REQUEST FOR A LETTER OF AUTHORIZATION FOR THE INCIDENTAL HARASSMENT OF MARINE MAMMALS RESULTING FROM PROGRAMMATIC MISSION ACTIVITIES CONDUCTED WITHIN THE SANTA ROSA ISLAND REGION OF INFLUENCE

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

µPa	Micropascal
µPa^2	Micropascal Squared
µPa^2-s	Micropascal Squared - seconds
96 CEG/CEVSN	Eglin Natural Resources Section
AAV	Amphibious Assault Vehicle
AFB	Air Force Base
ARG/MEU	Amphibious Ready Group/Marine Expeditionary Unit
cal	Caliber
CFR	Code of Federal Regulations
dB	Decibels
DET	Distributed Explosive Technology
DoD	Department of Defense
DPI	Direct Physical Impacts
EA	Environmental Assessment
EFDL	Energy Flux Density Level
FEIS	Final Environmental Impact Statement
FY	Fiscal Year
GPU	Gun Pod Unit
IHA	Incidental Harassment Authorization
kHz	Kilohertz
km	Kilometers
km^2	Square Kilometers
kPa	Kilopascals
LCAC	Landing Craft Air Cushion
LOA	Letter of Authorization
m	Meters
mm	Millimeter
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
NCSC	Naval Coastal System Center
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PBR	Potential for Biological Removal
PEA	Programmatic Environmental Assessment
PETN	Pentaerithrytol Tetranitrate
psi	Pounds per Square Inch
psi-msec	Pounds per Square Inch per Millisecond
PTS	Permanent Threshold Shift
re 1	Referenced to 1
SABRE	Shallow Water Assault Breaching
SRI	Santa Rosa Island
SWSS	Sperm Whale Seismic Study
SZTA	Surf Zone Test Area
TA	Test Area
TP	Target Practice
TTS	Temporary Threshold Shift
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
ZOI	Zone of Influence

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EXECUTIVE SUMMARY

With this submittal, Eglin Air Force Base (AFB) 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 by the programmatic mission activities within the Eglin Santa Rosa Island (SRI) study area over the next five years, as permitted by the Marine Mammal Protection Act (MMPA) of 1972, as amended. The surf zone test and training activities, in particular surf zone detonations, have been found to be the only activities that have the potential to impact marine mammals in the *Santa Rosa Island Mission Utilization Plan Programmatic Environmental Assessment* (PEA). Because in-place mitigations would clear the area of any marine mammals before detonations occur, it is anticipated that no federally protected marine animal takes would result in the form of mortality, injury, or Level A harassment. However, an LOA is being requested (versus an Incidental Harassment Authorization [IHA]) due to the longevity of the proposed actions.

Eglin proposes to establish Surf Zone Test Areas on SRI to support major surf zone exercises. Surf zone activities may involve live underwater detonations in shallow water that are used to clear mines and other obstacles. Additional activities may include the use of amphibious vehicles such as Landing Craft Air Cushion (LCAC) and Amphibious Assault Vehicles (AAVs). Potential impacts to marine mammals include noise and direct physical impacts associated with detonations and amphibious vehicle use. The potential takes outlined in Section 6 represent the maximum expected number of animals that the programmatic mission activities could affect. Eglin AFB has employed a number of mitigation measures in an effort to substantially decrease the number of animals potentially affected (Section 11). Eglin is committed to assessing the mission activity for opportunities to provide operational mitigations.

Using a conservative density estimate for each species and a zone of influence (ZOI) for each type of detonation, the resulting annual estimate of the potential number of animals exposed (harassed, injured, or killed) to noise was analyzed. Noise caused by detonations is anticipated to affect some marine mammal species. The total number of marine mammals exposed to injurious Level A harassment noise levels is low (2 total). Therefore, considering the mitigation measures outlined in Section 11, no Level A noise-related takes are anticipated. A number of animals, depending on the criterion utilized, would potentially experience Level B noise harassment without mitigations in place. Required mitigation measures are expected to substantially decrease the number of animals impacted.

There will be no effect to strategic marine mammal stocks. None of the marine mammal species that could potentially be taken are listed as threatened or endangered.

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).

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1. DESCRIPTION OF ACTIVITIES

The Eglin Military Complex is a Department of Defense (DoD) Major Range Test Facility Base that exists to support the DoD mission (Figure 1-1). Its primary function is to support research, development, test, and evaluation of conventional weapons and electronic systems. Through the *Santa Rosa Island Mission Utilization Plan Programmatic Environmental Assessment* (PEA), the 46th Test Wing has analyzed the environmental impacts associated with all current and anticipated future operations conducted on Eglin's Santa Rosa Island (SRI) property and a study area that includes the Gulf-side shoreline of the island to a depth of 30 feet. The distance from the island shoreline that corresponds to this depth varies from approximately 0.5 mile at the western side of the Air Force property to 1.5 miles at the eastern side, extending out into the inner continental shelf. SRI is a narrow barrier island approximately 50 miles long and less than 0.5 mile wide, separated from mainland northwest Florida by Santa Rosa Sound, a shallow lagoon varying in width from 400 to nearly 5,000 feet, and Choctawhatchee Bay. Activities conducted within the sound are addressed in the *Estuarine and Riverine Areas Programmatic Environmental Assessment* (U.S. Air Force, 2003). The Gulf of Mexico borders SRI on the south shore and Santa Rosa Sound and Choctawhatchee Bay border it on the north shore. As described in the SRI Landuse PEA, the Proposed Action is for the 46th Test Wing Commander to establish a mission utilization plan for SRI based on historical and anticipated future use. Current and future operations are categorized as either Testing or Training and consist of: 1) Air Operations, 2) Electronic Countermeasures and Electronic Systems Testing, 3) Surface-to-Air Missile Testing, 4) Open Air Hardware-in-the-Loop Testing, 5) Surf Zone Testing/Training, 6) Landing Craft Air Cushion (LCAC) Training and Weapons Testing, 7) Small Boat Obscurant Testing, 8) Ground Testing, 9) Live Fire, 10) Amphibious Assaults, 11) Personnel/Equipment Drops and Extractions, 12) Ground Training Operations, and 13) Special Operations Training.

Of these operations, some components of surf zone testing/training and expanded amphibious vehicle use (LCAC training/weapons testing, and amphibious assaults), as described in the Preferred Alternative of the PEA, have the potential to result in takes under the Marine Mammal Protection Act (MMPA) of 1972, as amended. Potential takes due to these activities may be the result of either underwater noise or direct physical impacts. The remaining operations listed above are analyzed in Chapter 4 of the PEA, and are not relevant to the MMPA.

1.1 SURF ZONE TESTING/TRAINING

Eglin proposes to establish Surf Zone Test Areas (SZTAs) on SRI to support major surf zone test exercises. Specific and dedicated areas on SRI would be utilized to perform these exercises. Major surf zone test exercises include neutral (inert) systems and live (containing explosive material) systems, which would be detonated in shallow water. Figure 1-2 shows the areas that will be evaluated for establishment of SZTAs.

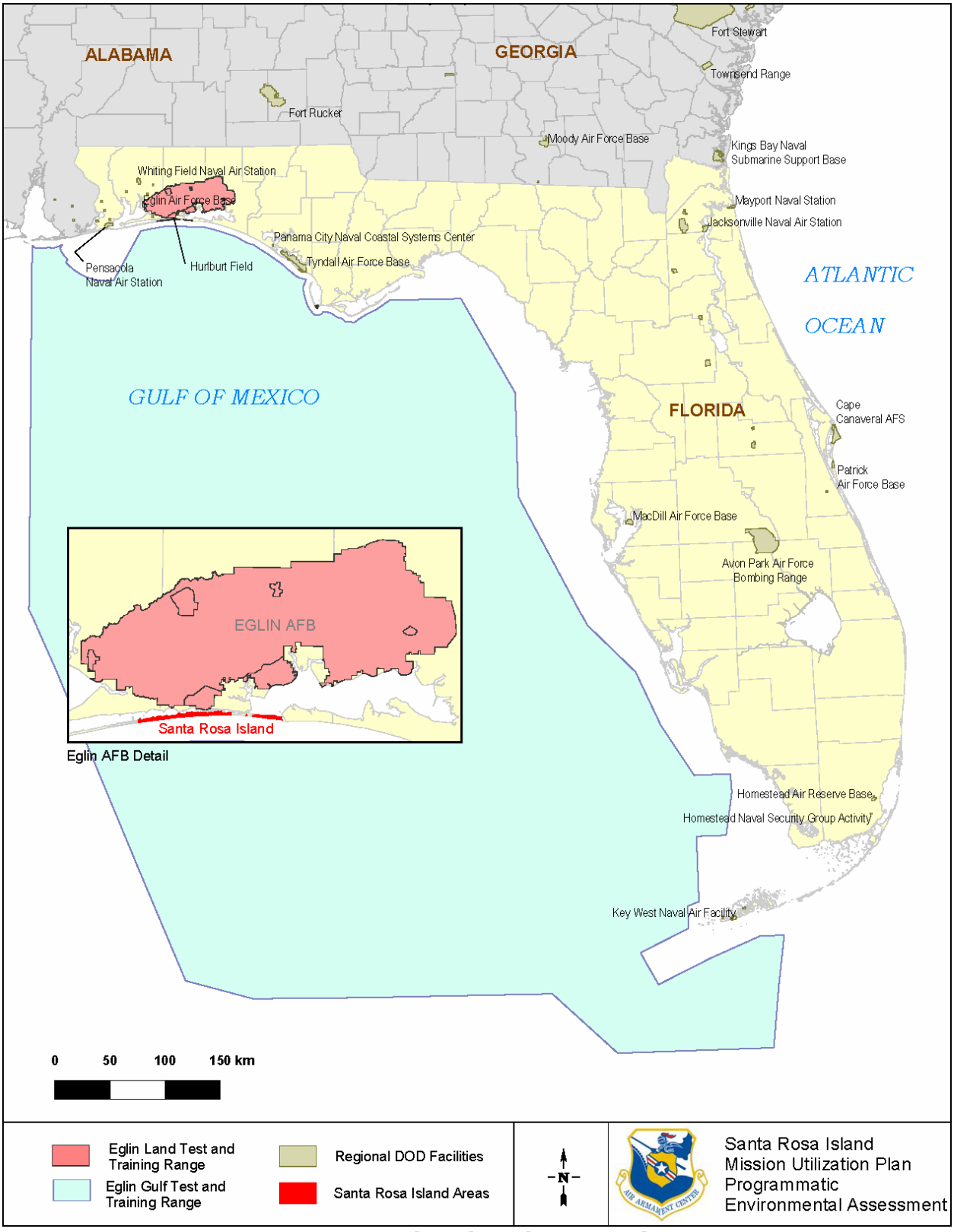

Figure 1-1. The Eglin Military Complex

Figure 1-2. Current and Potential Air Force Mission Use Areas on Santa Rosa Island

Current and proposed future surf zone activities pertinent to MMPA compliance include detonations of mine clearing line charges and bombs for obstacle clearing. These activities are described below.

- Line Charge Mine Clearance Testing

  The Naval Surface Warfare Center Panama City (NSWCPC) conducted a use of a line charge test in the past as a precursor to other tests to evaluate the effectiveness of underwater mine countermeasure and clearing techniques. The NSWCPC tested the line charge assembly in a shallow water area adjacent to SRI in fiscal year (FY) 1998. The M-58 Line Charge System was mounted on an Amphibious Assault Vehicle (AAV) and deployed to the vicinity of Test Site A-17. Once in position, the line charge was deployed from the LCAC by an MK 22 (Mod 4) Rocket. After the line charge was fully deployed, it was detonated. The line charge contained 1,750 pounds of C-4 explosives and 11 pounds of PETN (Pentaerithrytol Tetranitrate) explosives. These tests were evaluated and approved through the National Environmental Policy Act (NEPA) process in the *Final Environmental Assessment for Coastal Testing of the Shallow Water Assault Breaching (SABRE) and Distributed Explosive Technology (DET) Systems* (U.S. Air Force, 1999) and *Final Environmental Assessment for Testing of the MK-82 General Purpose Bombs and MK-5 Mine Clearance System* (U.S. Air Force, 1999a) and received a Letter of Authorization (LOA) for the incidental harassment of marine mammals from surf zone testing missions in 1998 through consultation with the National Marine Fisheries Service (NMFS).

- SABRE Mine Clearing Testing

  The Navy's SABRE explosive net clearing weapon is in development with testing ongoing at Eglin's Shallow Water Mine Pond Facility. This program also needs a location to demonstrate and evaluate the weapon and determine the effects it may have on the U.S. Navy LCAC. The surf zone is the only place SABRE can adequately be tested while crews train on proper weapon deployment. Testing of the SABRE system would involve launching of a line charge subsystem propelled by rocket motors. This could require closure of some areas of the Gulf of Mexico and Choctawhatchee Bay waters to accommodate a 2.5-mile, 110-degree safety fan if these tests are conducted on the eastern portion of the island. This test was evaluated and approved through the *Environmental Assessment for Coastal Testing of the Shallow Water Assault Breaching (SABRE) and Distributed Explosive Technology (DET) Systems* (U.S. Air Force, 1999) and *Biological Assessment for Coastal Testing of the SABRE and DET Systems* (U.S. Air Force, 1998) and received a LOA for the Incidental Harassment of Marine Mammals from Surf Zone Testing Missions at Eglin AFB, FL (U.S. Air Force, 1998a). However, only a portion of the test was completed, and future activities may involve this type of testing in areas other than those evaluated in the previous Environmental Assessment (EA).

- Beach Obstacle Clearing and Neutralization

  These activities involve simultaneous detonations of multiple bombs in the surf zone, which NSWCPC will evaluate to assess their effects on obstacles and mines as a potential

beach-clearing tactic. One way these surf zone tests can be easily facilitated is by establishing an island surf zone test area.

Concentrating surf zone detonation activities within specified areas may reduce the environmental impacts associated with these activities as well as standardize the logistics, operational planning, and safety procedures. The designated test/training areas would accommodate both historical and expanded activities. Navy personnel (NSWCPC) would establish the areas within current usage guidelines similar to the numerous test areas as described in the *AAC Technical Facilities Manual (Volume II Land Test Areas)* (U.S. Air Force, 1996). Such test area guidelines would include a description of operational and environmental constraints.

1.2 AMPHIBIOUS VEHICLE TESTING/TRAINING

Amphibious vehicles pertinent to this LOA request include the LCAC and the Amphibious Assault Vehicle (AAV). Both of these vehicles have the capability to transit through the land/water interface and are utilized in a variety of mission types. Operations that require the use of one or both of these vehicles are described below.

- Current LCAC Training and Weapons Testing

  The LCAC is a high-speed fully amphibious landing craft capable of traveling over both land and water, providing transition of personnel and equipment over the land-water interface. The LCAC is also used in the neutralization of beach obstacles and hostile watercraft, with test/training activities typically involving live/inert testing of various firing mechanisms in concert with travel through the land-water interface and across beach environments. In 1998, the Navy tested the integration of the LCAC with the GPU-5 (gun pod unit-five) 30 millimeter (mm) weapon system in a feasibility demonstration. This activity was evaluated through the NEPA process in the *Environmental Assessment for the Landing Craft Air Cushion (LCAC)/Gun Pod Unit-5 (GPU-5) Integration Demonstration* (U.S. Air Force, 1998b).

  The LCAC engaged targets on SRI from a position in Santa Rosa Sound approximately 1,000 feet from the shore, firing south in the direction of the Gulf. Targets were placed approximately 20 feet from the high water line of Santa Rosa Sound and included three each of concrete cubes, jersey barriers, steel hedgehogs, steel tetrahedrons, and 60 sea urchins (welded steel rods). Target practice (TP) training rounds were fired in burst lengths of less than 100 rounds. A total of 353 30-mm TP rounds were expended from Santa Rosa Sound into the Gulf. After engaging the targets, the LCAC crossed over SRI moving at less than 5 knots. The crossover occurred in the vicinity of Test Area (TA) A-13B. After maneuvering in the Gulf, the LCAC again crossed SRI into the sound and returned to TA A-22. A helicopter, two watercraft, and four all-terrain vehicles were employed to watch for non-participants within the testing area.

  In 2000, an LCAC Tank Transport test was conducted near TA A-13B on SRI that involved transport of a Hercules Tank Retriever from TA A-22 to Santa Rosa Sound and over the island. Use of the island for LCAC crossovers at TA A-13B was associated with amphibious assault exercises, and was evaluated in the *Amphibious Ready Group/Marine*

Expeditionary Unit (ARG/MEU) Readiness Training Environmental Assessment (U.S. Air Force, 2003a) and *ARG/MEU Biological Assessment* (U.S. Air Force, 2003b) for the U.S. Fish and Wildlife Service (USFWS).

- Future Expanded LCAC Training/Testing

  The need for expanded LCAC training and testing is related to the need for expanded special operations and amphibious assault training and testing activities. Expanded LCAC activities would involve increased use of the LCAC for both inert training activities and live fire testing and training, as described previously. The LCAC would utilize specific areas for crossing between the Gulf to Santa Rosa Sound, and for firing weapons systems. Similar activities have been evaluated and approved at TA A-13B under the *ARG/MEU Readiness Training Environmental Assessment* (U.S. Air Force, 2003a) and the *Environmental Assessment for the LCAC/GPU-5 Integration Demonstration* (U.S. Air Force, 1998b).

- Amphibious Assaults

  Several organizations have a need to initiate or expand their current work in or around the island. The Marine Corps has a need to use the island to perform amphibious assault exercises. These activities typically involve a coordinated mission utilizing large landing craft such as AAVs and LCACs, varying numbers of troops and personnel, and aircraft. Landing craft and personnel are dropped into the ocean several miles or several thousand yards off shore and traverse to the island. Upon reaching the island, the assault force breaches the shoreline, sets up a perimeter or staging area, and either proceeds to an objective or remains on site. The *ARG/MEU Readiness Training Environmental Assessment* (U.S. Air Force, 2003a) discusses these activities in further detail.

- Expanded Special Operations Training

  Eglin proposes to increase Special Operations training within established maneuver areas and the additional establishment of LCAC live fire and crossover areas on the island. Increased special operations training would involve covert beach landings and assaults and other mission training activities. These exercises could involve full-scale beach assaults involving dozens of troops and landing craft (i.e., LCACs and AAVs), or small-scale exercises involving dropping off personnel in rubber boats within the study area. Personnel would navigate in, conduct a covert landing on the beach, and capture a target on the island or proceed to transit the island and go to the mainland. The NSWCPC would enable live fire capability using low-range, high-fragmentation munitions at the maneuver areas to allow for more realistic training scenarios. The NSWCPC would direct live fire toward the Gulf. Figure 1-2 shows the areas that the NSWCPC will evaluate for these activities.

2. DURATION AND LOCATION OF THE ACTIVITIES

Surf zone testing/training activities and amphibious vehicle testing/training activities are intermittent yet ongoing, and therefore a request is made for a time period of five years. These

activities will occur within the study area, which includes the Gulf-side shoreline of SRI seaward to a depth of 30 feet (Figure 1-2). The distance from the shoreline that corresponds to this depth varies from approximately 0.5 mile at the western side of the Air Force property to 1.5 miles at the eastern side, extending into the inner continental shelf.

3. MARINE MAMMALS SPECIES AND NUMBERS

Marine mammal species potentially occurring within the study area include the Atlantic bottlenose dolphin (*Tursiops truncatus*), the Atlantic spotted dolphin (*Stenella frontalis*), and the Florida manatee (*Trichechus manatus latirostris*). A brief description of each species is provided, along with a discussion on abundance estimates.

3.1 CETACEANS

Cetacean species potentially occurring in the study area include the Atlantic bottlenose dolphin and the Atlantic spotted dolphin.

Atlantic bottlenose dolphin (*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 4 and 10 individuals, respectively, per herd as determined by GulfCet II surveys of eastern Gulf waters (Davis et al., 2000). Migratory patterns from inshore to offshore are likely associated with the movements of their prey rather than a preference for a particular habitat characteristic (such as surface water temperature) (Ridgeway, 1972; Irving, 1973; and Jefferson et al., 1992). The diet of Atlantic bottlenose dolphins consists mainly of fish, crabs, squid, and shrimp (Caldwell and Caldwell, 1983).

Atlantic spotted dolphin (*Stenella frontalis*). Atlantic spotted dolphins 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 preferred depth of the spotted dolphin is believed to be associated with food availability and water temperature. The diet of the Atlantic spotted dolphin consists of squid and fish.

3.1.1 Cetacean Abundance Estimates

Cetacean abundance estimates for the study area are derived from GulfCet II (Davis et al., 2000) aerial surveys of the continental shelf. Texas A&M University and the National Marine Fisheries Service conducted the aerial surveys within the Minerals Management Service (MMS) Eastern Planning Area from 1996 to 1998. In order to maximize species conservation and protection, the density estimate data were adjusted to reflect more realistic encounters of these animals in their natural environment and consider 1) surface and submerged variations, and 2) overall density estimate confidence.

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 obtained from Moore and Clarke (1998), and used to determine an adjusted density for each species.

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.

The final adjusted cetacean density estimates are shown in Table 3-1.

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

Species	Individuals/ 100 km^2	Individuals/km^2	Dive profile - % at surface	Adjusted density (Individuals/km^2)*
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	**24.353**	**0.244**		**1.54**

*Adjusted for undetected submerged animals to approximately two standard deviations.

3.2 SIRENIANS

The Florida manatee is the only sirenian that could potentially occur within the study area.

Florida manatee (*Trichechus manatus latirostris*). The Florida manatee is generally confined to the southern Florida peninsula during winter months (although the range has expanded due to artificial warm-water refuges), and moves farther north during warmer weather. They are primarily herbivorous, feeding on many types of aquatic vegetation, and may occasionally consume shoreline vegetation and fish (USFWS, 2001). Manatees are sighted infrequently in the north Florida panhandle. Winters in north Florida prevent the cold-sensitive manatees from occurring year-round. Their occasional presence is due to migration from warmer regions.

3.2.1 Manatee Abundance Estimates

The manatee population has proven difficult to estimate, but recent data suggest more than 3,000 total manatees in Florida waters (Perrin, 2002). Long-term studies suggest that there are four relatively distinct regional populations of manatees in Florida (USFWS, 2003). The study area lies within the northwest region, which extends along the Gulf coast from Escambia County to Hernando County. The northwest population accounts for approximately 12 percent of the total Florida population, and is thought to have been steadily increasing over the last 25 years (USFWS, 2003).

4. AFFECTED SPECIES STATUS AND DISTRIBUTION

The marine mammal species that the activities in the study area could potentially affect include the Atlantic bottlenose dolphin, Atlantic spotted dolphin, and the Florida manatee. In fulfillment of the Marine Mammal Protection Act, the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service has identified certain cetacean stocks as strategic, meaning non-natural mortalities or serious injuries 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 called the potential for biological removal, or PBR (Code of Federal Regulations [CFR], 1994). This metric is included for each of the species described below.

Atlantic bottlenose dolphin (*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) suggests 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). The northern Gulf of Mexico coastal stock, which is the stock that would occur in the study area, is not considered strategic. The PBR is 35 dolphins (Waring et al., 2001).

Atlantic spotted dolphin (*Stenella frontalis*). Atlantic spotted dolphins 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. 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).

Florida manatee (*Trichechus manatus latirostris*). Manatees are found in the temperate and equatorial waters of the southeastern United States, the Caribbean basin, northern South America, and equatorial West Africa. The Florida manatee, which is a subspecies of the Antillean manatee, ranges from southern Florida to Georgia year-round, and at the extremes of their summer distribution may be found from eastern Texas to Rhode Island (Perrin et al, 2002). Manatees generally disperse during the warm months as water temperatures rise and aquatic plant growth accelerates, and move south during cold weather, aggregating at natural or artificial warm-water sources such as springs. Manatees inhabit coastal, estuarine, and riverine systems. They are primarily herbivorous, feeding on many types of aquatic vegetation, and may occasionally consume shoreline vegetation and fish (USFWS, 2001). Manatees rarely venture into deeper waters, but have been spotted as far offshore as the Dry Tortugas Islands (U.S. Coast

Guard, 1996). Manatees are sighted infrequently in the north Florida panhandle. Winters in north Florida prevent the cold-sensitive manatees from occurring year-round. Their occasional presence is due to migration from warmer regions.

The Florida manatee is listed as endangered under the Endangered Species Act of 1973, as amended. The manatee is also considered a strategic stock due to the high level of mortality relative to estimated population, and because of threats to habitat. The PBR for this species is 3 individuals. However, because this number is significantly exceeded by human-caused mortality, the PBR is effectively zero (NOAA Fisheries, 2005).

5. TAKE AUTHORIZATION REQUESTED

A 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 predominant form of take. However, there is a potential, before any mitigations, that a very small number of marine mammals may be injured due to noise generated from underwater detonations.

6. NUMBERS AND SPECIES TAKEN

Potential impact to marine mammals may occur due to underwater noise and direct physical impacts. Noise is produced by underwater detonations in the surf zone and by the operation of amphibious vehicles. Direct physical impacts refer to the potential for marine mammals to be physically struck by an object. Direct physical impacts could result from collisions with amphibious vehicles and from ordnance live fire. Potential takes due to noise and physical impacts are discussed in the following sections.

6.1 NOISE

Underwater noise can potentially result in harassment of marine mammals. The extent of impact is determined by the physical properties of sound, the environmental conditions in which it is produced, and distance between the sound source and receptor. Potential harassment by noise is analyzed for both Surf Zone Testing/Training and Amphibious Vehicle Testing/Training activities.

6.1.1 Surf Zone Testing/Training

During Surf Zone Testing/Training activities, underwater detonation of live explosives may occur in shallow water (Section 1.1). Detonation noise impacts are considered within two categories: overpressure and acoustics. Underwater explosive detonations produce a wave of pressure in the water column. This pressure wave potentially has lethal and injurious impacts, depending on the receptor and the proximity to the source detonation. Humans and animals

receive the acoustic signature of noise as sound. Beyond the physical impacts, acoustics may cause annoyance and behavior modifications (Goertner, 1982). Both of these aspects of noise will be investigated in the following analysis.

Thresholds

Estimating the impacts to marine mammals from underwater detonations is difficult due to complexities of the physics of explosive sound under water and the lack of understanding with respect to hearing in marine mammals. Potential impacts from surf zone detonations at SRI on marine mammals were previously analyzed in the following documents.

- Final Environmental Assessment for Coastal Testing of the Shallow Water Assault Breaching (SABRE) and Distributed Explosive Technology (DET) Systems, January 1999 (U.S. Air Force, 1999).
- Final Environmental Assessment for Testing of the MK-82 General Purpose Bombs and MK-5 Mine Clearance System, January 1999 (U.S. Air Force, 1999a).
- Letter of Authorization for the Incidental Harassment of Marine Mammals from Surf Zone Testing Missions at Eglin AFB, FL, July 1998 (U.S. Air Force, 1998a).
- Naval Explosive Ordnance Disposal School Training Operations Biological Assessment (U.S. Air Force, 2004).
- Naval Explosive Ordnance Disposal School Incidental Harassment Authorization (U.S. Air Force, 2005).

These assessments use criteria and thresholds for impacts that were developed for the shock trials of the SEAWOLF submarine and the destroyer USS Winston S. Churchill (DDG-81) (DoN, 1998 and DoN, 2001, respectively). The criteria and thresholds used in these documents were adopted by the National Marine Fisheries Service (NMFS) in its Final Rule on the unintentional taking of marine animals incidental to the shock testing (Federal Register, 2001). Criteria for assessing impacts include 1) mortality, as determined by exposure to a certain level of positive impulse pressure (expressed as pounds per square inch per millisecond or psi-msec); 2) injury, both hearing related and non-hearing related; and 3) harassment, as determined by temporary loss of hearing ability and behavioral reactions. Permanent hearing loss is considered an injury and is defined as a permanent threshold shift (PTS). The NMFS historically categorizes PTS as a Level A type of harassment.

Temporary loss of hearing ability is termed temporary threshold shift (TTS), meaning a downward but recoverable decrease in hearing sensitivity. TTS is categorized as a Level B type of harassment and is considered here as non-injurious. The NMFS recognizes dual criteria for TTS, one based on peak pressure and one based on the greatest 1/3 octave energy flux density level (EFDL), with the more conservative (i.e., larger) of the two being selected for impacts analysis. The peak pressure metric used in the shock trials to represent TTS was 12 pounds per square inch (psi) which, for the net explosive weight used, resulted in a zone of Level B harassment approximately equal to that obtained by using a 182 decibel (dB) referenced to 1 (re 1) micropascal squared-second(s) (μPa^2-s) total EFDL metric. The 12 psi metric is largely based on anatomical studies and extrapolations from terrestrial mammal data. However, the

results of a more recent investigation involving marine mammals suggest that, for charges considerably smaller than those used in the Navy shock trials, the 12 psi metric is not an adequate predictor of the onset of TTS.

Finneran *et al.* (2002) measured TTS in a bottlenose dolphin and a beluga whale (*Delphinapterus leucas*) exposed to single underwater impulses produced by a seismic watergun in San Diego Bay. The watergun was chosen over other seismic sources, such as airguns, because the impulses contain more energy at high frequencies where odontocete hearing thresholds are relatively low (i.e., more sensitive). Hearing thresholds were measured at 0.4, 4, and 30 kilohertz (kHz). A relatively small and short-term level of masked TTS (7 dB at 0.4 kHz and 6 dB at 30 kHz) occurred in the beluga whale at a peak pressure of 160 kilopascals (kPa), which is equivalent to 23 psi, 226 dB re 1 micropascal (μPa) peak-peak pressure, and 186 dB re 1 μPa^2-s. The maximum experimental peak pressure exposure of 207 kPa (30 psi, 228 dB re 1 μPa peak-peak pressure, 188 dB re 1 μPa^2-s) did not cause any measurable masked TTS in the bottlenose dolphin. The results of these field experiments represent the most current science available for the relationship between peak pressure and TTS in marine mammals. Therefore, until additional information becomes available, 23 psi is considered an appropriate and conservative metric for predicting the onset of pressure-related TTS.

Documented behavioral reactions occur at noise levels below those considered to cause TTS in marine mammals (Finneran *et al.*, 2002; Schlundt *et al.*, 2000; Finneran and Schlundt, 2004). While not exposing an animal to physical injury, these noise levels may nevertheless indirectly affect survival or fecundity. In controlled experimental situations, behavioral effects are typically defined as alterations of trained behaviors. Behavioral effects in wild animals are more difficult to define but may include decreased ability to feed, communicate, migrate, or reproduce. Abandonment of an area due to repeated noise exposure is also considered a behavioral effect. Analyses in subsequent sections of this document refer to such behavioral effects as sub-TTS Level B harassment. Schlundt *et al.* (2000) exposed bottlenose dolphins and beluga whales to various sound frequencies and intensities in order to measure masked underwater hearing thresholds. Sound intensity levels were progressively increased until behavioral alterations were noted (at which point the onset of TTS was presumed). It was found that decreasing the sound intensity by 4 to 6 dB greatly decreased the occurrence of anomalous behaviors. The lowest sound pressure levels, over all frequencies, at which altered behaviors were observed, ranged from 178 to 193 dB re 1 μPa for the bottlenose dolphins and from 180 to 196 dB re 1 μPa for the beluga whales. Thus, it is reasonable to consider that sub-TTS effects occur at approximately 5 dB below the TTS-inducing sound level, or at approximately 177 dB in the greatest 1/3 Octave band EFDL.

Table 6-1 lists the relevant thresholds, which are specified levels of noise that result in mortality, injury, or harassment, and which are expressed in terms of the above metrics. Mortality and injury thresholds are designed to be conservative by considering the impacts that would occur to the most sensitive life stage (e.g., a dolphin calf).

Table 6-1. Criteria and Thresholds for Impact of Explosive Noise on Marine Mammals

Criterion	Criterion Definition	Threshold
Mortality	Extensive lung damage (1% of dolphin calves exposed would be killed)	30.5 psi-msec positive impulse
Injury (Non-Hearing Related)	Onset of slight lung injury for size of dolphin calf (i.e., an animal weighing less than 174 kilograms)	13 psi-msec positive impulse
Level A Harassment Auditory Injury	(50% of animals exposed would experience ear drum rupture, resulting in estimated 30% PTS)	205 dB Total EFDL
Level B Harassment	Temporary Threshold Shift (NMFS dual criterion)	23 psi peak pressure
Level B Harassment	Temporary Threshold Shift (NMFS dual criterion)	182 dB 1/3 Octave band EFDL
Behavioral	"Sub-TTS" behavioral disruption (Level B under MMPA; harassment under ESA)	177 dB 1/3 Octave band EFDL

Impact Areas

Impact areas are derived from mathematical calculations and models that predict the distances to which threshold noise levels would travel. The equations for the models consider the amount of net explosive, the properties of detonations under water, and environmental factors such as depth of the explosion, overall water depth, water temperature, and bottom type.

The end result of the analysis is an area known as the Zone of Influence (ZOI). A ZOI is based on an outward radial distance from the point of detonation, extending to the limit of a particular threshold level in a 360-degree area. Thus, there are separate ZOIs for mortality, injury (hearing-related injury and slight, non-fatal lung injury), and harassment (TTS and sub-TTS). Given the radius, and assuming noise spreads outward in a spherical manner, the entire area ensonified (i.e., exposed to the specific noise level being analyzed) is estimated.

The shallow water mine clearing systems described in Section 1.1 are composed of lines, or multiple blocks of explosives. This configuration results in a very complex acoustic signature and would typically produce non-spherical zones of influence. In the following ZOI calculations, all net explosive weight is totaled and a single point of detonation assumed for each system. This simplified approach provides a more conservative analysis in that the hypothetical combined explosive weight results in a larger acoustic footprint than the actual simultaneous detonation of the smaller explosive weight charges.

The radius of each threshold discussed above is shown for each shallow water surf zone mine clearing systems in Table 6-2. The radius is assumed to extend from the point of detonation in all directions, allowing calculation of the affected area. An additional test (Pentolite) occurred, but was not analyzed within the MK-82, M5 Line Charge, SABRE or DET Mine Countermeasure EAs. This test was conducted as a preliminary event to provide acoustic signature data in preparation for the SABRE testing. The largest Pentolite charge used was one 10-pound charge. Therefore, compared to the net explosive weights used in the other tests, the Pentolite test is considered negligible in determining potential impacts to marine mammals.

Table 6-2. Threshold Radii for Underwater Explosive Noise Produced from Four Mine Clearing Systems

Threshold	Criteria	RADIUS (METERS)			
		SABRE 232 lb NEW	MK-5 MCS 1750 lb NEW	DET 130 lb	MK-82 ARRAY 1372 lb
1/3 Octave 177 dB EFDL	Level B Behavior	1440	2299	1252	2207
1/3 Octave 182 dB EFDL	Level B TTS Dual Criterion	961	1658	796	1544
205 dB EFDL	Level A PTS	200	478	155	436
23 psi	Level B Dual Criterion	857	1788	761	1557
13 psi-msec	Level A Injury	60	100	58	86
30.5 psi-msec	Mortality	45	68	42	60

Take Estimates

The metric used in virtually all risk assessments (Navy, Air Force, U.S. Geological Survey [USGS], MMS, seismic industry) for estimating marine mammal injuries and applying for permits is the statistical expected value of the number of animals taken for each species. "Taken" here means exposure to sound levels in excess of a threshold.

The number of takes is calculated by applying marine mammal density to the ZOI (area) for each detonation type. Species density for most cetaceans is based on adjusted GulfCet II aerial survey data, which Table 6-3 provides. GulfCet II data were conservatively adjusted upward to approximately two standard deviations to obtain 99 percent confidence, and a submergence correction factor was applied to account for the presence of submerged, uncounted animals. The GulfCet II surveys were conducted from 1996 to 1998 and provide densities of cetacean species for the continental shelf and slope. Due to mission activities being localized to the surf zone, adjusted continental shelf species density estimates are used in Table 6-3.

Table 6-3. Cetacean Densities for Gulf of Mexico Shelf Region

Species	Individuals/ 100 km^2	Individuals/km^2	Dive profile - % at surface	Adjusted density (Individuals/km^2)*
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	**24.353**	**0.244**		**1.54**

*Adjusted for undetected submerged animals to approximately two standard deviations. km^2 = square kilometers.

Table 6-4 lists the noise-related dolphin take estimates resulting from surf zone detonations associated with the Preferred Alternative of the PEA. The take numbers represent the combined total of Atlantic bottlenose and Atlantic spotted dolphins, and do not consider any mitigation measures.

Potential impacts to marine mammals from these tests were presented to the NMFS in requesting an Incidental Harassment Authorization (IHA) for conducting the described surf zone activities off of SRI (U.S. Air Force, 1998a). NMFS permitted the MK-82, M5 Line Charge, SABRE, and DET Mine Countermeasure tests if certain management actions to avoid impacts to marine mammals

were conducted prior to and during the testing. The requirements in the expired IHA provide guidance for mitigation measures that will be employed during surf zone testing, as outlined in Section 11. Implementation of these measures is expected to significantly decrease the number of takes. Discussion of the amount of take reduction is provided in Section 6.3.

Table 6-4. Preferred Alternative Take Estimates from Noise Impacts to Dolphins

Threshold	Criteria	SABRE	MK-5 MCS	DET	MK-82 Array	Total Takes*
177 dB 1/3 Octave EFDL	Sub-TTS	10	26	8	24	68
182 dB 1/3 Octave EFDL	Level B Harassment TTS (dual criterion)	5	13	3	12	33
23 psi	Level B TTS (dual criterion)	4	15	3	12	34
205 dB Total EFDL	Level A PTS	0	1	0	1	2
13 psi-msec	Level A Non-lethal Injury	0	0	0	0	0
30.5 psi-msec	Mortality	0	0	0	0	0

*Estimated exposure with no mitigation measures in place

The West Indian manatee rarely migrates into the area of the surf zone off SRI. Occurrences of manatees would be expected during summer months only. Required visual surveys of the test area (outlined in Section 11) are likely to detect the presence of manatees, and conducting the tests during the wintertime would further decrease the likelihood of detrimental impacts. Therefore, takes of manatees are considered to be effectively zero.

6.1.2 Amphibious Vehicle Testing/Training

Amphibious assaults may involve the use of LCACs, AAVs, and Zodiac boats within 6 miles or less of the shoreline (Section 1.2). Overall LCAC use would be expanded as described in the Preferred Alternative of the SRI PEA. The noise that these vehicles create would expect to deter marine mammals from the immediate area during transit activities. However, activities would last only a few hours at the most on any given day. Noise impacts to marine mammals from amphibious assaults and from expanded LCAC operations are anticipated to be minor and short-term, and are not considered an issue of concern.

6.2 DIRECT PHYSICAL IMPACTS

Direct physical impact (DPI) refers to the potential for marine mammals to be physically struck by objects associated with Air Force activities. DPI could result from vessel traffic and from live fire of munitions, both of which are categorized as Amphibious Vehicle Testing/Training activities. Each of these activities is discussed below.

6.2.1 Direct Physical Impacts Resulting from Vessel Traffic

During the time that amphibious vehicles are operating in (or, in the case of LCACs, just above) the water, encounters with marine mammals are possible. A slight possibility exists that such

encounters could result in a vessel physically striking an animal. However, this scenario is considered very unlikely. Dolphins are extremely mobile and have keen hearing and would likely leave the vicinity of any vehicle traffic. The largest vehicles that would be moving are LCACs, and their beam measurement (width) can be used for conservative impact analyses. The operation which potentially uses the largest number of LCACs is ARG/MEU training. Based on analyses in the ARG/MEU EA, LCAC activities (over 10 days) could potentially impact 22.25 square miles of the total water surface area. The estimated number of bottlenose dolphins in this area is 6.9, with an approximately equal number of Atlantic spotted dolphins. These species would easily avoid collision because the LCACs produce noise that would be detected some distance away, and therefore would be avoided as any other boat in the Gulf. In addition, AAVs move very slowly and would be easily avoided. The potential for amphibious craft colliding with marine mammals and causing injury or death is therefore considered remote.

6.2.2 Direct Physical Impacts Resulting from Live Fire (Shrapnel and Direct Hits)

Live fire is associated with expanded Special Operations training on SRI, as described in the SRI PEA and in Section 1.2 of this document. The use of low-range munitions would be allowed only within designated live fire areas (Figure 1-2). Small caliber weapons between 5.56 mm and .50 caliber would be fired in a seaward direction. If available, soldiers would use frangible munitions (5.56 mm, 7.62 mm, and .50 cal) with effective ranges of 25 to 150 meters. The effective ranges for standard munitions (5.56 mm, 7.62 mm, and .50 cal) vary from 550 meters to 2000 meters.

Live fire operations with munitions directed towards the Gulf have the potential to impact marine mammals (primarily bottlenose and Atlantic spotted dolphins). The combined adjusted density for these species is 1.54 animals/km^2 (Table 6-3). Under a worst-case scenario (no frangible munitions available), the average range of the munitions is approximately 1 kilometer (km). If a given live fire area was 1 km wide, then approximately 1.5 dolphins could be vulnerable to a munitions strike. However, Figure 1-2 shows that even the largest live fire area is considerably less than 1 km wide. Further, live fire would typically occur at only a discreet location within the overall area. If live fire is conservatively estimated to originate from a section of beach 0.2 km wide, only 0.3 dolphins would be within the area of potential DPI. Visual surveys for the presence of marine mammals will be required before commencement of live fire activities (Section 11.2). This mitigation technique further reduces the number of dolphins potentially struck. Therefore, the likelihood of direct impacts to marine mammals due to live fire activities is considered remote.

6.3 REDUCTION OF TAKE ESTIMATE DUE TO MITIGATION EFFECTIVENESS

The previous analyses demonstrate that the only activity reasonably expected to result in marine mammal takes is underwater detonations in the surf zone where the takes would primarily consist of Level B and behavioral harassment due to noise. Table 6-4 provides the number of takes, without consideration of mitigation measures. However, the implementation of mitigation measures should not be ignored when calculating takes. Visual monitoring of the operational area can be a very effective means of detecting the presence of marine mammals. This is particularly true of the species most likely to be present (bottlenose and Atlantic spotted

dolphins) due to their tendency to occur in groups, their relatively short dive times, and their relatively high level of surface activity. In addition, the water clarity in the northeastern Gulf of Mexico is typically very high, rivaling that of many areas of the Caribbean Sea. It is often possible to view the entire water column in the water depth that defines the study area (30 feet). In the discussion of mitigation effectiveness related to the issuance of an IHA to Eglin AFB for Precision Strike Weapons tests in the Gulf, the NMFS considered detection probabilities for these species to be 100 percent for shipboard observers and 50 percent for aerial observers. Table 6-5 lists the number of potential takes associated with surf zone activities with no mitigations in place and with a mitigation effectiveness of 50 and 75 percent; 100 percent mitigation effectiveness would result in zero takes.

Table 6-5. Preferred Alternative Take Estimates from Noise Impacts to Dolphins with and without Mitigation Measures in Place

Threshold	Criteria	Total Takes Resulting from Surf Zone Detonations		
		Without Mitigations	50% Mitigation Effectiveness	75% Mitigation Effectiveness
177 dB 1/3 Octave EFDL	Sub-TTS	68	34	17
182 dB 1/3 Octave EFDL	Level B Harassment TTS (dual criterion)	33	17	8
23 psi	Level B TTS (dual criterion)	34	17	9
205 dB Total EFDL	Level A PTS	2	1	0.5
13 psi-msec	Level A Non-lethal Injury	0	0	0
30.5 psi-msec	Mortality	0	0	0

7. IMPACTS TO MARINE MAMMAL SPECIES OR STOCKS

Based on the analyses and results provided in Section 6, and with the mitigation measures outlined in Section 11, no strategic marine mammal stocks would be affected. 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 (35), Atlantic spotted dolphin (23), and Florida manatee (0).

8. IMPACT ON SUBSISTENCE USE

Potential impacts resulting from the proposed activity 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 surf zone detonations. 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 detonations are present in limited duration and are intermittent as well. Other activities that could affect marine mammal habitat were restricted to noise produced by amphibious vessels. The effects of these activities 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 discussion 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 these estimates take into consideration measures that will be employed by the proponent to minimize impacts to protected species. Eglin AFB has identified required mitigation measures, which are outlined below, in an effort to substantially decrease the number of animals potentially affected.

11.1 MITIGATION MEASURES FOR SURF ZONE DETONATIONS

- Testing will only be conducted under daylight conditions of suitable visibility and sea state of number three or less as Table 11-1 defines.

Table 11-1. Sea State Scale for Marine Mammal 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 meters (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

- Pre- and post-detonation monitoring will be conducted using vessel(s) and/or aircraft to survey the study area for marine mammals. If a marine mammal is sighted within the impact zone (Table 11-2), the mission will be suspended until the animal is clear of this area.

Table 11-2. Survey Area of the Injury Impact Zone Data for Each Test System

Test System	Maximum Water Depth (m)	Survey Area for Aerial Surveys
SABRE-22	10	0.75 km radius from test site
SABRE-23	10	1.0 km radius from test site
DET	12	1.0 km radius from test site
MK-82 GPB	18	6.0 km radius from test site
MK5 MCS	6	0.5 km radius from test site

11.2 MITIGATION MEASURES FOR LIVE FIRE ACTIVITIES

- Navy personnel (NSWCPC) will conduct Live fire testing only under conditions of suitable visibility and sea state of number three or less as Table 11-1 defines.
- Pre- and post-detonation monitoring will be conducted to survey the study area for marine mammals. If a marine mammal is sighted within the target or closely adjacent areas, the mission will be suspended until the area is clear.

12. MINIMIZATION OF ADVERSE EFFECTS ON SUBSISTENCE USE

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

13. MONITORING MEASURES

Eglin routinely employs mitigation measures, which include any supplemental activities that are designed and exercised to help reduce or eliminate the potential impacts to marine resources. Visual monitoring of mission areas is a very effective mitigation during the proposed activities. A qualified observer will conduct systematic monitoring of the impact area for marine mammals prior to, during, and after test events using aerial and/or vessel surveys. Observers will record information on any marine mammal observed during the mission activity. Information recorded will include exercise information (time, date, and location) and marine mammal and/or indicator presence. Stranded or injured marine mammals observed will be immediately reported to the NMFS stranding response network and NMFS Regional Office.

14. RESEARCH

Eglin AFB actively utilizes marine mammal stranding information as a means of ascertaining the effectiveness of mitigation techniques. Stranding data is collected and maintained for the Florida panhandle area as well as Gulf-wide. This task 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 Service statistical zone, both Gulf-wide and on the coastline in proximity to Eglin AFB. Stranding data is combined with records of over-water missions and analyzed for any possible correlation. In addition to being used as a measure of the effectiveness of mitigations, stranding data can yield insight into the species composition of cetaceans in the region.

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. From 1999 to 2003, Eglin's Natural Resources Branch, through a contract representative, has participated in summer cetacean monitoring and research. The contractor participated in visual surveys in 1999 for cetaceans in the 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, the 2002 Sperm Whale Seismic Study (SWSS), and the 2003 SWSS.

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