REQUEST FOR A LETTER OF AUTHORIZATION FOR THE INCIDENTAL HARASSMENT OF MARINE MAMMALS RESULTING FROM EGLIN GULF TEST AND TRAINING RANGE (EGTTR) PRECISION STRIKE WEAPONS (PSW) TEST (5-YEAR PLAN)

EGLIN AIR FORCE BASE, FLORIDA

Submitted To:

Office of Protected Resources
National Marine Fisheries Service (NMFS)
1315 East-West Highway
Silver Spring, MD 20910-3226

Submitted By:

Department of the Air Force
AAC/EMSN
Natural Resources Branch
501 DeLeon Street, Suite 101
Eglin AFB, FL 32542-5133

JANUARY 2004

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

μPa	MicroPascal
46 OG/OGMTP	46th Test Wing Precision Strike Division
AAC	Air Armament Center
AAC/EMSN	Air Armament Center/Natural Resources Branch
AFB	Air Force Base
CFR	Code of Federal Regulations
CONEX	Container Express
dB	Decibels
EA	Environmental Assessment
EFD	Energy Flux Density
EFDL	Energy Flux Density Level
EGTTR	Eglin Gulf Test and Training Range
ESA	Endangered Species Act
ft	Feet
GOM	Gulf of Mexico
GPS	Global Positioning System
HOB	Height of Burst
Hz	Hertz
in	Inch
JASSM	Joint Air-to-Surface Stand-off Missile
km^2	Square Kilometers
lb	Pound
LOA	Letter of Authorization
m	Meters
MMPA	Marine Mammal Protection Act
NEW	Net Explosive Weight
NM	Nautical Mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PBR	Potential for Biological Removal
PBX	Plastic Bonded Explosive
PBXN-109	Plastic Bonded Explosive 109
PSW	Precision Strike Weapons
re	Referenced
s	Second
SDB	Small-Diameter Bomb
SERO	Southeast Regional Office
TA	Test Area
TTS	Temporary Threshold Shift
USAF	U.S. Air Force
USN	U.S. Navy
ZOI	Zone of Influence

EXECUTIVE SUMMARY

With this submittal, Eglin Air Force Base requests a Letter of Authorization (LOA) for the incidental taking, but not intentional taking (in the form of noise-related harassment), of small numbers of marine mammals incidental to the Precision Strike Weapon (PSW) testing within the Eglin Gulf Test and Training Range (EGTTR) over the next five years, as permitted by the Marine Mammal Protection Act (MMPA) of 1972, as amended. These tests may expose cetaceans that potentially occur within the EGTTR to noise (Level A and Level B harassment). Because in-place mitigations would clear the area of any marine mammal before detonation, it is anticipated that no federally protected marine animal takes would result in the form of mortality, injury, or Level A harassment.

PSW missions involve air-to-surface impacts of two weapons (the Joint Air-to-Surface Stand-off Missile (JASSM) AGM-158 A and B and the small-diameter bomb (SDB) GBU-39/B) and result in underwater detonations (up to approximately 300 pounds of net explosive weight). As many as two live and four inert JASSM missiles per year would be launched from an aircraft above the Gulf of Mexico (GOM) at a target located approximately 15 to 24 nautical miles (NM) offshore of Eglin Air Force Base and as many as six live and 12 inert SDBs would also be dropped on a target per year. There are two possible targets to be used for the PSW mission tests in the EGTTR. The first is a Container Express (CONEX) target that consists of five containers strapped, braced, and welded together to form a single structure. The other possible target is a water barge.

The potential takes outlined in Section 6 represent the maximum expected number of animals that could be affected. Eglin AFB has employed a number of mitigation measures in an effort to substantially decrease the number of animals potentially affected. Eglin AFB is committed to assessing the mission activity for opportunities to provide operational mitigations (i.e., two helicopters for aerial surveys and visual clearance of the test area). Also, the use of conservative analyses (Section 11) serves as a functional mitigation technique.

Using a conservative density estimate for each species, the zone of influence (ZOI) of each type of missile or bomb deployed, and the total number of events per year, an annual estimate of the potential number of animals exposed to noise (harassed, injured, or killed) was analyzed. PSW testing is anticipated to affect some marine mammal species. Without any mitigation, a remote possibility exists for one each of both the Bottlenose and the Atlantic spotted dolphins to be exposed the noise levels sufficient to cause mortality. Additionally, nearly three cetaceans are estimated to be exposed to injurious Level A harassment noise levels (205 dB re 1 μPa^2-s), and as few as three or as many as 103 cetaceans (depending on the season and water depth) would potentially be exposed (annually) to a non-injurious (TTS) Level B harassment noise level (182 dB re 1 μPa^2-s). No strategic marine mammal stocks would be affected. None of the marine mammal species that could potentially be taken are listed as threatened or endangered. Although analyses also evaluated the potential for animals to experience a sub-TTS behavioral modification, no behavioral takes (176 dB re 1 μPa^2-s) are expected since repetitive exposures to the same animals are highly unlikely due to the infrequent test events, potential variability in target locations, and the continuous movement of the animals.

The information and analyses provided in this application are presented to fulfill the LOA requirements in Paragraphs (1) through (11) of 50 Code of Federal Regulations (CFR) 228.4(a).

1. DESCRIPTION OF ACTIVITIES

This section describes the mission activities conducted in the Eglin Gulf Test and Training Range (EGTTR) that could result in takes under the Marine Mammal Protection Act (MMPA) of 1972, as amended. The actions are air-to-surface test missions involving surface impacts of projectiles, detonations above water, and underwater detonations with the potential to affect cetaceans that may potentially occur within the EGTTR.

1.1 BACKGROUND

The U.S. Air Force (USAF) Air Armament Center (AAC) and U.S. Navy (USN), in cooperation with the 46th Test Wing Precision Strike Division (46 OG/OGMTP), will conduct a series of precision strike weapons (PSW) test missions during the next five years utilizing resources within the Eglin Military Complex, including two sites in the EGTTR (Figure 1-1). The weapons to be tested are the Joint Air-to-Surface Stand-off Missile (JASSM) AGM-158 A and B, and the small-diameter bomb (SDB) GBU-39/B. As many as two live and four inert JASSM missiles per year would be launched from an aircraft above the Gulf of Mexico (GOM) at a target located approximately 15-24 nautical miles (NM) offshore of Eglin Air Force Base. Detonation of the JASSM would occur under one of three scenarios:

- Detonation upon impact with the target (about 5 feet above the GOM surface);
- Detonation upon impact with a barge target at the surface of the GOM; or
- Detonation at 120 milliseconds after contact with the surface of the GOM.

In addition to the JASSM explosive, as many as six live and 12 inert SDBs per year would also be dropped on the target. Detonation of the SDBs would occur under one of two scenarios:

- Detonation of one or two bombs upon impact with the target (about 5 feet above the GOM surface), or
- Height of burst (HOB) test: Detonation of one or two bombs 10 to 25 feet above the GOM surface.

The JASSM (Figure 1-2) is a precision cruise missile designed for launch from outside area defenses to kill hard, medium-hardened, soft, and area type targets. The JASSM has a range of more than 200 NM and carries a 1,000-pound warhead. The JASSM has approximately 300 pounds of TNT equivalent net explosive weight (NEW). The explosive used is AFX-757, a type of plastic bonded explosive (PBX) formulation with higher blast characteristics and less sensitivity to many physical effects that could trigger unwanted explosions. AFX-757 uses less expensive ingredients and is easier to process than current commonly used explosives like tritonal and Plastic Bonded Explosive 109 (PBXN-109). The JASSM would be launched more than 200 NM from the target location. Platforms for the launch include the B-1, B-2, B-52, F-16, F-18, and F-117. Launch from the aircraft would occur at altitudes greater than 25,000 feet. The JASSM would cruise at altitudes greater than 12,000 feet for the majority of the flight profile until it makes the terminal maneuver toward the target.

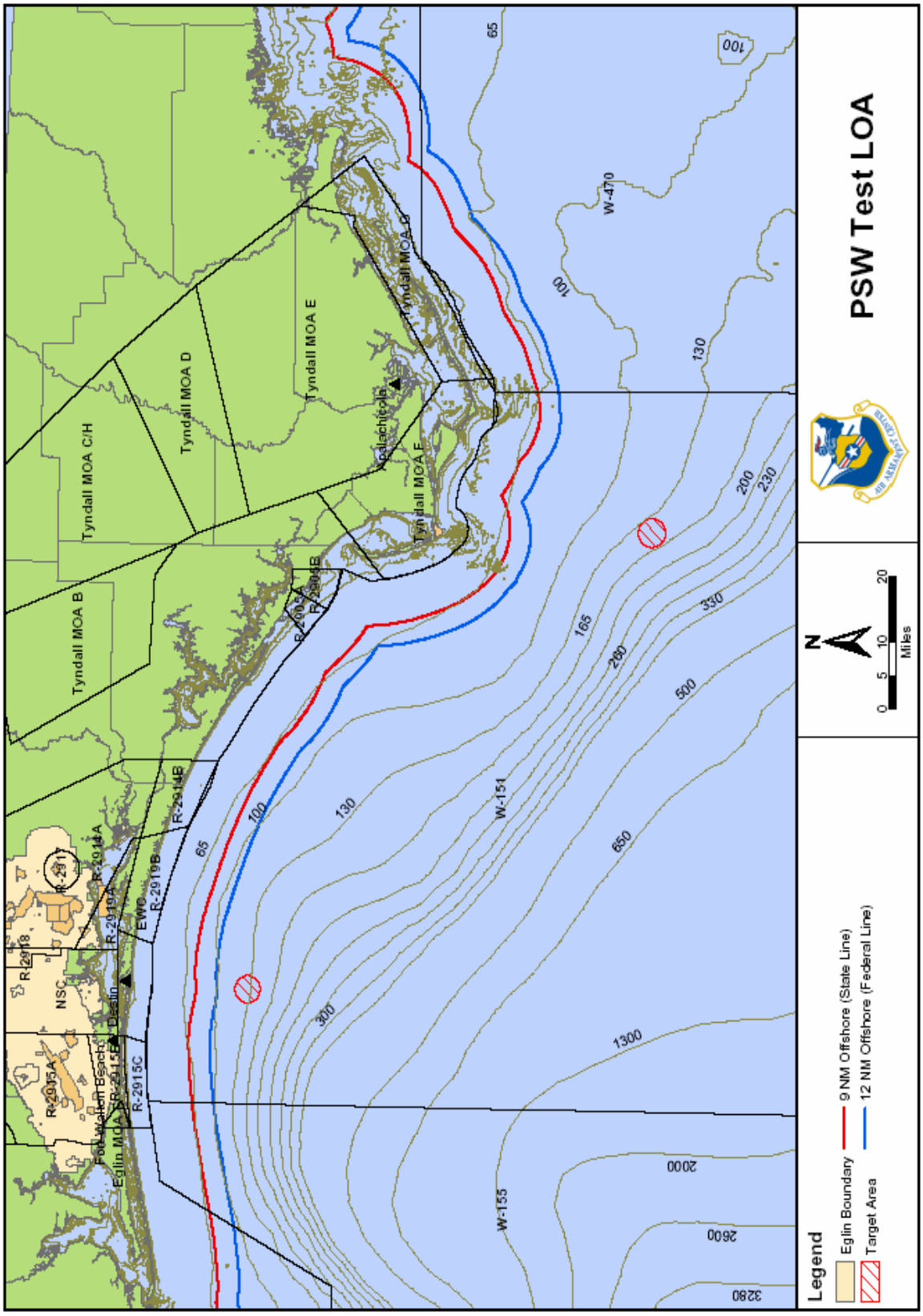

Figure 1-1. PSW Test Target Locations in the Eglin Gulf Test and Training Range (EGTTR)

Figure 1-2. Joint Air-to-Surface Stand-off Missile (JASSM) in Flight

The SDB (Figure 1-3) is a glide bomb. It allows aircraft to carry more munitions to more targets and strike them more effectively with less collateral damage. Because of its capabilities, the SDB system is an important element of the Air Force's Global Strike Task Force. The SDB has a range of up to 50 NM and carries a 217.4-pound warhead. The SDB has approximately 48 pounds of TNT equivalent NEW. The explosive used is AFX-757. The SDB would be launched up to 50 NM from the target location. Platforms for the launch include the B-1, B-2, B-52, F-15, F-16, and F-117. Launch from the aircraft would occur at altitudes greater than 15,000 feet. The SDB would commence a non-powered glide to the intended target.

Figure 1-3. Small-Diameter Bomb (SDB) in Flight

1.2 PROPOSED AIR-TO-SURFACE OPERATIONS

The JASSM involves a maximum of two live shots (single) and four inert shots (single) each year for the next five years. The SDB involves a maximum of six live shots a year, with two of the shots occurring simultaneously and a maximum of 12 inert shots with up to two occurring simultaneously (Table 1-1).

Table 1-1. PSW Test Proposed Action

Weapon	Number of Live Shots Per Year	Number of Inert Shots Per Year
JASSM	2 single shots	4 inert shots
SDB	6 shots (2 single shot and 2 double shot)	12 shots (4 single shots and 4 double shots)

The JASSM and SDBs would be launched from B-1, B-2, B-52, F-15, F-16, F-18, or F-117 aircraft. The JASSM would be launched from the aircraft at altitudes greater than 25,000 feet. The JASSM would cruise at altitudes greater than 12,000 feet for the majority of the flight profile until it makes the terminal maneuver toward the target. The SDB would be launched from the aircraft at altitudes greater than 15,000 feet. The SDB would commence a nonpowered glide to the intended target. Chase aircraft would include F-15, F-16, and T-38 aircraft. These aircraft would follow the test items during captive carry and free flight but would not follow either item below a predetermined altitude as directed by Flight Safety. Other assets on site may include an E-9 turboprop aircraft or MH-60/53 helicopters circling around the target location. Tanker aircraft including KC-10s and KC-135s would also be used. A second unmanned barge may also be on location to hold instrumentation. This barge would be up to 1,000 feet away from the target location.

There are two possible targets to be used for the PSW mission tests in the EGTTR. The first is a CONEX target (Figure 1-4) that consists of five containers strapped, braced, and welded together to form a single structure. The dimensions of each container are approximately 8 feet (ft) by 8 ft by 40 ft. Each container would contain 200 55-gallon steel drums (filled with air and sealed). These provide buoyancy to the target. The second possible target is a hopper barge, typical for transportation of grains, beans, or corn (Figure 1-5). The hopper barge is approximately 30 ft by 12 ft and 125 ft long. The targets would be held in place by a 4-point anchoring system using cables.

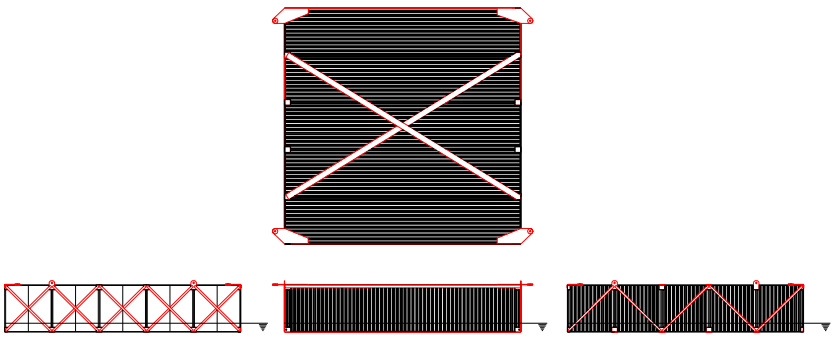

Figure 1-4. Schematic Diagram of the CONEX Target

Figure 1-5. Water Barge Target

The CONEX target would be constructed on land and shipped to the target location two to three days prior to the test. The barge target would also be stationed at target location two to three days prior to the test. Global positioning system (GPS) measurements at the target would be made and relayed to missile launchers as part of the preparation for each test. During an inert mission, the JASSM would pass through the target and the warhead would sink to the bottom of the Gulf. Immediately following impact, the JASSM recovery team would pick up surface debris (from the missile and target). Depending on the test schedule, the target may remain in the GOM for up to one month at a time. If the target is significantly damaged, and it is deemed impractical and unsafe to retrieve it, the target remains may be sunk through coordination with the U.S. Coast Guard or Tyndall Air Force Base. Coordination with the U.S. Army Corps of Engineers will be required prior to sinking a target.

The Proposed Action would occur in the northern GOM in the EGTTR. Targets would be located in less than 200 feet of water and from 15 to 24 NM offshore. Two target locations would be used: (1) south of Eglin Test Area 13-A (TA 13-A) on Santa Rosa Island (Figure 1-6) and (2) south of TA D-3 (Figure 1-7).

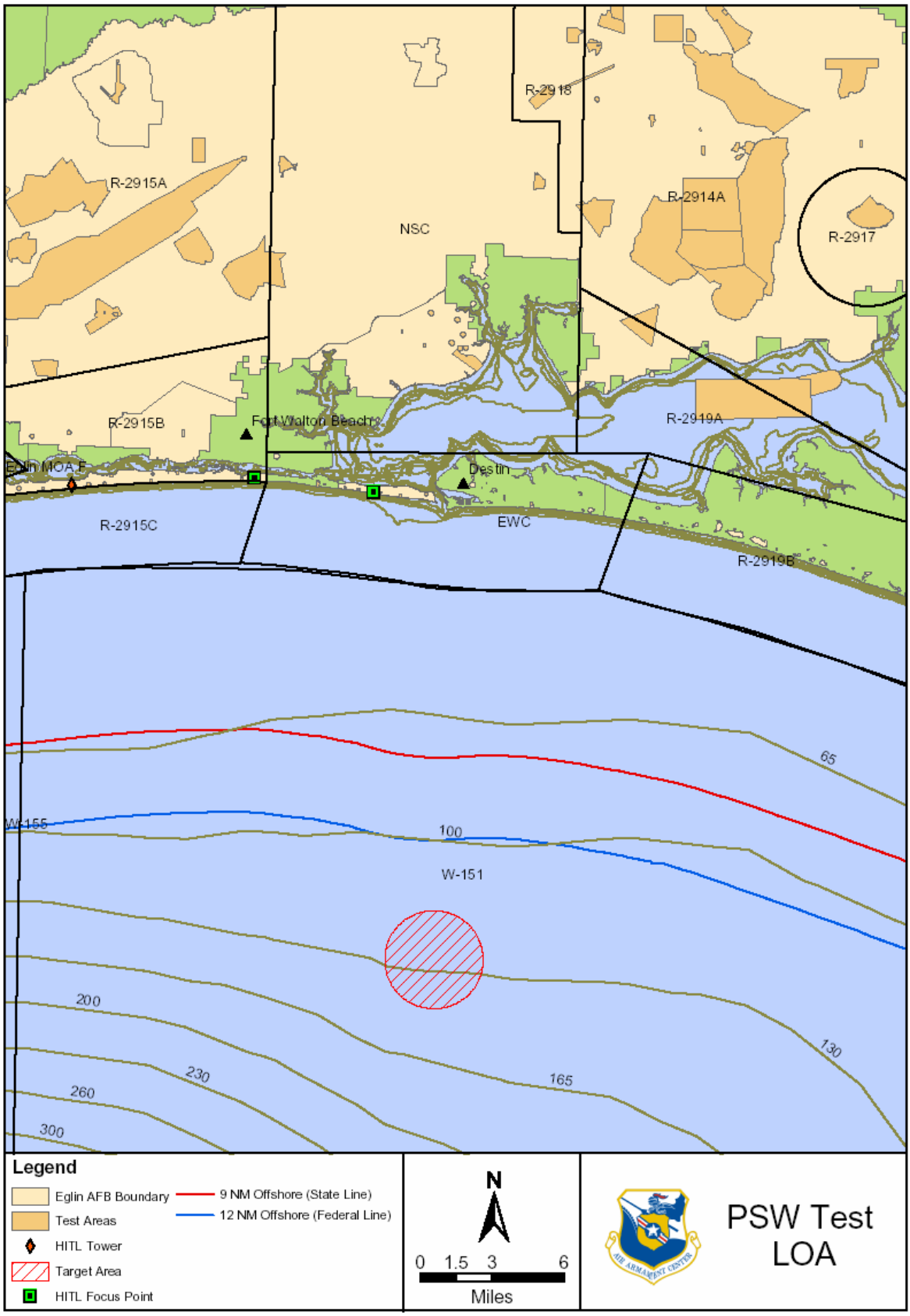

Figure 1-6. PSW Target Location Offshore of Santa Rosa Island, EGTTR, Florida

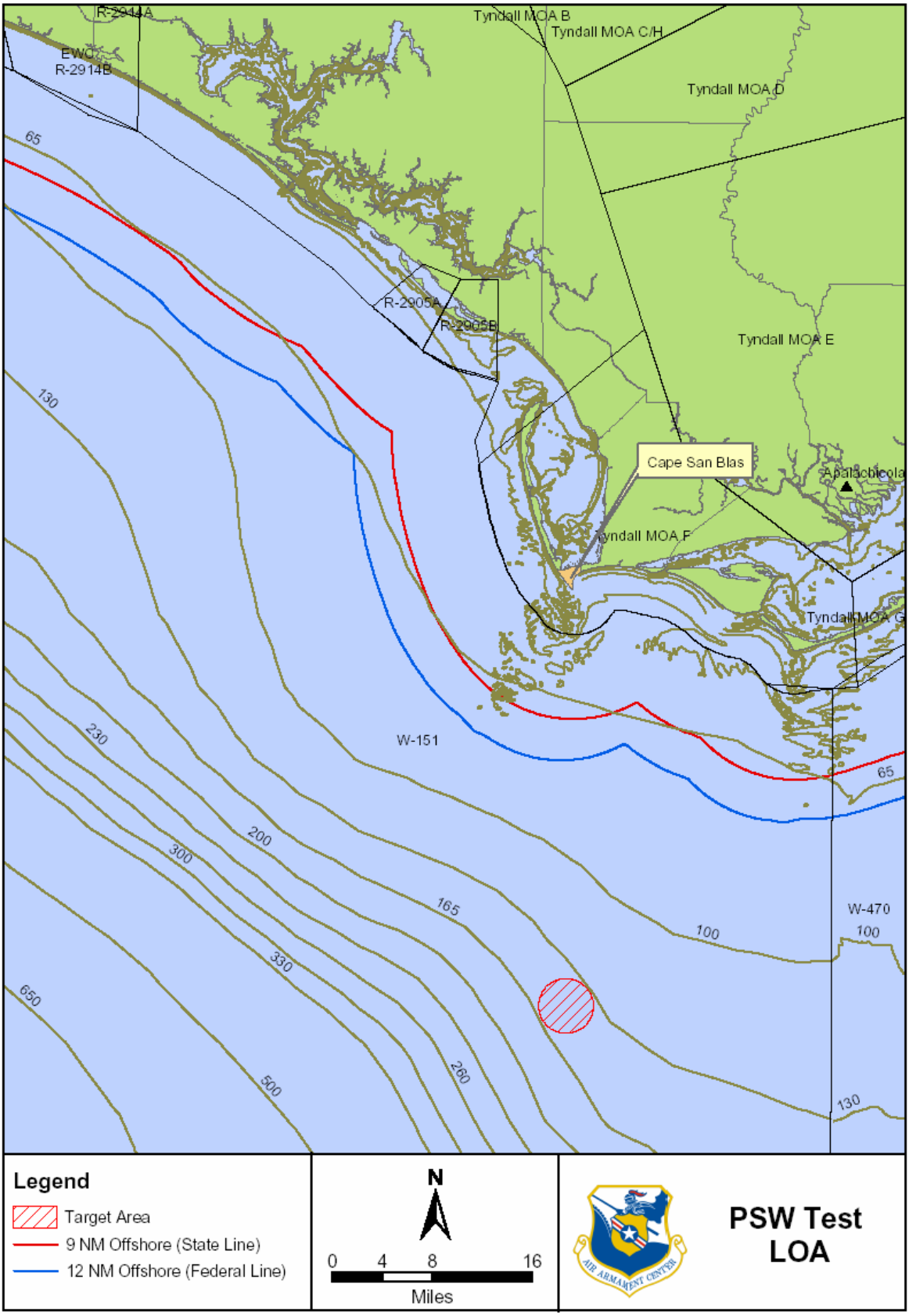

Figure 1-7. PSW Target Location Offshore of Test Area D-3, EGTTR, Florida

2. DURATION AND LOCATION OF THE ACTIVITIES

A series of PSW test missions would occur during the next five years utilizing resources within the Eglin Military Complex, including two sites in the EGTTR (Figure 1-1).

3. MARINE MAMMALS SPECIES AND NUMBERS

Marine mammal species that potentially occur within the EGTTR include several species of cetaceans and one sirenian, the West Indian manatee. During winter months, manatee distribution in the Gulf of Mexico is generally confined to southern Florida. During summer months, a few may migrate north as far as Louisiana. However, manatees primarily inhabit coastal and inshore waters and rarely venture offshore. PSW missions would be conducted from 15 to 24 NM offshore. Therefore, effects on manatees are considered very unlikely, and the discussion of marine mammal species is confined to cetaceans.

Cetacean abundance estimates for the study area are derived from GulfCet II (Davis et al., 2000) aerial surveys of the continental shelf within the Minerals Management Service Eastern Planning Area, an area of 70,470 square kilometers (km^2). Texas A&M University and the National Marine Fisheries Service conducted the surveys from 1996 to 1998. Abundance and density data from the aerial survey portion of the survey best reflect the occurrence of cetaceans within the EGTTR, given that the survey area overlaps approximately one-third of the EGTTR and nearly the entire continental shelf region of the EGTTR where military activity is highest. The GulfCet II aerial surveys identified different density estimates of marine mammals for the shelf and slope geographic locations. Only the shelf data is used because PSW missions will only be conducted on the shelf.

In order to maximize species conservation and protection, the species density estimate data were adjusted to reflect more realistic encounters of these animals in their natural environment and consider (1) temporal and spatial variations, (2) surface and submerged variations, and (3) overall density estimate confidence.

Temporal & Spatial Variations: The GulfCet II (1996-1998) aerial surveys have identified different density estimates of marine mammals between the winter and summer seasons, as well as between the shelf and slope geographic locations.

Surface and Submerged Variations: The GulfCet II surveys focus on enumerating animals detected at the ocean surface and therefore do not account for submerged animals or animals missed by the observer. As such, GulfCet II surveys do not provide a relative density estimate for the entire potential population of any given species and are therefore negatively biased. To provide a more conservative impact analysis, density estimates have been adjusted to account for submerged individuals. The percent of time that an animal is submerged versus at the surface was utilized to determine an adjusted density for each species. The percent of time submerged for each species was obtained from Moore and Clarke (1998). Density estimates were adjusted to conservatively reflect the potential for undetected submerged animals.

Density Estimate Confidence: The density estimates of marine mammals from GulfCet II aerial surveys were determined with an associated standard deviation and resulting coefficient of variation. Each of these analyses provides a measure of confidence about the resultant density estimate. An upper confidence value of 2.576 standard deviations (approximately a 99 percent confidence level) was utilized to further adjust the density estimate for each species.

Table 3-1 provides adjusted cetacean densities on the Gulf of Mexico shelf. Note that the adjusted density estimates are significantly greater than the GulfCet II estimates.

Table 3-1. Cetacean Densities for Gulf of Mexico Shelf Region

Species	Individuals/100 km^2 (From GulfCet II)	Individuals/km^2	Dive profile - % at surface	Adjusted density (Individuals/km^2)[a]
Dwarf/pygmy sperm whale	0.081	0.001	20	0.013
Bottlenose dolphin	14.798	0.148	30	0.810
Atlantic spotted dolphin	8.890	0.089	30	0.677
T. truncatus/S. frontalis	0.665	0.007	30	0.053
Totals	**24.4**	**0.245**		**1.553**

[a]Adjusted for undetected submerged animals to two standard deviations.

A brief description of each marine mammal species observed during GulfCet II aerial surveys on the shelf that has the potential to be present in the PSW test area is provided below.

Atlantic bottlenose dolphins (*Tursiops truncatus*). Atlantic bottlenose dolphins occur in slope, shelf, and inshore waters of the Gulf. The average herd or group size of Atlantic bottlenose dolphins in shelf and slope waters was approximately four and 10 individuals, respectively, per herd as determined by GulfCet II surveys of eastern Gulf waters (Davis et al., 2000). The diet of Atlantic bottlenose dolphins consists mainly of fish, crabs, squid, and shrimp (Caldwell and Caldwell, 1983).

Atlantic spotted dolphins (*Stenella frontalis*) can attain lengths of up to 8 feet at adulthood. Their distribution in the Atlantic ranges from the latitude of Cape May, New Jersey, along mainland shores to Venezuela, including the Gulf of Mexico and Lesser Antilles (Caldwell and Caldwell, 1983). The diet of the Atlantic spotted dolphin consists of squid and fish.

Dwarf Sperm Whales and Pygmy Sperm Whales. Dwarf sperm whales (*Kogia simus*) commonly inhabit the deeper offshore water, generally eating squid, crustaceans, and fish (Caldwell and Caldwell, 1983); but they do move into inshore waters during calving season. The pygmy sperm whale (*Kogia breviceps*) has a diet similar to that of the dwarf sperm whale. Both pygmy and dwarf sperm whales have been sighted in the northern Gulf of Mexico primarily along the continental shelf edge and in deeper shelf waters during all seasons except winter (Mullin et al., 1994). Dwarf and pygmy sperm whales have a high percentage of strandings relative to percent population of all cetaceans (Mullin et al., 1994). Pygmy and dwarf sperm whale Gulf of Mexico stocks are not considered strategic.

4. AFFECTED SPECIES STATUS AND DISTRIBUTION

The marine mammal species potentially affected include the Atlantic bottlenose dolphin, Atlantic spotted dolphin, dwarf sperm whales, and pygmy sperm whales. In fulfillment of the Marine Mammal Protection Act, the NOAA Fisheries has identified certain cetacean stocks as strategic, meaning non-natural mortalities or serious injuries (e.g., from commercial fishing) are either exceeding the predicted maximum that the stock can withstand or insufficient information exists to make such a determination. The "maximum number of animals that may be removed from a stock while allowing the stock to maintain its optimal sustainable population is termed potential for biological removal," or PBR (Code of Federal Regulations, 1994). This metric is included for two of the affected species described below.

Generally, distribution of cetaceans in the Gulf is primarily influenced by hydrographic features and ocean depth. The dominant hydrographic feature in the Gulf is the Loop Current that, though generally south of the continental slope, can generate anti-cyclonic (clockwise circulating) and cyclonic (counterclockwise) eddies that move onto or influence the slope and shelf regions. Davis and others (2000) noted during 1997-98 surveys of the northern Gulf of Mexico that cetaceans were concentrated along the continental slope and in or near cyclonic eddies.

Atlantic bottlenose dolphins (*Tursiops truncatus*). Bottlenose dolphins are distributed worldwide in tropical and temperate waters. Atlantic bottlenose dolphins occur in slope, shelf, and inshore waters of the entire Gulf of Mexico, and several stocks have been identified. In addition, a coastal and an offshore form of the bottlenose dolphin have been suggested. Baumgartner et al. (2001) suggest a bimodal distribution in the northern Gulf of Mexico, with a shelf population occurring out to the 150-meter isobath and a shelf break population out to the 750-meter isobath. Occurrence in water with depth greater than 1,000 meters is not considered likely. Migratory patterns from inshore to offshore are likely associated with the movements of prey rather than a preference for a particular habitat characteristic (such as surface water temperature) (Ridgeway, 1972; Irving, 1973; Jefferson et al., 1992). Bottlenose stocks for the shelf edge and slope are not considered strategic. The PBR for shelf and slope stocks is 45 dolphins (Waring et al., 2001).

Atlantic spotted dolphins (*Stenella frontalis*) are endemic to the tropical and warm temperate Atlantic Ocean. This species ranges from the latitude of Cape May, New Jersey, along mainland shores to Venezuela, including the Gulf of Mexico and Lesser Antilles (Caldwell and Caldwell, 1983). Sightings of this species are concentrated along the continental shelf and shelf edge (Fritts et al. 1983); but they also occur farther offshore. At one time, Atlantic spotted dolphins were considered to be the most abundant species of dolphin in offshore waters (Schmidly, 1981), with most sightings occurring at an average of 168 kilometers offshore. The preferred depth of the spotted dolphin is believed to be associated with food availability and water temperature. This stock is not considered strategic and the PBR is 23 dolphins (Blaylock et al., 1995).

Dwarf Sperm Whales and Pygmy Sperm Whales. Dwarf sperm whales (*Kogia simus*) commonly inhabit the deeper offshore water, generally eating squid, crustaceans, and fish (Caldwell and Caldwell, 1983), but they do move into inshore waters during calving season. The

pygmy sperm whale (*Kogia breviceps*) has a diet similar to that of the dwarf sperm whale. Both pygmy and dwarf sperm whales have been sighted in the northern Gulf of Mexico primarily along the continental shelf edge and in deeper shelf waters during all seasons except winter (Mullin et al., 1994). Dwarf and pygmy sperm whales have a high percentage of strandings relative to percent population of all cetaceans (Mullin et al., 1994). Pygmy and dwarf sperm whale Gulf of Mexico stocks are not considered strategic and NOAA does not have a minimum population estimate because it cannot be calculated from their latest Stock Assessment (2001). Therefore, the PBR is unknown for these species.

5. TAKE AUTHORIZATION REQUESTED

A Letter of Authorization (LOA) for the incidental taking (but not intentional taking) of small numbers of marine mammals is requested. It is understood that an LOA is applicable to activities that may cause mortality, injury, and harassment to marine mammal species. The subsequent analyses in this request will identify Level B noise harassment as the primary form of take; however, there is a potential, before any mitigations, that small numbers of marine mammals may be injured or possibly killed due to noise generated from the explosive sources.

6. NUMBERS AND SPECIES TAKEN

Marine mammals may be potentially harassed due to noise from PSW missions involving high explosive detonations in the EGTTR. The potential numbers and species taken by noise are assessed in this section. A PSW mission has been described in Section 1. Three key sources of information are necessary for estimating potential noise effects on marine resources: (1) the number of distinct firing or test events; (2) the zone of influence (ZOI) for noise exposure; and (3) the density of animals that potentially reside within the zone of influence.

For the acoustic analysis, the exploding charge is characterized as a point source. The impact thresholds used for marine mammals relate to potential effects on hearing from underwater noise from detonations. All marine mammals are protected under the Marine Mammal Protection Act. The same noise thresholds will also be applied to Endangered Species Act (ESA)-listed species of sea turtles. No ESA-listed marine mammals would be affected given the location of the Proposed Action on the eastern Gulf of Mexico continental shelf. The nearest ESA-listed species, the federally and state-listed endangered sperm whale occurs further out on the continental slope and in waters generally deeper than 600 meters.

For the explosives in question, actual detonation heights would range from 0 to 25 feet above the water surface. Detonation depths would range from 0 to 80 feet below the surface. To bracket the range of possibilities, detonation scenarios just above and below the surface were used to analyze bombs set to detonate on contact with the target barge. Potentially, the barge may interact with the propagation of noise into the water. However, barge effects on the propagation of noise into the water column cannot be determined without in-water noise monitoring at the time of detonation.

Potential exposure of a sensitive species to detonation noise could theoretically occur at the surface or at any number of depths with differing consequences. As a conservative measure a mid-depth scenario was selected to ensure the greatest direct path for the harassment ranges, and to give the greatest impact range for the injury thresholds.

Criteria and Thresholds for Impact of Noise on Protected Species

Criteria and thresholds that are the basis of the analysis of Precision Strike Weapons noise impacts to cetaceans were initially used in U.S. Navy environmental impact statements for ship shock trials of the SEAWOLF submarine and the WINSTON S. CHURCHILL vessel (DoN, 1998; DoN, 2001) and adopted by the National Marine Fisheries Service (NMFS, 2001). Supplemental criteria and thresholds have been introduced in the Eglin Gulf Test and Training (EGTTR) Programmatic EA (U.S. Air Force, 2002) and subsequent EGTTR LOA (U.S. Air Force, 2003) permit request .

Metrics

Standard impulsive and acoustic metrics were used for the analysis of underwater pressure waves in this document.

- *Peak Pressure*: The peak pressure is almost always used to measure maximum positive pressure or peak amplitude of impulsive sources with units of psi.
- *Positive Impulse*: The positive impulse represents a time-averaged pressure disturbance from an explosive source with units in psi-ms.
- *Energy flux density (EFD)*: EFD is the time integral of the squared pressure divided by the impedance. EFD levels have units of dB re 1 $\mu Pa^2 \cdot s$.
- *1/3-Octave EFD*: This is the energy flux density in a 1/3-octave frequency band; the 1/3 octave selected is the hearing range at which the subject animals' hearing is believed to be most sensitive.

Criteria and Thresholds: Lethality

The criterion for mortality for marine mammals used in the CHURCHILL FEIS is 'onset of severe lung injury.' This is conservative in that it corresponds to a 1 % chance of mortal injury, and yet any animal experiencing onset severe lung injury is counted as a lethal take. The threshold is stated in terms of the Goertner modified positive impulse with value "indexed to 31 psi-ms." Since the Goertner approach depends on propagation, source/animal depths, and animal mass in a complex way, the actual impulse value corrresponding to the 31-psi index is a complicated calculation. The acoustic threshold is derived from:

$$I_{1\%} = 42.9\ (M/34)^{1/3}\ \text{psi-ms},$$

were M is animal mass in kg. Again, to be conservative, CHURCHILL used the mass of a calf dolphin (at 12.2 kg), so that the threshold index is 30.5 psi-ms.

Criteria and Thresholds: Injury (Level A Harassment)

Non-lethal injurious impacts are defined in this document as eardrum rupture (i.e., tympanic-membrane (TM) rupture) and the onset of slight lung injury. These are considered indicative of the onset of injury. The threshold for TM rupture corresponds to a 50 percent rate of rupture (i.e., 50 percent of animals exposed to the level are expected to suffer TM rupture); this is stated in terms of an EFD value of 1.17 in-lb/in^2, which is about 205 dB re 1 μPa^2 • s. This recognizes that TM rupture is not necessarily a life-threatening injury, but is a useful index of possible injury that is well-correlated with measures of permanent hearing impairment (e.g., Ketten (1998) indicates a 30 percent incidence of permanent threshold shift (PTS) at the same threshold).

Criterion and Thresholds: Non-Injurious Impacts (Level B Harassment)

The CHURCHILL criterion for non-injurious harassment is temporary (auditory) threshold shift (TTS), a slight, recoverable loss of hearing sensitivity (DoN, 2001). The criterion for TTS used in this document is 182 dB re 1 μPa^2 • s maximum EFD level in any 1/3-octave band at frequencies above 100 Hz for toothed whales (e.g., dolphins). A 1/3-octave band above 10 Hz is used for impact assessments on baleen whales, which are not part of the affected environment of this project.

The CHURCHILL effort also introduce a second (dual) criterion for estimating TTS; 12 psi. The appropriate application of the dual TTS criteria is currently under debate by both the USAF and the USN. This 12 psi criterion was originally established for estimating impact of a 10,000-pound explosive to be employed for the Navy's shock trial. It was introduced to provide a more conservative range for TTS when the explosive or the animal approaches the sea surface (for which cases the explosive energy is reduced but the peak pressure is not).

For large explosives (2000 to 10,000 pounds) and explosive/animals not too close to the surface, the impact ranges for the two thresholds are about the same. However, for small shot detonations, the ranges for the two TTS thresholds become quite different, with ranges for the peak pressure threshold several times greater than those for energy. Eglin endorses the Navy's proposal for appropriately "scaling" the peak pressure threshold, in order to more accurately estimate TTS for smaller shots while preserving the safety feature provided by the peak pressure threshold. As such, the energy based criterion for TTS, 182 dB re 1 μPa2 • s (maximum EFD level in any 1/3-octave band), conservatively estimates non-injurious harassment for marine mammals.

Criterion and Thresholds: Behavioral Modification (Sub-TTS)

The scientific information necessary to adopt threshold criteria for assessing behavioral modifications is currently under debate and remains uncertain. Behavioral modification has been defined to address a noise level or other activities which may potentially cause marine mammals to alter normal biological behavior. NMFS defines these behavior responses as modifications resulting from repeated noise exposures (below TTS) to the same animals (i.e. resident) over a

relatively short period of time. One recommendation (but not necessarily, nor exclusively, the only one) for a reasonable assessment criterion might consider a level of 6 dB below TTS, presently identified at 182 dB re 1 μPa^2-s, as a threshold to assess potential behavioral responses. The behavioral threshold would then be 176 dB re 1 μPa^2-s.

Table 6-1 provides a summary of threshold criteria and metrics for potential noise impacts to sensitive species.

Table 6-1. Threshold Criteria and Metrics Utilized for Impact Analyses

Mortality	Level A Harassment	Level B Harassment	
1% mortality; based on the mass of a calf dolphin	Injurious; eardrum rupture (for 50% of animals exposed)	Non-injurious; temporary threshold shift (TTS) (temporary hearing loss)	Non-injurious behavioral response (for extended exposure times)
Modified positive impulse @ ~ 31-psi index	205 dB re 1 μPa^2-s EFD	182 dB re 1 μPa^2-s EFD* and/or 12 psi	176 dB re 1 μPa^2-s EFD*

* Note: In greatest 1/3-octave band above 10 Hz or 100 Hz

Risk Estimates

Methodology for Take Estimation

Noise zones of impacts (ZOIs) were calculated for depth detonation scenarios of 1 foot and 20 feet for both lethality and harassment (Level A and Level B). To determine the number of potential "takes" or animals affected, cetacean population information from ship and aerial surveys was applied to the various impact zones. The impact calculations for this section utilize marine mammal density estimates that have been derived from GulfCet II (1996-1998) surveys. In order to provide better species conservation and protection, the species density estimate data were adjusted to reflect more realistic encounters of these animals in their natural environment and consider temporal and spatial variations and surface and submerged variations. These calculations and estimates are explained in detail in Section 3 and adjusted density estimates are provided in Table 3-1.

Table 6-2 gives the estimated impact ranges for various explosive weights for summer and wintertime scenarios. The proposed test locations are from 15 to 24 NM offshore south of Santa Rosa Island and south of Cape San Blas Site D3-A in waters approximately 40 meters deep. SDB scenarios are for in-air detonations at heights of 1.5 m (5 feet) and 7.6 m (25 feet) at both locations. JASSM detonations were modeled for near surface (i.e., 1-foot depth) and below surface (>20-feet depth). To account for "double" (2 nearly simultaneous) events, the charge weights are added (doubled) when modeling for the determination of energy estimates (since energy is proportional to weight). Pressure estimates only utilize the single charge weights for these estimates.

Although analyses also evaluated the potential for animals to experience a sub-TTS behavioral modification, no behavioral impacts (176 dB re 1 μPa^2-s) are anticipated with the JASSM and SBD test activities. Repetitive exposures (below TTS) to the same resident animals are highly unlikely due to the infrequent JASSM and SBD test events, the potential variability in target locations, and the continuous movement of marine mammals in the northern Gulf.

Table 6-2. Zones of Impact for Underwater Explosions (Mid-Depth Animal)

Ordnance	NEW (TNT in lb)	Depth or Height of Explosion (m)	Ranges for 31 psi (m)	Ranges for 182 dB EFDL in 1/3-Octave Band (m)	Ranges for EFDL > 205 dB (m)
Summer					
Single SDB	48	1.5	n/a	47	12
		7.6	n/a	48	12
Double SDB	96	1.5	n/a	65	16
		7.6	n/a	66	17
Single JASSM	300	0.3	75	520	170
		>6.1	320	2490	550
Winter					
Single SDB	48	1.5	n/a	47	12
		7.6	n/a	48	12
Double SDB	96	1.5	n/a	65	16
		7.6	n/a	66	16
Single JASSM	300	0.3	75	580	170
		>6.1	320	3250	590

EFDL = Energy Flux Density Level

Applying the lethality (31 psi) and harassment (182 and 205 dB) impact ranges in Table 6-2 to the species densities of Table 3-1, the number of animals potentially occurring within the zones of influence was estimated. These results are presented in Tables 6-3, 6-4, and 6-5. The total number of animals potentially exposed are in bold. A whole animal (and potential take) is defined as 0.5 or greater, where calculation totals result in fractions of an animal. Where less than 0.5 animals are affected, no take is assumed.

Table 6-3. Marine Mammal Densities and Risk Estimates for Level A Harassment (205 dB EFD 1/3-Octave Band) Noise Exposure

Species	Density	Number of Animals Exposed from 1-ft Depth Detonations	Number of Animals Exposed from >20-ft Depth Detonations
Summer			
Dwarf/pygmy sperm whale	0.013	0.0024	0.0247
Bottlenose dolphin	0.81	0.1491	1.5417
Atlantic spotted dolphin	0.677	0.1246	1.2886
T. truncatus/S. frontalis	0.053	0.0098	0.1009
TOTAL		**0.29**	**3.0**
Winter			
Dwarf/pygmy sperm whale	0.013	0.0024	0.0285
Bottlenose dolphin	0.81	0.1491	1.7737
Atlantic spotted dolphin	0.677	0.1246	1.4824
T. truncatus/S. frontalis	0.053	0.0098	0.1161
TOTAL		**0.29**	**3.4**

Table 6-4. Marine Mammal Densities and Risk Estimates for Level B Harassment (182 dB EFD 1/3-Octave Band) Noise Exposure

Species	Density	Number of Animals Exposed from 1-ft Depth Detonations	Number of Animals Exposed from >20-ft Depth Detonations
Summer			
Dwarf/pygmy sperm whale	0.013	0.0226	0.5070
Bottlenose dolphin	0.81	1.4089	31.5886
Atlantic spotted dolphin	0.677	1.1776	26.3735
T. truncatus/S. frontalis	0.053	0.0922	2.0669
TOTAL		**2.7**	**60.5**
Winter			
Dwarf/pygmy sperm whale	0.013	0.0280	0.8633
Bottlenose dolphin	0.81	1.7448	53.7906
Atlantic spotted dolphin	0.677	1.4583	44.9300
T. truncatus/S. frontalis	0.053	0.1142	3.5196
TOTAL		**3.3**	**103.1**

Table 6-5. Marine Mammal Densities and Risk Estimates for Lethality (31 psi) Noise Exposure

Species	Density	Number of Animals Exposed from 1-ft Depth Detonations	Number of Animals Exposed from >20-ft Depth Detonations
Summer			
Dwarf/pygmy sperm whale	0.013	0.0005	0.0084
Bottlenose dolphin	0.81	0.0286	0.5212
Atlantic spotted dolphin	0.677	0.0239	0.4356
T. truncatus/S. frontalis	0.053	0.0019	0.0341
TOTAL		**0.0549**	**0.992**
Winter			
Dwarf/pygmy sperm whale	0.013	0.0005	0.0084
Bottlenose dolphin	0.81	0.0286	0.5212
Atlantic spotted dolphin	0.677	0.0239	0.4356
T. truncatus/S. frontalis	0.053	0.0019	0.0341
TOTAL		**0.0549**	**0.992**

Noise Effects Summary

The tables above indicate that given the range of depth detonations at the barge target, the potential for lethality (slight), non-injurious (Level B) harassment, as well as the onset of injury (Level A) harassment to cetaceans are possible from the Proposed Action without any mitigation measures. The 1-foot and >20-feet depths represent the bounds of potential effects, though in reality some combination of depths would occur during actual testing. A more accurate estimate lies somewhere in between the upper and lower impact ranges. Summer and winter impact calculations are independent and should not be additive. Wintertime testing would potentially result in a higher number of takes than summertime testing.

The potential exists for one each of both the Bottlenose and the Atlantic spotted dolphins to be exposed the noise levels sufficient to cause mortality. Approximately three cetaceans are estimated to be exposed to the Level A Harassment (205 dB re 1 μPa^2-s) noise zone of influence. Level B Harassment (182 dB re 1 μPa^2-s) noise would potentially affect as few as three or as many as 103 cetaceans depending on the season and depth of the JASSM tests. None of the above impact estimates consider mitigation measures that will be employed by the proponent to minimize potential impacts to protected species. These mitigation measures are described in Section 11 and are anticipated to greatly reduce potential impacts to marine mammals.

7. IMPACTS TO MARINE MAMMAL SPECIES OR STOCKS

Based on the analyses and results provided in Section 6, no strategic marine mammal stocks would be affected, and none of the marine mammal species that could potentially be taken is listed as threatened or endangered. The PBR for each species is: bottlenose dolphin (45); Atlantic spotted dolphin (23); and dwarf/pygmy sperm whale (unknown because the minimum population cannot be calculated).

8. IMPACT ON SUBSISTENCE USE

Potential impacts resulting from the Proposed Action will be limited to individuals of marine mammal species located in the Gulf of Mexico that have no subsistence requirements. Therefore, no impacts on the availability of species or stocks for subsistence use are considered.

9. IMPACTS TO MARINE MAMMAL HABITAT AND THE LIKELIHOOD OF RESTORATION

The primary source of marine mammal habitat impact is noise resulting from live PSW missions. However, the noise does 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 missions are present in limited duration and are intermittent as well.

Other sources that may affect marine mammal habitat were considered and potentially include the introduction of fuel, debris, ordnance, and chemical residues into the water column. The effects of each of these components were considered in the PSW EA and were determined to be insignificant. Marine mammal habitat would not be affected.

10. IMPACTS TO MARINE MAMMALS FROM LOSS OR MODIFICATION OF HABITAT

Based on the discussions in Section 9, marine mammal habitat will not be lost or modified.

11. MEANS OF AFFECTING THE LEAST PRACTICABLE ADVERSE IMPACTS

The potential takes outlined in Section 6 represent the maximum expected number of animals that could be exposed to noise. None of the above impact estimates take into consideration measures that will be employed by the proponent to, primarily ensure the safety of test participants and non-participants alike, and secondly to minimize impacts to protected species. Eglin AFB has employed a number of mitigation measures, which are discussed below, in an effort to substantially decrease the number of animals potentially affected. Eglin AFB is committed to assessing the mission activity for opportunities to provide operational mitigations while potentially sacrificing some mission flexibility.

Impact Minimization Measures and Proposed Management Practices

Prior to the mission, trained observers aboard two helicopters will survey (visually monitor) the test area, a very effective method for detecting sea turtles and cetaceans. The area to be surveyed will be 1.75 NM in every direction from the target (this is approximately the size of the largest

harassment ZOI.). In addition, another trained observer aboard a surface support vessel will conduct ship-based monitoring for non-participating vessels as well as protected species. The helicopters fly approximately 250 feet above the sea surface to allow observers to scan a large distance. Surface observation would be effective out to several kilometers.

Weather that supports the ability to sight small marine life (e.g., sea turtles) is required to mitigate the test site effectively (DoN, 1998). Wind, visibility, and surface conditions of the Gulf of Mexico are the most critical factors affecting mitigation operations. Higher winds typically increase wave height and create "white cap" conditions, both of which limit an observer's ability to locate surfacing marine mammals and sea turtles. PSW missions would be delayed if the sea state were greater than the number three of Table 11-1 below. This would maximize detection of marine mammals and sea turtles.

Table 11-1. Sea State Scale for Marine Mammal and Sea Turtle Observation

Scale Number	Sea Conditions
0	Flat calm, no waves or ripples
1	Small wavelets, few if any whitecaps
2	Whitecaps on 0-33% of surface; 0.3 to 0.6 m (1 to 2 feet) waves
3	Whitecaps on 33-50% of surface; 0.6 to 0.9 m (2 to 3 feet) waves
4	Whitecaps on greater than 50% of surface; greater than 0.9 m (3 feet) waves

Visibility is also a critical factor for flight safety issues. A minimum ceiling of 305 meters (1000 feet) and visibility of 5.6 kilometers (3 NM) is required to support mitigation and safety-of-flight concerns (DoN, 2001).

Aerial Survey/Monitoring Team

The proponent has agreed to adequately train personnel to conduct aerial surveys for protected species. The aerial survey/monitoring team would consist of two observers and a pilot familiar with flying marine mammal/turtle surveys. A helicopter provides a preferable viewing platform for detection of protected marine species. Each aerial observer should be experienced in marine mammal surveying and be familiar with species that may occur in the area. Each aircraft would have a data recorder who would be responsible for relaying the location (latitude and longitude), the species, and the number of animals sighted. The aerial monitoring team would also identify large schools of fish, jellyfish aggregations, and any large accumulation of *Sargassum* that could potentially drift into the ZOI. Standard line transect aerial surveying methods, as developed by NMFS (Blaylock and Hoggard, 1994; Buckland et al., 1993) would be used. Aerial observers are expected to have above average to excellent sighting conditions at sunrise to 1.85 km on either side of the aircraft within the weather limitation noted previously. Observed marine mammals and sea turtles would be identified to species or the lowest possible taxonomic level and the relative position recorded. Mission activity would occur no earlier than three hours after sunrise and no later than three hours prior to sunset to ensure adequate daylight and pre- and post-mission monitoring.

Shipboard Monitoring Team

The proponent has agreed to conduct shipboard monitoring to reduce impacts to protected species. The monitoring would be staged from the highest point possible on a mission ship. Observers should be experienced in shipboard surveys and be familiar with the marine life of the area. The observer on the vessel must be equipped with optical equipment with sufficient magnification (e.g., 25X power "Big-Eye" binoculars, as these have been successfully used in monitoring activities from ships), which should allow the observer to sight surfacing mammals from as far as 11.6 km and provide overlapping coverage from the aerial team. A team leader would be responsible for reporting sighting locations, which would be based on bearing and distance.

The aerial and shipboard monitoring teams will have proper lines of communication to avoid communication deficiencies (Figure 11-1). The observers from the aerial team and operations vessel will have direct communication with the lead scientist aboard the operations vessel. The lead scientist reviews the range conditions and recommends a Go/No-Go decision from the test director. The test director recommends the Go/No-Go decision to the Officer in Tactical Command, who makes the final Go/No-Go decision.

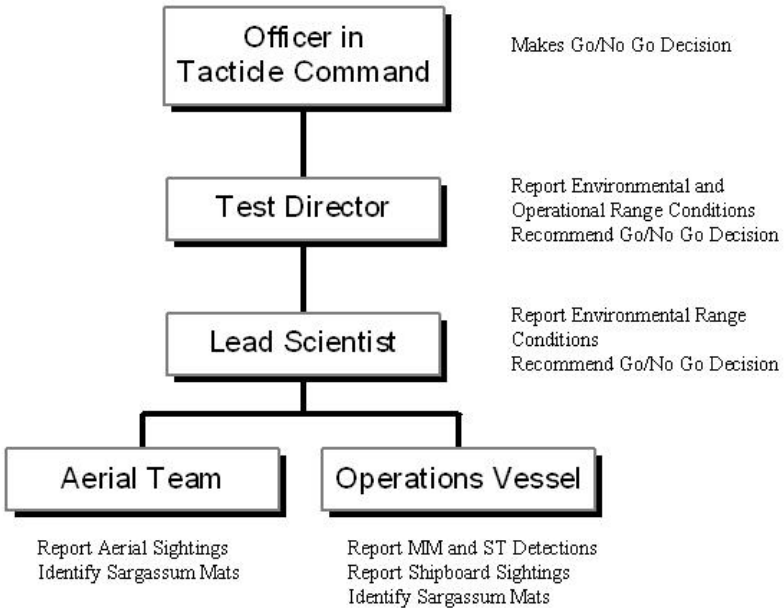

Figure 11-1. PSW Lines of Communication for Go/No-Go Decision

Mitigation Procedures Plan

Stepwise mitigation procedures for PSW missions are outlined below. All zones (mortality, injury, TTS, and safety zones) are monitored.

Pre-mission Monitoring: The purposes of pre-mission monitoring are to (1) evaluate the test site for environmental suitability of the mission (e.g., relatively low numbers of marine mammals and turtles, few or no patches of *Sargassum*, etc.) and (2) verify that the ZOI is free of visually detectable marine mammals, sea turtles, large schools of fish, large flocks of birds, large *Sargassum* mats, and large concentrations of jellyfish (both are possible indicators of turtle presence). On the morning of the test, the lead scientist would confirm that the test sites can still support the mission and that the weather is adequate to support mitigation.

(a) Five Hours Prior to Mission

Approximately five hours prior to the mission, or at daybreak, the appropriate vessel(s) would be on-site in the primary test site near the location of the earliest planned mission point. Observers onboard the vessel will assess the suitability of the test site, based on visual observation of marine mammals and sea turtles, the presence of large *Sargassum* mats, and overall environmental conditions (visibility, sea state, etc.). This information will be relayed to the lead scientist.

(b) Two Hours Prior to Mission

Two hours prior to the mission, aerial monitoring would commence within the test site to evaluate the test site for environmental suitability. Monitoring would commence at the same end of the test site that the mission ship would be entering. Evaluation of the entire test site would take approximately one hour. Shipboard observers would monitor the area around the ship, and the lead scientist would enter all marine mammals and sea turtle sightings, including time of sighting, into a marine animal tracking and sighting database.

(c) Forty Minutes Prior to Mission

Forty minutes prior to the mission, the aerial monitoring team would begin monitoring the 12.56 NM^2 safety buffer around the target area. The shipboard monitoring and acoustic monitoring teams would combine with the aerial team to monitor the area immediately around the mission area including both the ZOI and buffer zone.

(d) Fifteen Minutes Prior to Detonation

Aerial and shipboard viewers would be instructed to leave the area and remain outside the safety area (over 2 NM from impact). Visual monitoring would continue to document any missed animals that may have gone undetected during the past two hours.

(e) Go/No-Go Decision Process

The lead scientist would plot and record sightings and bearing for all marine animals detected. This would depict animal sightings relative the to the mission area. The lead scientist would have the authority to declare the range fouled and recommend a hold until monitoring indicates that the ZOI is and will remain clear of detectable animals.

The mission would be postponed if:

1. Any marine mammal or sea turtle is visually detected within the ZOI. The delay would continue until the marine mammal or sea turtle that caused the postponement is confirmed to be outside of the ZOI due to the animal swimming out of the range.
2. Any marine mammal or sea turtle is detected in the safety zone (2 NM radius) and subsequently cannot be reacquired. The mission would not continue until the last verified location is outside of the ZOI and the animal is moving away from the mission area.
3. Large *Sargassum* rafts or large concentrations of jellyfish are observed within the ZOI. The delay would continue until the *Sargassum* rafts or jellyfish that caused the postponement are confirmed to be outside of the ZOI either due to the current and/or wind moving them out of the mission area.
4. Large schools of fish are observed in the water within 1 NM of the mission area. The delay would continue until the large fish schools are confirmed to be more than 1 NM outside the ZOI.

In the event of a postponement, pre-mission monitoring would continue as long as weather and daylight hours allow. Aerial monitoring is limited by fuel and the on-station time of the monitoring aircraft. If a live warhead failed to explode, operations would attempt to recognize and solve the problem while continuing with all mitigation measures in place. The probability of this occurring is very remote but the possibility still exits. Should a weapon fail to explode, the Proponent would attempt to identify the problem and detonate the charge with all marine mammal and sea turtle mitigation measures in place as described.

Post-mission monitoring: Post-mission monitoring is designed to determine the effectiveness of pre-mission mitigation by reporting any sightings of dead or injured marine mammals or sea turtles. Post-detonation monitoring would commence immediately following each detonation. The vessel could be assisted by aerial surveys over the same time period. The helicopter would resume transects in the area of the detonation and continue monitoring for at least two hours, concentrating on the area down current of the test site. Aerial and shipboard monitoring is intended to locate and identify dead and injured animals.

Marine mammals or sea turtles killed by an explosion would likely suffer lung rupture, which would cause them to float to the surface immediately due to air in the blood stream. Animals that were not killed instantly but were mortally wounded would likely resurface within a few days, though this would depend on the size and type of animal, fat stores, depth, and water temperature (DoN, 2001). The monitoring team would attempt to document any marine mammals or turtles that were killed or injured as a result of the test and, if practicable, recover and examine any dead animals. The species, number, location, and behavior of any animals observed by the observation teams would be documented and reported to the lead scientist.

Post-mission monitoring activities could include coordination with marine animal stranding networks. The NMFS maintains stranding networks along coasts to collect and circulate information about marine mammal and sea turtle standings. Local coordinators report stranding data to state and regional coordinators. Any observed dead or injured marine mammal or sea turtle would be reported to the appropriate coordinator.

Summary of Mitigation Plan

Should human safety concerns arise or protected species are sighted within the noise impact zones, the test will be postponed. The area to be surveyed will be 2.00 NM in every direction from the target (approximately the size of the largest harassment ZOI.). If a protected species is observed within this area, the test will be stopped or postponed until the area is clear of the animals. The total area to be monitored is 12.56 NM^2. The survey vessels and aircraft will leave the safety footprint immediately prior to weapons launch. This will be no more than 15 minutes prior to impact of the weapons at the target area.

Avoidance of impacts to schools of cetaceans will most likely be realized through these measures since groups of dolphins are relatively easy to spot with the survey distances and methods that will be employed. Typically solitary marine mammals such as dwarf/pygmy sperm whales and sea turtles, while more challenging to detect, will also be afforded substantial protection through pre-test monitoring.

One helicopter and vessel(s) would conduct post-mission monitoring for two hours after each mission. The monitoring team would attempt to document any marine mammals or turtles that were killed or injured as a result of the test and, if practicable, recover and examine any dead animals. Post-mission monitoring activities could include coordination with marine animal stranding networks.

Hardbottom habitats and artificial reefs would be avoided to alleviate any potential impacts to protected habitat. PSW testing would be delayed if large *Sargassum* mats were found in the ZOI. Testing would resume only when the mats move outside of the largest ZOI. The PSW mission team will make every effort to recover surface debris, from the target or the weapons following test activities.

Conservative Estimates of Marine Mammal Densities

By using conservative mathematic calculations, conservative density estimates can serve as a respectable mitigation technique for take estimates. Marine mammal densities used to calculate takes were based on the most current and comprehensive Gulf of Mexico surveys available (GulfCet II). The densities are adjusted for the time the animals are submerged, and further adjusted by applying standard deviations to provide an approximately 99 percent confidence level. As an example, the density estimates for bottlenose dolphins range from 0.06 to 0.15 animals/km^2 in GulfCet II aerial surveys of the shelf and slope. However, the final adjusted density used in take calculations is 0.81 animals/km^2.

12. MINIMIZATION OF ADVERSE EFFECTS ON SUBSISTENCE USE

Based on the discussions in Section 8, there are no impacts on the availability of species or stocks for subsistence use.

13. MONITORING AND REPORTING MEASURES

Mitigations may include any supplemental activities that are designed, proposed, and exercised to help reduce or eliminate the potential impacts to the marine resources. The Air Force recognizes the importance of such "in-place" mitigations and is aware that NMFS recommends an approved mitigation plan that outlines the scope and effectiveness of the Proposed Action's mitigations.

The risk of harassment (Levels A & B) to marine mammals has been determined to be relatively small (Section 6). Eglin AFB has determined that with the implementation and commitment to utilizing the "visual monitoring" mitigations (Section 11), potential takes are greatly reduced.

For PSW testing, areas to be used in missions are visually monitored for marine mammal presence from aircraft and surface vessels prior to commencement of the mission. Monitoring would be conducted before missions to clear marine mammals (and sea turtles) within an impact area. Firing would be postponed until the animals left the area. The following procedures may be feasible during the mission activities using the operational aircraft.

- Conduct overflight clearance procedures using best operational methods possible. Clearance procedures would include several grid patterns at low altitude.
- Clear impact area and avoid all protected species and *Sargassum* rafts to the maximum extent possible.
- Reconduct clearance procedures if whales, dolphins, turtles, or *Sargassum* rafts are encountered.
- Conduct post-mission observation and report operations data as required by Eglin's Natural Resources Branch; AAC/EMSN.
- Submit an annual summary of mission observations to:

National Marine Fisheries Service
Southeast Regional Office (SERO)
Protected Resources Division
9721 Executive Center Drive North
St. Petersburg, FL 33702

14. RESEARCH

Although Eglin AFB does not currently conduct independent Air Force monitoring efforts, Eglin's Natural Resources Branch does participate in marine animal tagging and monitoring programs lead by other agencies. Additionally, the Natural Resources Branch also supports participation in annual surveys of marine mammals in the Gulf of Mexico with NOAA Fisheries. From 1999 to 2002, Eglin's Natural Resources Branch has, through a contract representative, participated in summer cetacean monitoring and research opportunities. The contractor participated in visual surveys in 1999 for cetaceans in Gulf of Mexico, photographic

identification of sperm whales in the northeastern Gulf in 2001, and as a visual observer during the 2000 Sperm Whale Pilot Study and the 2002 sperm whale Satellite-tag (S-tag) cruise. Support for these research efforts is anticipated to continue.

Eglin AFB conducts other research efforts that utilize marine mammal stranding information as a means of ascertaining the effectiveness of mitigation techniques. Stranding data is collected and maintained for the Florida panhandle and Gulf-wide areas. This is undertaken through the establishment and maintenance of contacts with local, state, and regional stranding networks. Eglin AFB assists with stranding data collection by maintaining its own team of stranding personnel. In addition to simply collecting stranding data, various analyses are performed. Stranding events are tracked by year, season, and NOAA Fisheries statistical zone, both Gulf-wide and on the coastline in proximity to Eglin AFB. Stranding data is combined with records of EGTTR mission activity in each water range and analyzed for any possible correlation. In addition to being used as a measure of the effectiveness of mission mitigations, stranding data can yield insight into the species composition of cetaceans in the region.

15. LIST OF PREPARERS

Mike Nunley, Marine Scientist
Science Applications International Corporation (SAIC)
Natural Resources Branch
Eglin AFB, Florida 32578
(850) 882-4164 x 315
nunleyj@eglin.af.mil

Jamie McKee, Marine Scientist
Science Applications International Corporation (SAIC)
1140 Eglin Parkway
Shalimar, Florida 32579
(850) 609-3418
mckeew@saic.com

Alex Locklear, Environmental Scientist
Science Applications International Corporation (SAIC)
1140 Eglin Parkway
Shalimar, Florida 32579
(850) 609-3468
lockleara@saic.com

Dennis Peters, Marine Scientist
Science Applications International Corporation (SAIC)
1140 Eglin Parkway
Shalimar, Florida 32579
(850) 609-3414
petersd@saic.com

16. REFERENCES

Baumgartner, M. F., K. D. Mullin, L. N. May, and T. D. Leming, 2001. Cetacean habitats in the northern Gulf of Mexico. Fishery Bulletin 99:219-239.

Blaylock, R. A. and W. Hoggard, 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. NOAA Tech. Mem. NMFS-SEFSC-356. p. 10.

Blaylock, R. A., J. W. Hain, L. J. Hansen, D. L. Palka, and G. T. Waring, 1995. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments, U.S. Department of Commerce-NOAA Technical Memorandum, NMFS-SEFSC-363. pp. 1-207. July.

Buckland, S. T., D. R. Anderson, R. P. Burnham, and J. L. Laake, 1993. Distance Sampling. Chapman and Hall Publishing, London. p. 446.

Caldwell, D. K. and M. C. Caldwell, 1983. Mammals. In: The Audubon Society Field Guide to North American Fishes, Whales, and Dolphins (A. A. Knopf, ed.). Alfred A. Knopf, Inc., New York, NY. pp. 767-812.

Code of Federal Regulations, 1994. Subpart F-Taking of Marine Mammals Incidental to Underwater Detonation of Conventional Explosives by the Department of Defense. 50 CFR Chapter II, 228.37. Source: 59 FR 5126. DMS# 9605151073.

Davis, R. W., W. E. Evans, and B. Wursig, eds., 2000. Cetaceans, Sea Turtles and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical Report. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geological Survey, Biological Resources Division, USGS/BRD/CR-1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region, New Orleans LA. OCS Study MMS 2000-003. p. 346.

DoN (Department of the Navy), 1998. Final Environmental Impact Statement, shock testing the SEAWOLF submarine. Washington D.C.: Naval Sea Systems Command.

DoN (Department of the Navy), 2001. Final Environmental Impact Statement, shock trial of the Winston S. Churchill (DDG 81). Washington D.C.: Naval Sea Systems Command.

Fritts, T. H., A. B. Irvine, R. D. Jennings, L. A. Collum, W. Hoffman, and M. A. McGehee, 1983. Turtles, birds, and mammals in the northern Gulf of Mexico and nearby Atlantic waters. U.S. Fish and Wildlife Service, Division of Biological Services, Washington, D.C. FWS/OBS-82/65. p. 455.

Irving, L., 1973. Aquatic mammals. In: Comparative Physiology of Thermoregulation (Whittow, G. C. ed.) Academic Press, New York. pp. 47-96.

Jefferson, T. A., S. Leatherwood, L. K. M. Shoda and R. L. Pitman, 1992. Marine Mammals of the Gulf of Mexico: a Field Guide for Aerial and Shipboard Observers. Texas A&M University Printing Center, College Station. 92 pp. DMS# 06-03-08-9602121040.

Ketten, D. R. 1998. Marine mammal auditory systems: A summary of audiometric and anatomical data and its implications for underwater acoustic impacts. NOAA Technical Memorandum NOAA-NMFS-SWFSC-256:1-74.

Moore, S. E. and J. E. Clark, 1998. Summary of Marine mammal Occurrence and population Estimates in U.s. Coastal Waters Subject to Military Aircraft Overflights. Prepared for U.S. Air Force Research Laboratory, Wright-Patterson AFB, OH.

Mullin, K., T. A. Jefferson, L. J. Hall and W. Hoggard, 1994. First sightings of Melon Headed whale Peponocephala electra) in the Gulf of Mexico. Marine Mammal Science, 10(3):342-348. pp. 342-348.

References

National Marine fisheries Service (NMFS), 2001. Marine Recreational Fisheries Statistics Survey (MRFSS) accessed in December 2001 via the internet at: http://www.st.nmfs.gov/st1/recreational/data.html.

Ridgeway, S. H., 1972. Homeostasis in the aquatic environment. In: Mammals of the sea: Biology and medicine (S.H. Ridgeway, ed.) Charles C. Thomas, Springfield, Ill. pp. 590-747.

Schmidly, D. J., 1981. Marine Mammals of the Southeastern United States and Gulf of Mexico. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C. FWS/OBS-80/41. p. 163.

Waring, G. T., J. M. Quintal, and S. L. Swartz, eds., 2001. U.S. Atlantic And Gulf Of Mexico Marine Mammal Stock Assessments – 2001. NOAA Technical Memorandum NMFS-NE-168. U.S. Department Of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center. Woods Hole, MA. December.

U.S. Air Force, 2002. Eglin Gulf Test and Training Range Programmatic Environmental Assessment. Air Armament Center, Eglin AFB, FL. November, 2002.

————, 2003. Request for a Letter of Authorization for the Incidental Harassment of Marine Mammals Resulting from the Programmatic Mission Activities within the EGTTR. Air Armament Center, Eglin AFB, FL. February, 2003.