hour period.

(g) In the Alenuihaha Channel (between Maui and Hawaii), the Navy will conduct shoreline reconnaissance and nearshore observations by a team of observers rotating between Mahukona and Lapakahi before, during, and after the exercise.

(9) The Navy will conduct five exercises in the Pacific Missile Range Facilities that fall within 25 km (13.5 nm) of the 200–m (656–ft) isobath. The live sonar component of these 5 exercises will total approximately 6.5 hours. During these exercises, the Navy will conduct the monitoring described in (8)(b), (c), and (d).

(10) NMFS and the Navy will continue coordination on the ''Communications and Response Protocol for Stranded Marine Mammal Events During Navy Operations in the Pacific Islands Region'' that is currently under preparation by NMFS PIRO to facilitate communication during RIMPAC. The Navy will coordinate with the NMFS Stranding Coordinator for any unusual marine mammal behavior, including stranding, beached live or dead cetacean(s), floating marine mammals, or out-of-habitat/milling live cetaceans that may occur at any time during or shortly after RIMPAC activities. After RIMPAC, NMFS and the Navy (CPF) will prepare a coordinated report on the practicality and effectiveness of the protocol that will be provided to Navy/NMFS leadership.

(11)The Navy will provide a report to NMFS after the completion of RIMPAC that includes:

(a) An estimate of the number of marine mammals affected by the RIMPAC ASW exercises and a discussion of the nature of the effects, if observed, based on both modeled results of real-time exercises and sightings of marine mammals.

(b) An assessment of the effectiveness of the mitigation and monitoring measures with recommendations of how to improve them.

(c) Results of all of the marine species monitoring (real-time Navy monitoring from all platforms, independent aerial monitoring, shore-based monitoring at chokepoints, etc.) before, during, and after the RIMPAC exercises.

(d) As much information (unclassified and, to appropriate recipients, classified ''secret'') as the Navy can provide including, but not limited to, where and when sonar was used (including sources not considered in take estimates, such as submarine and aircraft sonars) in relation to any measured received levels (such as at sonobuoys or on PMRF range), source levels, numbers of sources, and frequencies, so it can be coordinated with observed cetacean behaviors.

The mitigation and monitoring proposed in this IHA are intended to function adaptively, and NMFS fully expects to refine them for future authorizations based on the reporting input from the Navy.

Shutdown Criteria

Pursuant to section101(a)(5)(D)(iv) of the MMPA, The Secretary of Commerce shall modify, suspend, or revoke an authorization if the Secretary finds that the provisions of clauses (i) or (ii) of section 101(a)(5)(D) are not being met. Marine mammal strandings are a common event in Hawaii and over the course of the 22 days of ASW exercises, NMFS expects that 1 or 2 single-animal strandings may occur that are not related to RIMPAC. To distinguish these strandings from a stranding that NMFS believes may occur as a result of exposure to the hull-mounted Mid-Frequency Active Sonar (MFAS) activities covered in this authorization, NMFS and the U.S. Navy have established this ''shutdown criteria'' to provide the necessary time for the Secretary to investigate the cause of uncommon marine mammal stranding events and determine whether the IHA should be modified, suspended, or revoked. The established protocols in place between NMFS Stranding Coordinator Pacific and COMPACFLT Environmental Coordinator are the basis for this document.

Definitions

Shutdown area–An area within 50 km (27 nm) of the half of the island centered on the place where the animal was found.

Limited Chokepoint Shutdown–Temporary suspension of the hull-mounted MFAS during the choke point exercises.

Uncommon Stranding Event–An event involving any one of the following:

- Two or more individuals of a commonly stranded species found dead or live beached within a two day period (not including mother/calf pairs), or
- A single uncommonly stranded whale found dead or live beached, or
- A group of 10 or more animals milling out of habitat (e.g. such as occurred with melon headed whales in Hanalei Bay in 2004)

Commonly Stranded Odontocete Species–spinner dolphin, striped dolphin, Kogia sp, Tursiops sp, melon-headed whale, pilot whale, and sperm whales.

Investigation–consists of the following components and can be conducted within 3 days of notification of a stranding event

(1) NMFS will undertake a survey around stranding site to search for other stranded/out of habitat animals

(2) Physical Exam of animal (and blood work if live animals) to investigate and verify presence or absences

(a) Of impacts on the hearing of live stranded mammals. If feasible and if medical condition of the animal allows, Acoustic Brainstem Response (ABR) and Auditory Evoke Potential (AEP) will be conducted to rapidly assess whether the hearing of a live stranded animal has been affected.

(b) Of long term illness (based on body condition), life threatening infection, blunt force traumas or fishery interaction that would indicate the likely cause of death

(c) Of gross lesions or CT/MRI findings that have been documented in previous sonar related strandings (i.e., gas emboli or fat emboli, hemorrhages in organs, hemorrhage in ears). Note: Care must be taken to control and document the conditions under which the carcass is handled. The investigation of microscopic histology can be compromised by the decomposition, freeze/thaw, transport conditions and subsequent necropsy of the mammal.

(3) Evaluation of environmental conditions (through remote sensing, modeling and direct observations) preceding and during the stranding or out of habitat event to determine if environmental factors that are known to contribute to such events were in place, such as fronts, swells, particular currents, Kona winds, prey abundance, seismic events, lunar phase, toxins or predators in area. Navy will assist in providing environmental data that is otherwise collected for tactical purposes.

- Strong evidence of environmental factors that might contribute to stranding event were present
- Weak to no evidence of environmental factors that might contribute to stranding were present

(4) Within 72 hours of notification of an Uncommon Stranding Event, Navy will provide information regarding where and what (or where not) the Navy was operating sonar leading up to the stranding.

Shutdown Protocol:

1. NMFS will respond to all reports of marine mammal strandings during the exercise. If a stranding is suspected to be an Uncommon Stranding Event, the NMFS Stranding Coordinator Pacific will immediately notify the COMPACFLT Environmental Coordinator. The Coordinators will utilize existing protocols as amplified by this document to verify whether or not an event constitutes an Uncommon Stranding Event.

2. If an Uncommon Stranding Event is verified, NMFS will inform the Navy and will identify the shutdown area. NMFS will also confirm with Navy the start time and duration of any recent choke-point exercises.

3. The Navy will cease hull-mounted MFAS activities in the shutdown area. Additionally, if the uncommon stranding event occurred during or within 48 hours of the end of a choke point exercise the Navy will invoke the limited choke point shutdown for up to 4 days.

4. NMFS will conduct its investigation and inform the Navy of its findings as soon as possible, but no later than 4 days from the date the Uncommon Stranding Event was verified.

5. If the results of the investigation indicate that the stranding resulted from causes other than activities covered by this authorization NMFS will inform the Navy that exercises authorized by this IHA may resume.

6. If NMFS determines that the Navy's activities authorized under the IHA may have contributed to the uncommon marine mammal stranding event NMFS will advise the Navy whether the IHA should be modified, suspended, or revoked.

Communication

Effective communication is critical to the successful implementation of this protocol.

- NMFS will provide Navy with a list of NMFS staff, empowered to inform the Navy to implement the appropriate shutdown protocol as described above. These individuals will be reachable 24 hours/day for 22 consecutive days (a pre-identified group will be on call in shifts to make these decisions and a phone tree will be available). Week-end on call will be designated for HQ staff by noon on Friday.
- Navy will provide NMFS a list of people empowered to implement the shut down protocol, at least one of whom will be reachable at any hour during the 22 days of ASW exercises prior to the initiation of the exercise

Negligible Impact Determination and Avoidance of Mortality of Marine Mammals

Negligible Impact

Negligible impact is defined 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.'' Because NMFS does not authorize or expect any mortality or injury to result from these activities, NMFS believes the authorized takings, by harassment, can be reasonably expected not to adversely

affect the species or stock through effects on annual rates of survival. NMFS acknowledges that Level B Harassment to large enough portions of a species or stock or over a long enough time could potentially adversely affect survival rates, however, due to the required mitigation and monitoring during this proposed activity (which reduce the numbers of animals exposed and the levels they are exposed to), as well as the duration and nature of the activities, NMFS does not believe the RIMPAC ASW exercises will adversely affect survival of any of the affected species.

As discussed earlier (see Stress Responses), some portion of the animals exposed to SELs greater than 173 dB during the RIMPAC exercises will undergo a physiological stress response. Relationships between stress responses and inhibition of reproduction (by suppression of pre-ovulatory luteinizing hormones, for example) have been well-documented. However, NMFS believes the manner in which individual animals respond to different stressors varies across a continuum that is normally distributed with hyper-sensitive and hypo-sensitive animals being on the tails of the curve. Therefore, NMFS does not believe that much more than a small portion of animals exposed to sound levels above 173 dB would respond in a manner that physiologically inhibits reproduction. Additionally, suppression of pre-ovulatory luteinizing hormones would only be of a concern to species whose period of reproductive activity overlaps in time and space with RIMPAC. NMFS also believes that due to the enhanced nature of the monitoring required in this authorization, combined with the shutdown zones, the likelihood of seeing and avoiding mother/calf pairs or animals engaged in social reproductive behaviors is high. Consequently, NMFS believes it is unlikely the authorized takings will adversely affect the species or stocks through effects on annual rates of recruitment.

Table 3 summarizes the reasoning behind NMFS' negligible impact determination, in terms of how mitigation measures contribute towards it and what other factors were considered. Several of the measures addressed have a visual monitoring component, which NMFS recognizes is most effective in reducing impacts to larger animals and species that travel in larger groups. However, NMFS has also included coastal and steep bathymetry restrictions, and extended power-down/shut-down zones, which will significantly reduce the numbers of animals taken, regardless of whether they are cryptic or easily seen, and will effectively reduce the likelihood of mortality, or serious injury, of marine mammals.

BILLING CODE 3510–22–S

Qualitative Assessment of Negligible Impact and Minimization of Mortality and Serious Injury	
Measures that make the chances of a stranding less likely	**Mechanisms**
1) No sonar operation in areas of steep bathymetry or constricted channels (except for 3 chokepoint exercises)	Measures 1, 2, and 3 all reduce the chances of a confluence of 3 or more of the five factors believed to have contributed to the Bahamas stranding
2) Expanded power-/shut-down zone in strong surface-ducting conditions (2 km power-down, 500m shutdown)	Measure 3 also gives beaked whales (or other deep divers) that may potentially have been driven by sonar into a constricted channel or shallow disorienting circumstances, a wider berth around the sound source to escape to deeper water through
3) No sonar operation within 25 km of 200 m isobath (except for three chokepoint exercises)	Measure 4 (because of wider view and ability to cover larger area) specifically decreases the chances that animals will enter the safety zone without being seen and increases the chances that injured animals or animals exibiting abnormal behaviors (indicative of a potential stranding) are sighted, and sonar shut down
4) During chokepoint exercises, real-time aerial monitoring linked to sonar operation (to advise shut-down, etc.)	*All Measures in this section also reduce #s animals exposed and levels exposed to
Measures that further contribute to a negligible impact	
5) Standard (not during strong surface ducts) expanded, power-down zones	In Measure 5 (versus the power-/shutdown at injury threshold required in previous authorizations), power-down will occur if an animal gets within 1000 m (which NMFS believes will typically be at a distance ensonified to a lower level than that thought to induce injury) and again at 500 m, which will both reduce the numbers of animals exposed and the levels to which they are exposed.
6) NMFS-trained lookouts will visually monitor around all ships operating mid-frequency sonar	
7) Though most are not dedicated observers, all RIMPAC participants (many with good opportunity) are required to report marine mammal sightings to the Officer in Command (lookouts, pilots, passive acoustic monitors)	In Measures 4, 6, and 7, real-time monitoring, in combination with power- and shut-down zones, decreases both the number of animals potentially exposed to sound, and the sound level to which they are exposed
Further considerations in the negligble impact determination for this specific activity	
A) Because this IHA does not authorize injury or mortality, the chance of adversely affecting the affected species through annual survival rates is low.	
B) The number of individuals harassed, in relation to the abundance of the species or stock, factors into the negligible impact determination. The numbers produced by the model do not take into account that the above measures reduce the the number, as well as the severity, of exposures significantly.	
C) NMFS believes the Navy's model overestimated the number marine mammals taken by assuming that animals remain stationary throughout their overlap with the ensonified area, that an animal is always located in the loudest point in any column of ensonified water, and that every exposure is a different animal .	
D) Additionally, the majority of the populations of the marine mammals around Hawaii extend out beyond the EEZ, and so the percentages of the animals in the EEZ affected are higher than the percentage of the biological populations.	

Table 3. A summary of the Measures that reduce the chance of a stranding and contribute to the negligible impact determination.

As mentioned in Table 3, the number of individuals estimated to be harassed, in relation to the abundance of the species or stock, factors into the

BILLING CODE 3510-22-C

negligible impact determination. In Table 4, NMFS shows the raw percent of the Navy's modeled exposures for each species divided by the estimated abundance of each species within the Hawaiian EEZ. Though NMFS uses these numbers as a starting point for assessing approximately what portion of any affected population may be affected by Level B Harassment through this activity, these numbers suggest impacts to a far greater portion of the populations than NMFS believes will actually occur because they do not take into account several important factors discussed below. Though no particular numeric reduction of the raw modeled percentages can be justified, they are semi-quantitatively addressed in Table 4, which illustrates how certain factors and protective measures reduce the percent of population affected by these activities for each species. Below are the reasons NMFS believes that the percentages of each stock affected are lower:

(1) The effectiveness of mitigation measures has not been taken into account. The following measures will reduce the numbers of individuals harassed:

(a) The 25 km (13.5 nm) coastal exclusion area - For species that have significantly higher densities inshore (10 - 40 times greater within 25 nm (46 km) of the shore), the Navy is excluded from operating sonar within 25 km (13.5 nm) of shore, which significantly reduces the numbers of individuals exposed to sonar. This an especially important point for the spinner dolphin, which has an inshore density of 40 times that of the offshore density.

(b) Monitoring and implementation of powerdowns, shutdowns, and avoidance maneuvers - Species of large body size and large average group size are significantly more likely to be detected by monitoring (active submarine sonar prior to startup, and visual monitoring during the exercise) than those animals that are deep divers or cryptic and the surface, and, therefore, powerdowns and shutdowns are expected to be especially effective in reducing the numbers of these species affected.

(2) The estimated percentage of the portion of the population or stock harassed was calculated by dividing the modeled Level B harassment takes by the estimated abundance in the Hawaiian EEZ. NMFS beleives that the modeled number of takes is an overestimate of the actual number for the following reasons:

(a) As discussed in more detail in the sub-section entitled ''Model'' in the ''Estimated Number of Takes'' section previously, NMFS believes that the model overestimates the take of marine mammals significantly by assuming that animals remain stationary throughout their overlap with the ensonified area and by assuming that an animal is always located in the loudest point in any column of ensonified water.

(b) Additionally, when further analyzing the effects of these takes on the affected species and stocks, NMFS believes it would be unrealistic, considering the fast-paced, multi-vessel nature of the exercise and the fact that the exercise continues over the course of a month in an area with resident populations of cetaceans, to assume that each exposure involves a different whale. Some whales are likely to be exposed once, while others are likely to be exposed more than once. One way to numerically address this concept is to assume that the exposure events would be distributed normally, with the exposures that each affect a different whale falling within one standard deviation (68.26 percent), the exposures assumed to affect different whales each twice within 2 standard deviations (27.18 percent), the exposures assumed to affect different whales each 3 times within 3 standard deviations (4.28 percent), and so on, if the populations are larger. If this relationship is applied to estimated numbers of exposures produced by the Navy's model, the calculated number of affected animals is approximately 16 percent less than the estimated number of exposures for any given species. NMFS acknowledges the lack of specific sonar/marine mammal data to support this approach, however, NMFS believes that this approach will help us more closely approximate the number of animals potentially taken than an assumption that each sonar ping affects a different cetacean.

(3) As mentioned in number 2, the estimated percentage of the portion of the population or stock harassed was calculated by dividing the modeled Level B harassment takes by the estimated abundance in the Hawaiian EEZ. However, almost all of the biological populations extend past the boundary of the Hawaiian EEZ, some to an unknown distance, some pantropically, some to the northern Pacific, and some farther. This means that the percentages of populations effected are further lower than the percentages reported in Table. This point may be less applicable to spinner dolphins and bottlenose dolphins as there may be additional population sub-division within the Hawaiian Islands.

BILLING CODE 3510–22–S

		Percentage of Actual Stock Taken is Generally Lower		Mitigation Measures Especially Effective To Decrease % of Population				
				25 km Coastal Exclusion	Monitoring Especially Effective for Minimizing Take		Monitoring Less Effective For Minimizing Take	
Species	From Model % Taken of Extimated Abundance in EEZ	Rare in Hawaii	Popul. Beyond EEZ	Inshore Density Signif. >> OffshoreDensity*	Large Group Size**	Large Body	Cryptic at Surface	Deep Divers
Sei whale	38	X	X			X		
Fin whale	37	X	X			X		
Bryde's whale	20		X			X		
Sperm whale*	21		X			X		O
Pygmy sperm whale	19		X				O	O
Dwarf sperm whale	21		X				O	O
Cuvier's beaked whale	20		X				O	O
Blainville's beaked whale	21		X				O	O
Longman's beaked whale	19		X		X			
Rough-toothed dolphin	20		X		X			
dolphin	36			X	X			
Pantropical spotted dolphin	44		X	X	X			
Spinner dolphin	103			XX	X			
Striped dolphin	27		X		X			
Risso's dolphin	20		X		X			
Melon-headed whale	21		X		XX			
Fraser's dolphin	20	X	X		XXX			
Pygmy killer whale	17		X		X			
False killer whale	51		X	X	X			
Killer whale	23		X			X		
Short-finned pilot whale	34		X	X	X			

* For "Inshore Density Signif >> Offshore Density", X = 10 times greater, XX = 40 times greater

** For Large Group Size", X = 10 to 40, XX = 89, XXX = 286

Table 4. Based on the Navy model, the second column shows the the percent of the estimated abundance in the EEZ, by species, that could be taken by Level B Harassment by the RIMPAC activities. The middle columns indicate, by Xs, when there is a clear reason to believe that these percentages will be lower for the given reason.

Subsequent to the proposed IHA NMFS published the Final Report being published in the **Federal Register**, addressing the melon-headed whale

BILLING CODE 3510-22-C

event that occurred in Hanalei Bay during the RIMPAC exercises last year. This report concluded that mid-frequency sonar operation in the area was a plausible, if not likely, contributor to the event. NMFS recognizes that the deaths of these animals could potentially have resulted measurable effects on the population. To minimize that possibility in the future, NMFS will implement Shutdown Critieria during RIMPAC that require the Navy to cease sonar operations if an uncommon stranding event (such as the Hanalei event) is verified (see Mitigation, Monitoring, and Reporting above).

NMFS has determined that, based on the nature and duration of the proposed activities, and dependent upon the full implementation of the required mitigation and monitoring measures, which will reduce both the severity of effects on animals that may be potentially exposed and the numbers of animals potentially exposed, the RIMPAC ASW exercises will result in the Level B Harassment of the species addressed here, consisting primarily of temporary behavioral modifications, in the form of temporary displacement from feeding or sheltering areas, low-level physiological stress responses, and, to a lesser extent, TTS. NMFS has further determined that these takings, by harassment, will result in a negligible impact to the affected species or stocks.

Avoidance of Serious Injury or Mortality

NMFS has required a suite of mitigation measures in the IHA that reduces the likelihood of a stranding resulting from the RIMPAC ASW activities. However, several points that were emphasized in the public comments (i.e., the difficulty (even in ideal conditions) of detecting beaked whales, which have been among the species stranded in most of the strandings associated with sonar, and the fact that choke-point exercises will be conducted both at night and in surface-ducting conditions) and the published conclusions of the melon-headed whale stranding report do not allow NMFS to rule out the possibility of a stranding resulting from the RIMPAC ASW activities. Consequently, NMFS has included specific shutdown criteria (see Mitigation and Monitoring, above), which are intended to ensure MMPA compliance. These criteria require the Navy to temporarily cease operating sonar in a designated area when a stranding is verified during the RIMPAC ASW exercise. NMFS will then conduct an investigation, and if NMFS finds that the Navy's activities may have contributed to the stranding, NMFS will modify, revoke, or suspend the IHA.

Endangered Species Act (ESA)

There are seven marine mammal species and five sea turtle species that are listed as endangered or threatened under the ESA with confirmed or possible occurrence in the RIMPAC ASW area: humpback whale, North Pacific right whale, sei whale, fin whale, blue whale, sperm whale, and Hawaiian monk seal, loggerhead sea turtle, the green sea turtle, hawksbill sea turtle, leatherback sea turtle, and olive ridley sea turtle.

Under section 7 of the ESA, the Navy consulted with NMFS on the proposed RIMPAC ASW exercises. NMFS also consulted internally on the issuance of an IHA under section 101(a)(5)(D) of the MMPA for this activity. The Endangered Species Division, NMFS, issued a Biological Opinion (BiOp) that concluded that the proposed action is not likely to result in jeopardy to the species or in the destruction or adverse modification of critical habitat..

The BiOp includes an incidental take statement for harassment of sperm whales, fin whales, and sei whales, which also contains the same required terms and conditions (mitigation, monitoring, and reporting) as those contained in the IHA.

National Environmental Policy Act (NEPA)

In April, 2006, the Navy prepared a revised 2006 Supplement on the 2002 Programmatic Environmental Assessment (EA) on RIMPAC. NMFS has adopted the Navy's EA and issued an associated Finding of No Significant Impact (FONSI).

Conclusions

A determination of negligible impact is required for NMFS to authorize incidental take of marine mammals. By regulation, an activity has a ''negligible impact'' on a species or stock when it is determined that the total taking is not likely to reduce annual rates of adult survival or recruitment (i.e., offspring survival, birth rates). Based on each species' life history information, the expected behavioral patterns of the animals in the RIMPAC locations, the duration of the activity, the anticipated implementation of the required mitigation and monitoring measures, and an analysis of the behavioral disturbance levels in comparison to the overall populations, an analysis of the potential impacts of the Proposed Action on species recruitment or survival support the conclusion that proposed RIMPAC ASW training events would have a negligible impact on the affected species or stocks. NMFS has also determined that the issuance of the IHA would not have an unmitigable adverse impact on the availability of the affected species or stocks for subsistence use. Additionally, NMFS has set forth in its IHA the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings.

Authorization

NMFS has issued an IHA to the Navy for conducting ASW exercises, using tactical mid-frequency sonar, in the Hawaiian Islands OpArea, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: June 29, 2006.

James H. Lecky,

Director, Office of Protected Resources, National Marine Fisheries Service.

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BILLING CODE 3510–22–S