REQUEST FOR A LETTER OF AUTHORIZATION FOR THE INCIDENTAL HARASSMENT OF MARINE MAMMALS RESULTING FROM THE PROGRAMMATIC MISSION ACTIVITIES WITHIN THE EGLIN GULF TEST AND TRAINING RANGE (EGTTR)

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Submitted To:

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

#	Number
m Pa	Micro Pascal
AFB	Air Force Base
AFSOC	Air Force Special Operations Command
BA	Biological Assessment
cal	Caliber
CFR	Code of Federal Regulations
D	Densities
dB	Decibels
DPI	Direct Physical Impacts
EFD	Energy Flux Density
EGTTR	Eglin Gulf Test and Training Range
FEIS	Final Environmental Impact Statement
FU	Full-up
FY	Fiscal Year
GOM	Gulf of Mexico
HE	High Explosive
Hz	Hertz
IHA	Incidental Harassment Authorization
IR	Infrared Sensors
km^2	Square Kilometers
LOA	Letter of Authorization
m	Meters
mm	Millimeter
MMPA	Marine Mammal Protection Act
N	North
NEW	Net Explosive Weight
NM	Nautical Mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PBR	Potential for Biological Removal
PEA	Programmatic Environmental Assessment
re	Referenced
s	Second
SERO	Southeast Regional Office
SEFSC	Southeast Fisheries Science Center
SWFSC	Southwest Fisheries Science Center
TR	Training Round
TTS	Temporary Threshold Shift
TV	Television
USAF	U.S. Air Force
W	West
Yr	Year
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 programmatic mission activities within the Eglin Gulf Test and Training Range (EGTTR) over the next 5 years, as permitted by the Marine Mammal Protection Act (MMPA) of 1972, as amended. The air-to-surface gunnery test and training activities comprise the majority of Eglin's missions that deploy ordnance into the Gulf of Mexico and have been found to be the only impactive activities in the EGTTR Programmatic Environmental Assessment (PEA). Although it is not anticipated that any federally protected marine animal takes would result in the form of mortality, injury, or Level A harassment, an LOA is being requested [versus an Incidental Harassment Authorization; (IHA)] due to the longevity of the proposed air-to-surface gunnery action.

Air-to-surface gunnery missions involve surface impacts of ordnance projectiles and result in small underwater detonations (up to approximately 5 pounds). These activities may expose cetaceans that potentially occur within the EGTTR to noise. Gunnery mission activities, although conducted primarily in the W-151 ranges, may potentially occur anywhere within the EGTTR. All guns are fired at specific targets in the water, usually Mk-25 flares. Nighttime gunnery training is proposed using the new 105-mm training round (TR) in addition to the baseline level of activity, which includes limited daytime gunnery testing. 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. ramping up and using nighttime training rounds) while potentially sacrificing some mission flexibility. Even though the forfeit of some mission aspects may improve overall mitigation effectiveness, the gunnery mission itself does not accommodate typical mitigations, such as aerial surveys. As such, the use of conservative analyses (Section 11.3) serves as a functional mitigation technique.

Using a conservative density estimate for each species, the zone of influence (ZOI) of each type of round deployed, and the total number of events per year, an annual estimate of the potential number of animals exposed (harassed, injured, or killed) to noise was analyzed. Gunnery noise is anticipated to affect some marine mammal species. The total number of marine mammals exposed to injurious Level A harassment noise levels (205 dB re 1 μPa^2-s or higher) is effectively zero (0.03 animals). Therefore, no Level A noise-related takes are considered. Less than 6.3 marine mammals would potentially be exposed (annually) to a non-injurious (TTS) Level B harassment noise level (182 dB re 1 μPa^2-s). Although approximately 25 animals would potentially experience (annually) noise at the behavioral threshold (176 dB re 1 μPa^2-s), 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 variability in target location selection and the continuous movement of the animals.

Other components of Eglin's programmatic mission activities that could potentially affect marine mammals were considered in Chapter 4 of the EGTTR PEA. These components included

supersonic and subsonic noise from aircrafts, occasional fuel releases, debris, the release of chemicals into the water from munitions, chaff, flares, drones, and missiles, and direct physical impacts from air-to-surface gunnery. The effects of each were determined to be insignificant.

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.

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 fall under the category of Eglin ordnance testing and training. Air-to-surface gunnery missions involve surface impacts of projectiles and small underwater detonations (up to approximately 5 pounds) with the potential to affect cetaceans that may potentially occur within the EGTTR. These missions typically involve the use of 25 millimeter (mm), 40 mm, and 105 mm gunnery rounds (Figure 1-1). The Air Force has developed a 105 mm training round that contains less than 10 percent of the amount of explosive material as compared to the 105 Full Up round. The training round was developed as a method to mitigate effects on marine life. The EGTTR annually supports nearly 39,000 sorties, or individual aircraft flights, that were baselined at the level of activity captured during fiscal years (FY) 95, 96, 97, 98 and 99. This baseline encompasses mission activities over several years in order to capture infrequent, yet important, mission events conducted in the EGTTR. The baseline is represented by the maximum number of each mission type from any one year over the five-year period. The maximum amount of activity rather than a five-year average was selected to best represent typical sortie activity since some mission types were not conducted in every year. This baseline database represents Eglin's most current data available and identifies types of aircraft, where they were flown, where expendables were released, and types of missions flown. The baseline database was compiled from data extracts of the *FY95, FY96, FY97, FY98, and FY99 Range Utilization Reports* (U.S. Air Force, 1996, 1998, 1998a, 2000, 2000a).

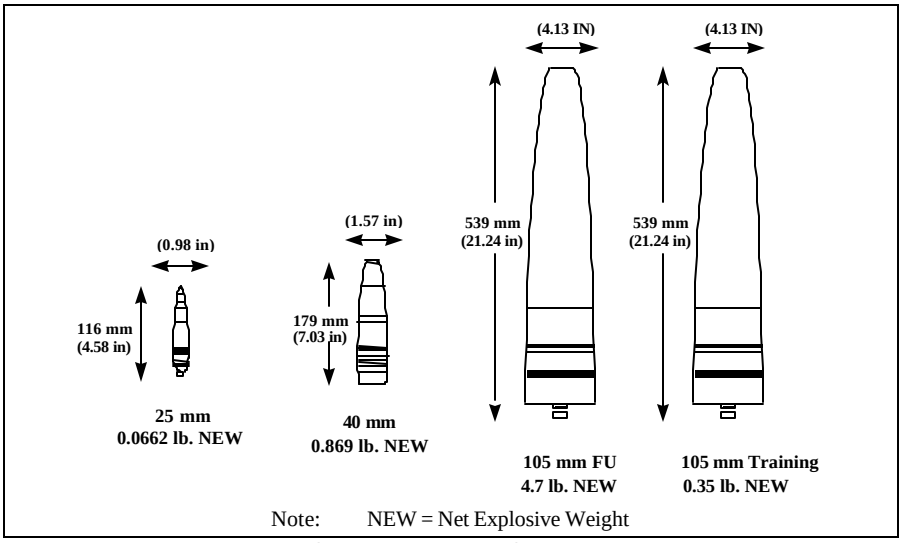

Figure 1-1. Projectiles of the Air-to-Surface Operations in the EGTTR

Other components of Eglin's programmatic mission activities that could potentially affect marine mammals were considered in Chapter 4 of the EGTTR Programmatic Environmental Assessment (PEA) (U.S. Air Force, 2002). These components included supersonic and subsonic noise from aircraft, occasional fuel releases, debris, release of chemicals into the water from munitions, chaff, flares, drones, and missiles, and direct physical impacts from air-to-surface gunnery operations. The effects of each were determined to be insignificant. Please refer to pages 4-1 through 4-33 in the EGTTR PEA for analyses of Eglin's programmatic mission activities other than noise-related air-to-surface gunnery activities.

Air-to-Surface Gunnery Operations

Water ranges within the EGTTR (Figure 1-2) that are typically used for the gunnery operations include W-151A, W-151B, W-151C, and W-151D (Figure 1-3). Based on baseline data, W-151A was the most frequently used water range due to its proximity to Hurlburt Field. Gunships normally transit from Hurlburt Field to the water ranges at a minimum of 4,000 feet above surface level. At a typical distance from the coast of at least 15 miles, the crews scan a 5-mile radius around the potential impact area to ensure it is clear of surface craft and marine species. Scanning is accomplished using radar, all-light television (TV), infrared sensors (IR), and visual means. An alternative area would be selected if any cetaceans or vessels were detected within a 5-mile search area. Once the scan is completed, Mk-25 flares are dropped and the firing sequence is initiated.

A typical gunship mission lasts approximately 5 hours without refueling and 6 hours when air-to-air refueling is accomplished. A typical mission includes:

- 30 minutes to take off and perform airborne sensor alignment; align electro-optical sensors (IR and TV) to heads-up display.
- 1½ to 2 hours of dry fire (no ordnance expended); this time includes transition time.
- 1½ to 2 hours of live fire; this time includes clearing the area and transiting to and from the range; actual firing activities typically do not exceed 30 minutes.
- 1 hour air-to-air refueling, if and when performed.
- 30 minutes transition work (takeoffs, approaches, and landings—pattern work).

The guns are fired during the live fire phase of the mission. The actual firing can last from 30 minutes to 1½ hours but is typically completed in 30 minutes. The number and type of air-to-surface gunnery munitions deployed during a mission varies with each type of mission flown. In addition to the 25-, 40-, and 105-mm rounds, marking flares are also deployed as targets. Training rounds for the 105-mm ammunition are used during nighttime training.

All guns are fired at a specific target in the water, usually an Mk-25 flare. To establish the test target area, two Mk-25 flares are deployed into the center of a 5-nautical mile (nm) radius cleared area (visually clear of aircraft, ships, and marine species) on the water's surface of the EGTTR (Figure 1-4). The flare's burn time normally lasts 10 to 20 minutes but could be much less if actually hit with one of the ordnance projectiles; however, some flares have burned as long as 40 minutes. Live fires are a continuous event with pauses during the firing usually well under a minute and rarely from 2 to 5 minutes. Firing pauses would only exceed 10 minutes if surface boat traffic caused the mission to relocate; if aircraft, gun, or targeting system problems existed; or if more flares needed to be deployed. The Eglin Safety Office has further described the gunnery missions as having 95 percent containment with a 99 percent confidence level within a 5-meter area around the established flare target test area (Figure 1-4).

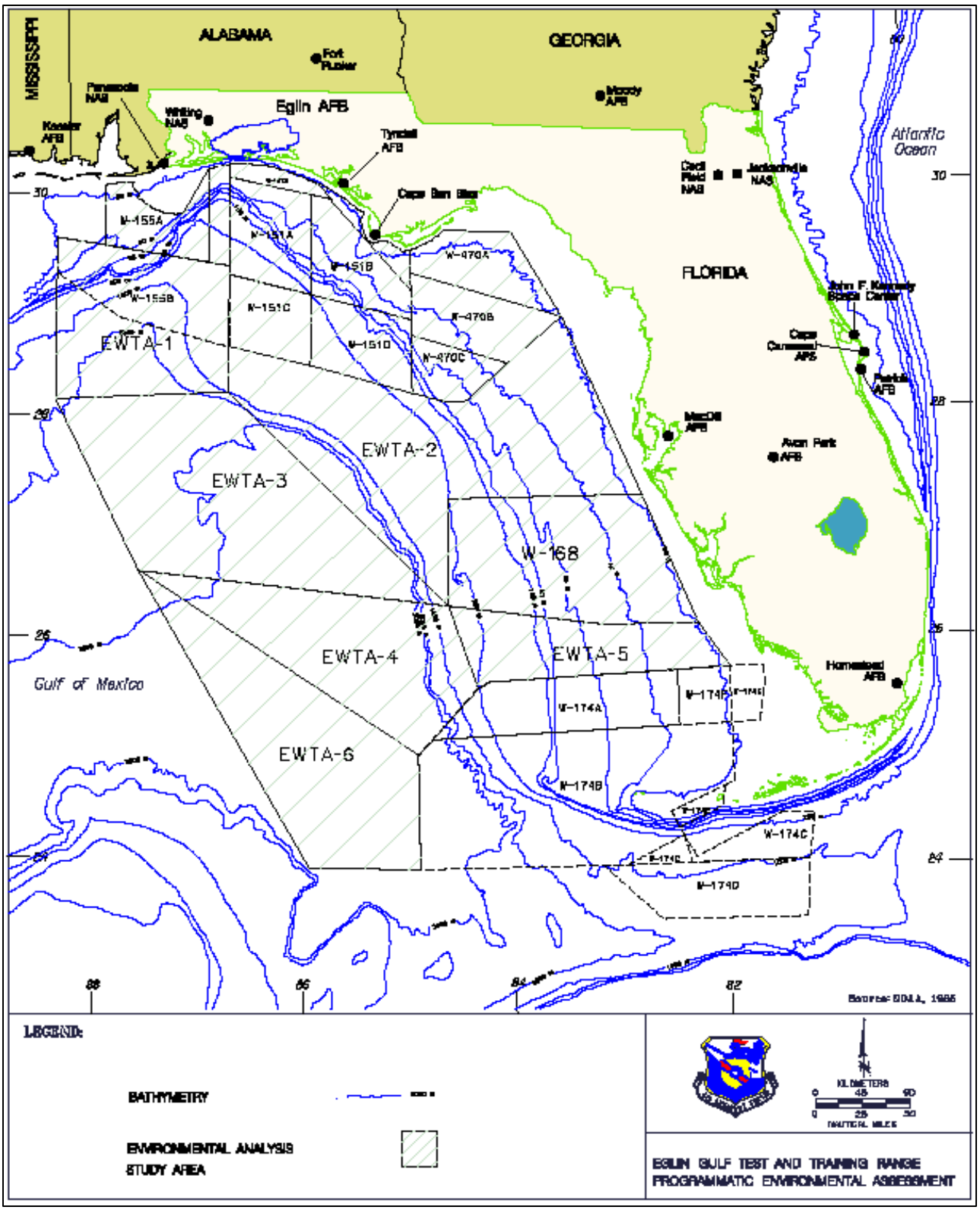

Figure 1-2. Eglin Gulf Test and Training Range

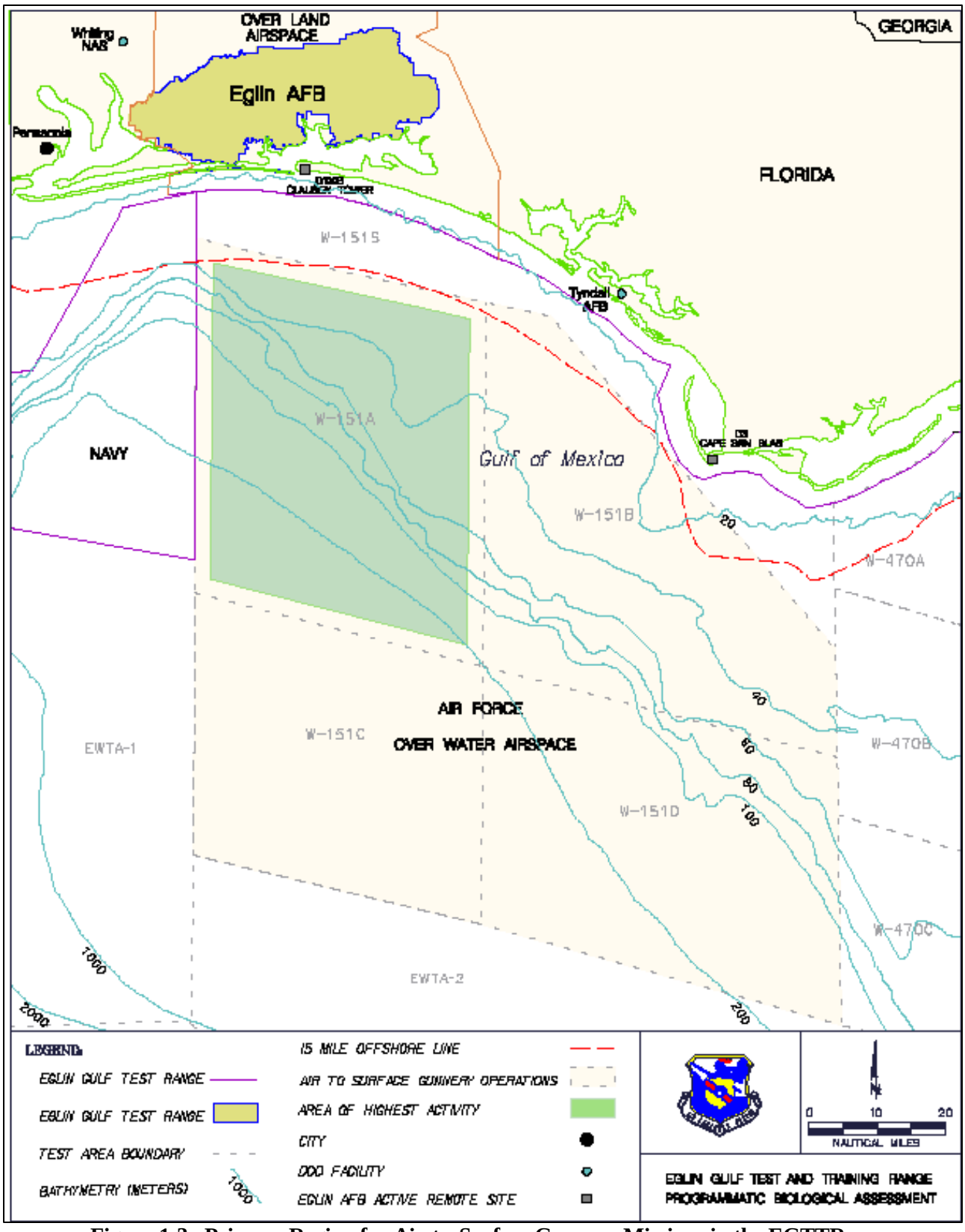

Figure 1-3. Primary Region for Air-to-Surface Gunnery Missions in the EGTTR

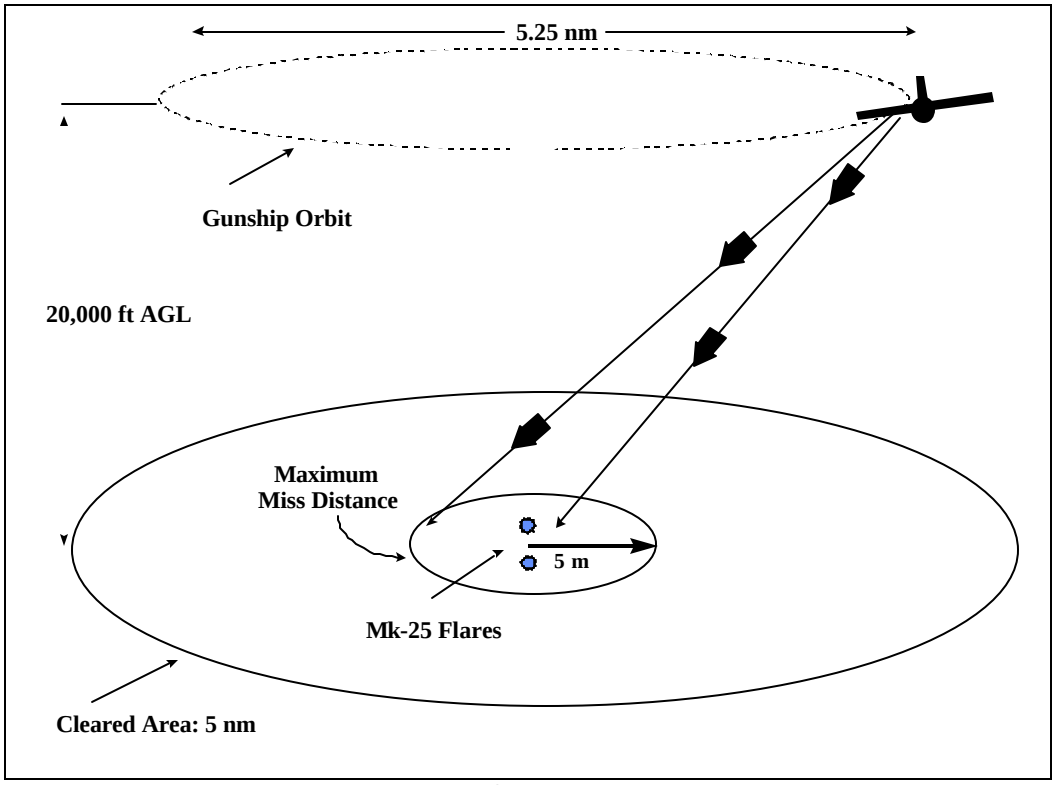

Figure 1-4. Typical Air-to-Surface Gunnery Mission in the EGTTR

The baseline quantity of 105-mm rounds expended annually was approximately 242. Table 1-1 lists the number of expendables, missions, and events expected for daytime gunnery testing.

Table 1-1. Yearly Summary of EGTTR Daytime Gunnery Testing Operations

Test Area	Category	Expendable	Condition	Number of Missions	Daytime Gunnery Expendables
W-151A	GUN	105 mm FU	LIVE	6	128
		25 mm HE	LIVE	1	1,275
		40 mm HE	LIVE	6	536
W-151B	GUN	105 mm FU	LIVE	2	46
		25 mm HE	LIVE	1	294
		40 mm HE	LIVE	1	146
W-151C	GUN	105 mm FU	LIVE	1	10
		25 mm HE	LIVE	1	142
		40 mm HE	LIVE	1	50
W-151D	GUN	105 mm FU	LIVE	2	39
		25 mm HE	LIVE	1	567
		40 mm HE	LIVE	2	198
W-151S	GUN	105 mm FU	LIVE	1	19
		25 mm HE	LIVE	1	283
		40 mm HE	LIVE	1	99
				28	**3,832**

Note: The quantities of gunnery ordnance (105 mm, 40 mm, and 25 mm) were adjusted to reflect the most recent (09/01/99) AFSOC aircraft loading requirements.
HE = high explosive; FU = Full Up

Gunnery testing addressed in this request includes historical baseline yearly amounts in addition to proposed nighttime gunnery missions. Daytime gunnery testing would occur using the 105-mm full-up (FU) round and constitutes the baseline level of EGTTR gunnery activity.

Nighttime gunnery training is proposed using the new 105-mm training round (TR) in addition to the baseline level of activity, which includes limited daytime gunnery testing. An increase in gunnery activity would therefore occur. The number of 105-mm rounds including nighttime operations would amount to 1,742, compared to the baseline quantity of 242. The number of air operations and other ordnance testing and training missions would remain the same as the baseline. Table 1-2 lists the number of expendables, missions, and events expected for nighttime gunnery training only.

Table 1-2. Yearly Summary of EGTTR Nighttime Gunnery Training Operations

Test Area	Category	Expendable	Condition	Missions	Quantity
W-151A	GUN	105 mm TR	LIVE	45	902
		25 mm HE	LIVE	8	7,864
		40 mm HE	LIVE	102	9,811
W-151B	GUN	105 mm TR	LIVE	13	255
		25 mm HE	LIVE	2	1,452
		40 mm HE	LIVE	31	3,023
W-151C	GUN	105 mm TR	LIVE	9	197
		25 mm HE	LIVE	2	2,301
		40 mm HE	LIVE	24	2,302
W-151D	GUN	105 mm TR	LIVE	7	133
		25 mm HE	LIVE	1	830
		40 mm HE	LIVE	16	1,583
W-151S	GUN	105 mm TR	LIVE	1	13
		25 mm HE	LIVE	1	54
		40 mm HE	LIVE	1	82
		TOTAL		**263**	**30,802**

Note: The quantities of gunnery ordnance (105 mm, 40 mm, 25 mm, 7.62 mm, and 0.50 cal) were adjusted to reflect the most recent (09/01/99) AFSOC aircraft loading requirements.
HE = high explosive; TR = training round

Table 1-3 provides a comprehensive list of the number of rounds, missions, and events that would occur from the addition of nighttime gunnery training with daytime gunnery testing. This is the anticipated annual amount of gunnery activity that would occur under the EGTTR proposed action. As shown in Table 1-3, most of the gunnery activity takes place in W-151A (Figure 1-3).

Table 1-3. Yearly Summary of EGTTR Gunnery Nighttime Training and Daytime Testing Operations

Test Area	Category	Expendable	Condition	Number of Missions	Quantity
W-151A	GUN	105 mm FU	LIVE	6	128
		105 mm TR	LIVE	45	902
		25 mm HE	LIVE	9	9,139
		40 mm HE	LIVE	108	10,347
W-151B	GUN	105 mm FU	LIVE	2	46
		105 mm TR	LIVE	13	255
		25 mm HE	LIVE	3	1,746
		40 mm HE	LIVE	32	3,169
W-151C	GUN	105 mm FU	LIVE	1	10
		105 mm TR	LIVE	9	197
		25 mm HE	LIVE	3	2,443
		40 mm HE	LIVE	25	2,352
W-151D	GUN	105 mm FU	LIVE	2	39
		105 mm TR	LIVE	7	133
		25 mm HE	LIVE	2	1,397
		40 mm HE	LIVE	18	1,781
W-151S	GUN	105 mm FU	LIVE	1	19
		105 mm TR	LIVE	1	13
		25 mm HE	LIVE	2	337
		40 mm HE	LIVE	2	181
		TOTAL		**291**	**34,634**

HE = High Explosive; TR = Training Round

2. DURATION AND LOCATION OF THE ACTIVITIES

Gunnery mission activities, although conducted primarily in the W-151 ranges (and predominantly in W-151A), may potentially occur anywhere within the EGTTR (Figure 1-2). Therefore, the entire area is included in the scope of this LOA request. Eglin's mission activities are intermittent yet ongoing, and therefore a request is made for a time period of five years.

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. Eglin's gunnery missions may be conducted as close as three miles from shore, but more frequently occur offshore as far as 15 miles. 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.

Cetaceans inhabiting the study area may be grouped as odontocetes (toothed whales, including dolphins) or mysticetes (baleen whales). Most of the cetaceans occurring in the Gulf are odontocetes. Very few baleen whales exist in the Gulf and most would not be expected to occur within the study area given the known distribution of these species. Cetaceans considered to be common in the Gulf of Mexico include the Atlantic bottlenose dolphin (*Tursiops truncatus*), pantropical spotted dolphin (*Stenella attenuata*), Atlantic spotted dolphin (*Stenella frontalis*), and striped dolphin (*Stenella coeruleoalba*). Of all large whale species in the Gulf, sperm whales (*Physeter macrocepalus*) are most abundant (Mullin, 1996). Table 3-1 lists the cetacean species identified in GulfCet II aerial surveys and provides surface density and abundance estimates for each species. In order to provide better species conservation and protection, the species density estimate data were adjusted by incorporating 1) temporal and spatial variations, 2) surfaced and submerged variations, and 3) overall density estimate confidence.

The GulfCet II aerial surveys identified different density estimates of marine mammals for the shelf and slope geographic locations. Accordingly, the greatest species density estimate available for any given location was utilized for conservative impact assessments. The final adjusted density incorporates marine mammal submergence factors and a confidence level of the density estimates. The GulfCet II surveys focus on enumerating animals detected at the ocean surface and therefore do not account for submerged animals. The percent time that an animal is submerged versus at the surface was obtained from Moore and Clarke (1998), and the density estimates were adjusted accordingly. Additionally, the standard deviations of the densities were calculated, and the information was used to provide an approximately 99 percent confidence level for the adjusted densities. Table 3-1 shows the GulfCet II data and the final adjusted densities.

A brief description of each marine mammal species observed during GulfCet II aerial surveys is provided below.

3.1 BALEEN WHALES

Bryde's whales (*Balaenoptera edeni*) can attain a length of up to 46 feet. Their distribution ranges in the Atlantic from Virginia to the southeast Caribbean, including the northern and eastern Gulf of Mexico (Caldwell and Caldwell, 1983). They are the only regularly occurring baleen whales in the Gulf of Mexico. In addition to filter feeding, Bryde's whales may also feed directly on small schools of fish such as anchovies. Most sightings of the Bryde's whale have occurred during the spring and summer months along the continental shelf edge (Davis et al., 2000).

Table 3-1. Cetacean Statistics from Surveys of the Continental Slope (1996-98)

Species	n	S	D	N	Dive Profile - % at Surface	Adjusted Density/ km^2
Bryde's whale	2	4.0	.035	25	20	0.007
Sperm whale	8	1.5	.052	37	10	0.011
Dwarf/pygmy sperm whale	19	1.8	.267	188	20	0.024
Cuvier's beaked whale	2	2.0	.031	22	10	0.010
Mesoplodon spp.	5	2.2	.084	59	10	0.019
Pygmy killer whale	3	15	.309	218	30	0.030
False killer whale	1	31	.213	150	30	0.026
Short-finned pilot whale	1	33	.227	160	30	0.027
Rough-toothed dolphin	1	34	.234	165	30	0.028
Bottlenose dolphin	83	9.9	14.798	3,959	30	0.810
Risso's dolphin	31	8.8	1.87	1,317	30	0.113
Atlantic spotted dolphin	15	24.8	8.89	1,800	30	0.677
Pantropical spotted dolphin	43	67.4	19.369	13,649	30	1.077
Striped dolphin	7	66.7	3.119	2,198	30	0.237
Spinner dolphin	72	63.1	12.302	8,670	30	0.915
Clymene dolphin	5	97.4	3.253	2,292	30	0.253
Unidentified dolphin*	5	8.2	0.665	199	30	0.053
Unidentified small whale	1	3.0	0.023	16	10	0.008
Totals			**65.74**			**4.325**

Source: Davis et al., 2000; Moore and Clarke, 1998
n = number of groups, S = mean group size, D = animals/100 km^2, N = abundance estimate
*Bottlenose dolphin/Atlantic spotted dolphin

3.2 TOOTHED WHALES AND DOLPHINS

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 4 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.

Blainville's beaked whales (*Mesoplodon densirostris*) may attain lengths of up to 17 feet. Limited to the warm temperate and tropical waters of the world, their distribution in the Atlantic ranges from Nova Scotia to Florida, the Bahamas, and the northern Gulf of Mexico (GOM). General information on the Mesoplodon family of GOM species of beaked whales (Blainville's, Gervais, and Sowerby's) describes these animals as deep-diving, feeding mainly on fish, squid, and deep-water benthic (bottom) invertebrates. Blainville's beaked whales are difficult to distinguish from other beaked whales during surveys, but beaked whales in general were sighted in all seasons during the GulfCet II surveys of the northern GOM (Davis et al., 2000).

Clymene dolphins (*Stenella clymene*) can attain lengths of up to 6.5 feet at adulthood. This species has been primarily sighted in deep waters and feeds mostly on mesopelagic fish and squid. The Clymene dolphin is a recently recognized species, having been designated in 1981.

Cuvier's beaked whales (*Ziphius cavirostris*) are known to attain a maximum size of 24 feet, 9 inches. Their distribution in the Atlantic ranges from Massachusetts to the West Indies, including the Gulf of Mexico (Caldwell and Caldwell, 1983). Diet consists of squid and deepwater fishes (Caldwell and Caldwell, 1983). Perhaps the most common beaked whale in the Gulf, these animals have been sighted in all seasons during the GulfCet II surveys of the northern GOM (Davis et al., 2000).

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.

False killer whales (*Pseudorca crassidens*) can reach 19 feet in length at adulthood. Their distribution in the Atlantic ranges from Maryland to Venezuela, including the eastern and northwestern Gulf of Mexico. Squid and fish are the primary prey (Thurman, 1993). False killer whales were seen in the spring and summer during the GulfCet II surveys of the northern GOM (Davis et al., 2000).

Fraser's dolphins (*Lagenodelphis hosei*) are estimated at adulthood to weigh between 330 and 460 pounds. No information on length was available. This species is tropical in distribution and should be expected in pelagic waters of all oceans. Diet consists of squid, crustaceans, and deep-sea fish. This species has been sighted in the northern GOM in deeper water off of the continental shelf (Mullin et al., 1994, Leatherwood et al., 1993).

Gervais' beaked whales (*Mesoplodon europaeus*) are relatively unknown with little specific information available on size, distribution, or feeding habits. Beaked whales generally range from 13 to 43 feet in length. Generally Mesoplodon beaked whales (Blainville's, Gervais, and Sowerby's) are deep-diving, feeding mainly on fish, squid, and deep-water benthic (bottom) invertebrates. Life history descriptions of beaked whales are limited. Occurrences of beaked whales are typically alone or in pairs, and they are often seen covered with circular markings (scratches). Beaked whales have been seen during all seasons of GulfCet II surveys (Davis et al., 2000).

Killer whales (*Orcinus orca*) are the largest of the dolphin family, attaining lengths to 32 feet. Killer whales are found in all oceans of the world, with local distribution ranging from the Atlantic pack ice to the Lesser Antilles, including the northern, eastern, and western portions of the GOM. Their primary diet consists of fish, squid, sea turtles, sea birds, and other marine mammals. Sightings of killer whales during the GulfCet II surveys occurred only during the spring in the north-central Gulf (Davis et al., 2000).

Melon-headed whales (*Peponocephala electra*) are generally described as medium sized. Their distribution is worldwide from tropical to warm-temperate waters including the Atlantic Ocean and Gulf of Mexico. Their diet consists of squid and small fish. Melon-headed whales were sighted in the GOM during the 1992-1993 marine mammal assessment survey by the National Oceanic and Atmospheric Administration (NOAA) Southwest Fisheries Science Center (SWFSC) and Texas A&M University.

Pantropical spotted dolphins (*Stenella attenuata*) are abundant in tropical oceans and are commonly observed over the continental slope and deep pelagic areas of the Gulf of Mexico. Squid and a variety of schooling fish comprise their diet.

Pygmy killer whales (*Feresa attenuata*) may attain lengths up to 9 feet at adulthood. Their distribution in the Atlantic ranges from North Carolina to the Lesser Antilles, including the Gulf of Mexico. Their diet consists of squid and fish (Thurman, 1993).

Risso's dolphins (*Grampus griseus*) may attain lengths of up to 13 feet upon reaching adulthood. Distribution in the Atlantic ranges from eastern Newfoundland to the Lesser Antilles, including northern and eastern Gulf of Mexico waters. Prey items are primarily squid and some fishes. Sightings in the Gulf occur along the continental shelf and slope.

Rough-toothed dolphins (*Steno bredanensis*) reach sizes up to 8 feet at adulthood. The Atlantic distribution of this species includes waters from Virginia to northeastern South America, including the eastern and northwestern Gulf of Mexico. Squids and octopi are the primary prey items. Rough-toothed dolphins are expected to occur throughout the year in the GOM (Jefferson et al., 1992; Minerals Management Service, 1990). Sightings of this species were recorded in the eastern Gulf in the spring and summer during the GulfCet II surveys (Davis et al., 2000).

Short-finned pilot whales (*Globicephalus sp.*) can attain lengths of up to 23 feet. Their distribution in the Atlantic ranges from New Jersey to Venezuela, including Gulf of Mexico (Caldwell and Caldwell, 1983). This species feeds on squid and fishes. Short-finned pilot whales are more commonly observed in the western and central Gulf than in the eastern Gulf. Sightings of short-finned pilot whales occurred in the spring and winter in the oceanic northern Gulf during the GulfCet II survey (Davis et al., 2000).

Sperm Whales ***(Physeter macrocephalus).*** Sperm whales are the most abundant of the federally endangered whales in the GOM and may attain lengths of up to 69 feet at adulthood (Jefferson et al., 1992; Caldwell and Caldwell, 1983). Their distribution in the Atlantic ranges from Davis Straits to Venezuela (Caldwell and Caldwell, 1983). Sperm whales can be found along the continental slope and shelf break, as well as near seamounts and submarine ridges, feeding on fish and squid. These animals have been sighted in the GOM during all seasons, and areas of relatively high occurrence have been noted near the Mississippi River delta (Davis et al., 2000).

Spinner dolphins (*Stenella longirostris*) are found in tropical and subtropical waters worldwide, and can attain lengths of up to 7 feet at adulthood. This species typically occurs in deep water. Spinner dolphins feed primarily on mesopelagic fish and squid.

Striped dolphins (*Stenella coeruleoalba*) are distributed worldwide in tropical to temperate waters and may attain lengths of up to 9 feet. The striped dolphin is an oceanic species. Feeding occurs at mid-depths on fishes, squid, and crustaceans.

4. AFFECTED SPECIES STATUS AND DISTRIBUTION

The marine mammal species potentially affected by Level B harassment (see Section 6 for impact assessment) include the Atlantic bottlenose dolphin, Risso's dolphin, Atlantic spotted dolphin, pantropical spotted dolphin, striped dolphin, spinner dolphin, and Clymene dolphin. 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 each 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) 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). 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).

Risso's dolphins (*Grampus griseus*) are distributed worldwide in tropical and warm temperate waters. In the Atlantic Ocean, distribution ranges from eastern Newfoundland to the Lesser Antilles, including northern and eastern Gulf of Mexico waters. There is no information to indicate stock differentiation in the Atlantic population. Sightings in the Gulf occur along the continental shelf and slope, with a possible slope preference due to prey (squid) abundance. This stock is not strategic and the PBR for this species is 22 animals (Blaylock et al., 1995).

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).

Pantropical spotted dolphins (*Stenella attenuata*) are distributed worldwide in tropical and subtropical waters. They inhabit the Gulf of Mexico year-round (Fritts and Reynolds, 1981), and are commonly observed over the continental slope and deep pelagic areas in waters greater than 200 meters (Blaylock et al., 1995). This stock is not strategic and the PBR for this species is 265 animals (Blaylock et al., 1995).

Spinner dolphins (*Stenella longirostris*) are distributed worldwide in tropical to warm temperate waters. This species may be found in the Atlantic from North Carolina to southern Brazil and in northern, eastern, and western Gulf of Mexico waters (Caldwell and Caldwell, 1983). This species was sighted in the eastern Gulf during the winter, spring, and summer seasons (Davis et al., 2000). This species is not a strategic stock. The PBR is 45 dolphins (Blaylock et al., 1995).

Striped dolphins (*Stenella coeruleoalba*) are distributed worldwide in tropical to temperate waters. Their distribution in the Atlantic ranges from Halifax, Nova Scotia, to Lesser Antilles, including the Gulf of Mexico. Striped dolphins are primarily found off deeper waters of the continental shelf and have been sighted in the northern Gulf during fall, winter, and spring. This species is not a strategic stock. The PBR is 34 dolphins (Blaylock et al., 1995).

Clymene dolphins (*Stenella clymene*) are endemic to tropical and sub-tropical waters of the Atlantic Ocean. Their distribution in the Atlantic ranges from New Jersey to the Lesser Antilles, including the Gulf of Mexico (Caldwell and Caldwell, 1983). They occur primarily from the shelf break to deeper waters. This stock is not considered strategic and the PBR is 41 dolphins (Blaylock et al., 1995).

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, and that subsequent analyses in this request will identify harassment as the only form of take. However, the activities described in this request are ongoing, and as such a five-year LOA is requested.

6. NUMBERS AND SPECIES TAKEN

Marine mammals may be potentially harassed due to noise from air-to-surface gunnery operations involving ordnance testing and training in the EGTTR. The potential numbers and species taken by noise are assessed in this section. A "typical" gunnery 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 noise analyses, the number of firing events from gunnery missions is synonymous with the quantity of rounds expended. When utilizing energy threshold metrics, one must consider that the energy released from multiple shots should be evaluated as an additive exposure and, therefore, events must consider all shots fired. The number of events for daytime gunnery testing operations, nighttime gunnery training operations, and combined operations are listed in Tables 2-3, 2-4, and 2-5, respectively.

Marine mammals may potentially be affected by noise at various decibel levels from the exploding ordnance. The EGTTR BA utilizes similar noise energy metrics as used in the Navy's ship shock trials (CHURCHILL FEIS) (US Department of the Navy, 2001) to evaluate Level A and Level B harassment criteria. In addition, informal coordination meetings with NOAA Fisheries (Office of Protected Species, 5/23/02 and 8/15/02) have resulted in the assessment of an additional threshold for Level B harassment that addresses behavioral modification. As a result, three thresholds are considered, each defined by a particular received sound decibel level as follows:

Level A Harassment
Injurious – eardrum rupture in 50 percent of animals exposed
205 dB re 1 μPa^2-s

Level B Harassment
Non-injurious, temporary threshold shift
182 dB re 1 μPa^2-s

Level B Harassment
Non-injurious, behavioral response
176 dB re 1 μPa^2-s

Using the adjusted density estimates of each species, the ZOI of each type of round deployed, and the total number of events per year, an annual estimate of the potential number of animal takes from noise was calculated. Analyses were also performed for total densities of cetaceans. Table 6-1 provides the total number of potentially affected (exposed) marine mammals for all gunnery events of the 105-mm (FU and TR), 40-mm, and 25-mm rounds using the greatest 1/3-octave band energy flux density metric. The numbers in Table 6-1 represent the maximum exposures reasonably expected to occur, and may possibly be lowered by mitigation techniques.

Table 6-1. Yearly Estimated Number of Marine Mammals Affected by the Gunnery Mission Noise

Species	Adjusted Density (#/km^2)	Level A Harassment Injurious 205 dB* EFD For Ear Rupture	Level B Harassment Non-Injurious 182 dB* EFD For TTS	Level B Harassment Non-Injurious 176 dB* EFD For Behavior
Bryde's whale	0.007	<0.001	0.010	0.041
Sperm whale	0.011	<0.001	0.016	0.064
Dwarf/pygmy sperm whale	0.024	<0.001	0.035	0.139
Cuvier's beaked whale	0.10	<0.001	0.015	0.058
Mesoplodon spp.	0.019	<0.001	0.028	0.110
Pygmy killer whale	0.030	<0.001	0.044	0.174
False killer whale	0.026	<0.001	0.038	0.151
Short-finned pilot whale	0.027	<0.001	0.039	0.157
Rough-toothed dolphin	0.028	<0.001	0.041	0.163
Bottlenose dolphin	0.810	0.006	1.177	4.706
Risso's dolphin	0.113	0.001	0.164	0.657
Atlantic spotted dolphin	0.677	0.005	0.984	3.934
Pantropical spotted dolphin	1.077	0.008	1.565	6.258
Striped dolphin	0.237	0.002	0.344	1.377
Spinner dolphin	0.915	0.007	1.330	5.316
Clymene dolphin	0.253	0.002	0.368	1.470
Unidentified dolphin**	0.053	<0.001	0.077	0.308
Unidentified whale	0.008	<0.001	0.012	0.046
All marine mammals	4.325	0.032	6.29	25.13

km^2 = square kilometers; NA = not applicable
*dB= dB re 1 μPa^2-s
**Bottlenose dolphin/Atlantic spotted dolphin

Table 6-1 shows that gunnery noise is anticipated to affect only certain marine mammal species. Less than 6.3 marine mammals would potentially be exposed (annually) to a non-injurious (TTS) Level B harassment noise level (182 decibels [dB] re 1 μPa^2-s). Although approximately 25 animals would potentially experience (annually) noise at the behavioral threshold, (176 dB re 1 μPa^2-s), no behavioral impacts would result because repetitive exposures to the same animals are highly unlikely due to the variability in target location selection and the continuous movement of the animals. No marine mammal species would be exposed to injurious Level A harassment or greater noise levels (205 dB re 1 μPa^2-s or higher).

Based on the noise threshold exposure of Table 6-1, the total number of marine mammal takes via Level A harassment is effectively zero (0.03). Therefore, no Level A noise-related takes are considered. The numbers of marine mammal takes (by species) in the Level B harassment categories are shown in Table 6-2. These data have been extracted from Table 6-1 and adjusted to the nearest whole animal, which slightly reduces the overall number of Level B TTS (182 dB re 1 μPa^2-s) takes from six to five. As a conservative estimate, however, six takes are being requested based on the summation of all marine mammals and the best available science. Zero behavioral takes (176 dB re 1 μPa^2-s) are expected since repetitive exposures to the same animals are highly unlikely. Those species that do not appear in Table 6-2, but were considered in Table 6-1, have extremely small risk of being exposed (averaging < 0.09 per species).

Table 6-2. Estimated Annual Noise Related Takes

Species	Level A Harassment Injurious 205 dB* EFD For Ear Rupture[1]	Level B Harassment Non-Injurious 182 dB* EFD For TTS[2]	Level B Harassment Non-Injurious 176 dB* EFD For Behavior[3]
Bottlenose dolphin	0	1	0
Atlantic spotted dolphin	0	1	0
Pantropical spotted dolphin	0	2	0
Spinner dolphin	0	1	0
Additional dolphin[4]	0	1	0
TOTAL	**0**	**6**	**0**

*dB= dB re 1 μPa^2-s

Notes: [1] Values less than 0.01; [2] Values > 0.5 from impact Table 6-1; [3] Zero behavioral takes since repetitive exposures to same animals are highly unlikely; [4] Included for conservative estimation of take from round-off of species numbers from Table 6-1

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); pantropical spotted dolphin (265); and spinner dolphin (45).
No strategic marine mammal stocks would be affected.

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 which 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 gunnery 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. The target flare's burn time normally lasts 10 to 20 minutes. Given this short time of a lighted environment and the variable locations they are dropped, no increases in density of phytoplankton or other organisms introducing primary productivity into the waters would affect marine mammal habitat or populations. Also, live fires are a continuous event with pauses during the firing usually well under a minute and rarely from 2 to 5 minutes. Likewise, 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, chaff, debris, ordnance, and chemical residues into the water column. Chemical residues can enter the water through ammunition, flares, drones, missiles, and smoke.

The effects of each of these components were considered in the EGTTR PEA and were determined to be insignificant (U.S. Air Force, 2002). Please refer to pages 4-1 through 4-33 in the EGTTR PEA for analyses of Eglin's programmatic mission activities other than noise-related air-to-surface gunnery activities. 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. 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 (i.e. ramping up and using nighttime training rounds) while potentially sacrificing some mission flexibility. Even though the forfeit of some mission aspects may improve overall mitigation effectiveness, the gunnery mission itself does not accommodate typical mitigations, such as aerial surveys. As such, the use of conservative analyses (Section 11.3) serves as a functional mitigation technique.

Visual Monitoring

Areas to be used in gunnery missions are visually monitored for marine mammal presence from aircraft prior to commencement of the mission. If the presence of marine mammals is detected, these areas are avoided. In addition, monitoring continues during the mission. If marine mammals are detected, the mission is halted or relocated as necessary. Unfortunately, visual monitoring mitigations to reduce effects of gunnery testing and training are not very effective at 20,000 feet unless there is a large herd of marine mammals. Nighttime visual surveys are generally considered to be ineffective; however, the nighttime mission has been altered to incorporate the training round (below).

Development of Training Round

The largest type of ammunition used during typical gunnery missions is a 105-mm round containing 4.7 pounds of HE. This is several times more HE than that found in the next largest round (40 mm). As a mitigation technique, the Air Force developed a 105-mm training round that contains only 0.35 pounds of HE. The training round was developed to significantly reduce the effects of nighttime operations, when visual surveying for marine mammals is of limited effectiveness. Use of the training round at night dramatically reduces the risk of harassment and is essentially a mitigation brought about in response to the cessation of nighttime gunnery training in the Gulf. An example of the expected effectiveness of this mitigation is presented in

Table 11-1 below. The conservative threshold level of 160 dB re 1 $\mu Pa^2 \cdot s$ is used here to better show the difference in the size of the ZOI and the number of animals exposed between the training round and the full-up round.

Table 11-1. Example of Mitigation Effectiveness Using the 105-mm Training Round Versus the 105-mm Full Up Round

Threshold (dB)	105 mm TR (~0.3 lbs. HE)		105 mm FU (~4.7 lbs. HE)		Mitigation (Percent Reduction)	
DB	**ZOI (km^2)**	**Affected Animals (#)**	**ZOI (km^2)**	**Affected Animals (#)**	**ZOI (%)**	**Affected Animals (%)**
160	6.8	29.4	179.2	775.2	96	96

TR = training round; HE = high explosive; km^2 = square kilometers

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). These surveys identified different densities for species in the survey areas dependent on location (continental shelf versus continental slope). The continental shelf is shallower than the slope and is not frequented by as many different species, nor is it habitat for the only endangered cetacean likely to be encountered in the Gulf, the sperm whale. Conducting activities in areas of lower marine mammal and threatened and endangered species densities would reduce potential effects. Table 11-2 identifies the number of shelf and slope marine mammals that may potentially be exposed to the 182 dB (greatest 1/3-octave band energy flux density) threshold. These data indicate that potential mitigation benefits may exist when considering geographic locations for conducting gunnery operations.

Table 11-2. Geographic Density Variations for Marine Mammal Species

Shelf versus Slope		
	Shelf	Slope
Marine Mammal Species	2.26	4.78

In addition to using conservative baseline numbers based on location, 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.

Ramp-Up and Warning Procedures

Ramping up, or beginning with the lowest or least impactive action and proceeding to subsequently greater impactive actions (in this case the lowest caliber of munition up to 105 mm), allows for animals to perceive steadily increasing sound waves and react if necessary.

Alerting animals in advance of injurious sound waves by transmitting low-power "warning" signals a short time before the action provides a safeguard where there is potential for a significant risk of injury.

Ramp-up procedures for potentially impactive acoustic sources are incorporated in many formal mitigation plans. The movement of the animal away from a potentially impactive source is generally not interpreted as harassment.

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 (i.e., incidental harassment takes) 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 activity's mitigations.

Unfortunately, visual monitoring to detect the presence of marine mammals during gunnery testing and training is not considered very effective at 15,000 to 20,000 feet, unless there is a large herd or pod of marine mammals. Furthermore, visual monitoring is considered to be even less effective during nighttime EGTTR mission activities. The risk of harassment (Level A & B) to marine mammals has been determined to be very small (Section 6.). Eglin has determined that with the implementation and commitment to utilizing the "operational" mitigations (Section 11), the conduct of nighttime training precludes the use of nighttime visual monitoring techniques.

For daytime gunnery testing, areas to be used in gunnery missions are visually monitored for marine mammal presence from aircraft prior to commencement of the mission. Monitoring would be conducted before gunnery operations to select the least impactive site, and during the gunnery activity, observations of marine mammals (and sea turtles) within an impact area would initiate an immediate cease-fire and subsequent relocation of the activity or abatement of firing until the animal left the area. The following procedures may be feasible during the daytime mission activities using the operational aircraft:

- Conduct air-to-surface gunnery test operations within the W-151 area of EGTTR.
- Conduct overflight clearance procedures using best operational methods possible, with extensive focus using all available on-board visual and sensor capabilities. Clearance procedures should include several orbits at low altitude.
- Clear impact area and avoid all protected species and *Sargassum* rafts to the maximum extent possible.

- Relocate and reconduct clearance procedures if whales, dolphins, turtles, or *Sargassum* rafts are encountered.
- Ramp up during live fire phase of test operations by initiating live fire with smallest rounds first and concluding with progressively larger rounds (to 105 mm).
- Conduct post-firing observation and report operations data as required by Eglin's Natural Resource Branch; AAC/EMSN.
- Submit annual summary of post-firing 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 does not currently conduct independent Air Force monitoring efforts, Eglin's Natural Resources Management Branch does participates 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 Natural Resources 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 conducts other research efforts which 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 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 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.

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APPENDIX A

NOISE IMPACT ESTIMATIONS

NOISE IMPACT ESTIMATIONS

A.1 EXPLOSIVE SOURCE CHARACTERIZATION

After determining the number of live fire events for the gunnery missions, it is necessary to estimate noise levels from the explosive shells (source characterization), as well as the loss of noise energy (transmission loss) over distance from the explosion source. The source energy level for an explosive shell is the estimated energy level at a nominal distance (usually 1 meter) from the center of the charge. Transmission loss simply describes the loss of acoustic energy (or decrease in noise level) at locations away from the source of the explosion. Standard models for the source properties of explosives and for the propagation of explosive energy, both based on measurements, are used here to estimate the energy at and away from the charge.

The metric used in this assessment for effects of sound on marine life is energy flux density (EFD). EFD in 1/3-octave bands are considered since precedent for previous noise research used thresholds based on 1/3 octave bands (Churchill, TTS study). Table A-1 provides the EFD source levels for explosive charges used in the EGTTR. The EFD levels are stated in units of dB re 1 $\mu Pa^2 \cdot s$.

Table A-1. Explosive Shell Source Metric Levels

Expendable	EFD in Greatest 1/3-Octave Band > 10 Hz	EFD in Greatest 1/3-Octave Band > 100 Hz
105 mm TR	212	212
105 mm FU	223	223
40 mm HE	216	216
25 mm HE	204	204

The following analyses will utilize the energy metrics used in the Navy's ship shock trials (*CHURCHILL* FEIS) (U.S. Department of the Navy, 2001) for underwater noise impact analysis of marine mammals. Use of these metrics will enable a thorough analysis of underwater noise effects.

A.2 NOISE METRICS AND THRESHOLD CRITERIA

Two of the selected threshold criteria, Level A (injurious) and Level B (non-injurious) harassment, utilized in this document correspond to those employed in the CHURCHILL FEIS noise analyses and are currently recognized by NOAA Fisheries as criteria for assessing hearing related harassments to marine mammals for single-event explosive and/or impulsive noise sources. Temporary threshold shift (TTS), which is a temporary decrease in hearing sensitivity, is one criterion for Level B harassment. An additional threshold criterion was employed to assess Level B (non-injurious) harassment for multiple events (shots), and addresses long-term behavioral response (Table A-2). In order for an animal to experience long-term behavioral effects, multiple exposures are required.

During informal coordination meetings with NOAA Fisheries (Office of Protected Resources, 5/23/02 and 08/15/02) topics of Level B harassment assessment and/or approach to estimating potential behavioral modifications or responses for marine mammals were also discussed. The scientific information necessary to adopt threshold criteria for assessing behavioral modifications is currently under debate and remains uncertain. 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. Use of these three thresholds will enable a thorough analysis of the potential underwater noise effects on protected marine species resulting from the EGTTR mission activities. Thresholds employed for potential impact assessments to marine mammals are also the source of much scientific controversy and debate.

Table A-2. Threshold Criteria and Metrics Utilized for Impact Analyses

Level A Harassment	Level B Harassment	Level B Harassment
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)
205 dB re 1 μPa^2-s EFD	182 dB re 1 μPa^2-s (EFD in greatest 1/3 octave band above 10 Hz or 100 Hz)	176 dB re 1 μPa^2-s (EFD in greatest 1/3 octave band above 10 Hz or 100 Hz)

EFD = energy flux density

A.3 NOISE ZONE OF INFLUENCE

The source levels of noise for each explosive gunnery shell were used to estimate the noise zone of influence (ZOI) within the EGTTR. The number of animals potentially exposed within the ZOI was calculated based on density and population information obtained from NOAA Fisheries marine mammal surveys. Generally, a ZOI describes the minimum region (of water) of the underwater explosion within which marine animals would be potentially exposed to a particular level of noise. For simplicity, ZOIs are often described as cylinders centered at the explosion with a constant radius over all depths. The ZOI radius for a given underwater explosion further depends on the noise metric and threshold selected for the impact analyses.

Table A-3 identifies and summarizes the individual ZOI radii for each gunnery ordnance type at three harassment threshold criteria: 1) Level A harassment, injury threshold utilizing the 205 dB re 1 μPa^2-s (greatest 1/3 octave band EFD) criteria; 2) Level B harassment, non-injurious TTS threshold utilizing the 182 dB re 1 μPa^2-s (greatest 1/3-octave band EFD) criteria; and 3) Level B harassment, non-injurious behavioral modification threshold utilizing the 176 dB re 1 μPa^2-s (greatest 1/3-octave band EFD) criteria.

Table A-3. Estimated Range of ZOI Distance for the EGTTR Ordnance

Expendable	Level A Harassment Injurious (205 dB) EFD (meters)	Level B Harassment Non-Injurious (182 dB) EFD For TTS (meters)	Level B Harassment Non-Injurious (176 dB) EFD For Behavior (meters)
105 mm FU	0.79	11.1	22.1
105 mm TR	0.22	3.0	6.0
40 mm HE	0.33	4.7	9.4
25 mm HE	0.11	1.3	2.6

EFD = energy flux density; FU = full up; TR = training round

It should be noted that when more than one explosion occurs, estimating the average number of animals affected at a particular threshold criteria becomes complicated by source and animal spatial and temporal effects. Often computations are further complicated by thresholds that depend on the duration or number of exposures for each animal. The general case of moving animals, moving sources, and varying exposure thresholds is difficult to solve analytically. Information from Table A-3 may be incorporated with the known animal density estimates to derive the expected number of animals potentially affected by an underwater explosion.

A.4 METHODOLOGY FOR TAKE ESTIMATION

The impact calculations for this section utilize marine mammal density estimates that have been derived from aerial surveys during the GulfCet II (1996-1997) surveys. Abundance and density data from the aerial survey portion of the GulfCet study best reflect the abundance and density 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 survey area is known as the Minerals Management Service Eastern Planning Area and may be divided into continental shelf and continental slope regions. The survey area of the shelf for GulfCet II is defined as 18.5 kilometers offshore to 100 meters deep between 88°10.0'West and 85°55.0'W and totals 12,326 km^2. The slope region is defined as waters 100 to 2,000 meters deep east of 88°10.0'W and north of 26°00.0'N and covers an area of 70,470 km^2 (Davis et al., 2000).

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 1) temporal and spatial variations, 2) surface and submerged variations, 3) individual and group associations, and 4) overall density estimate confidence.

Temporal and Spatial Variations: The GulfCet II (1996-1997) 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. Accordingly, the greatest species density estimate available for any given season (winter or summer), location (shelf or slope), or survey type (aerial or ship) was utilized for conservative impact assessments.

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, however, density estimates have been adjusted to account for submerged individuals. The percent time that an animal is submerged versus at the surface was utilized to determine an adjusted density for each species. Percent 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.

Individual and Group Associations: Since many marine mammals travel in groups or pods, impact assessments need to consider how this nonrandom distribution influences the calculations of potential effects on a population. In some situations, the number of marine mammal groups (rather than individuals) may be an appropriate unit to consider potential risk. One useful application of this information would evaluate the probability of encountering a group of marine mammals to estimate the effectiveness of the survey-clearing mitigation within the ZOI. In the case of the EGGTR mission activities, however, the largest impact area or ZOI is quite small (approximately 22 m) and therefore renders the assessment using groups to be no more beneficial than just considering the likelihood of randomly encountering a single individual marine mammal.

Density Estimate Confidence: The density estimates of marine mammals and sea turtles resulting from the GulfCet II (1996-1997) 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. These impact assessments for estimating protected species takes utilize a methodology that incorporates the standard deviation to determine an upper confidence value for the density estimates. Similar methodologies have been employed by NOAA Fisheries, particularly at the Southeast Regional Office (SERO), to determine take assessments for biological opinions within this region. The standard deviation for each species abundance estimate was employed to increase the confidence of the analyses. Therefore, an upper confidence value of two standard deviations (approximately a 99 percent confidence level) was utilized to further adjust the density estimate for each species.

Table A-4 summarizes adjusted density estimates for individual marine mammals for the EGTTR test area and includes considerations of 1) temporal and spatial variations, 2) surface and submerged variations, 3) individual and group associations, and 4) overall density estimate confidence. As a conservative approach for estimating marine mammal densities where spatial data were available, Continental Shelf data were utilized for the bottlenose dolphin, Atlantic spotted dolphin, and bottlenose dolphin/Atlantic spotted dolphin species, and Continental Slope data were used for the dwarf/pygmy sperm whale.

Using the adjusted density estimate of each species, the ZOI of each type of round deployed, and the total number of events per year, an estimate of the potential number of animal takes per year from noise was analyzed. Analyses were also performed for total densities of cetaceans. Table A-5 provides the total number of potentially affected (exposed) marine mammals for all gunnery events of the 105-mm (FU and TR), 40-mm, and 25-mm rounds using the greatest 1/3-octave band energy flux density metric. The numbers in Table A-5 represent the maximum exposures reasonably expected to occur, and may possibly be lowered by mitigation techniques.

Table A-4. Marine Mammal Densities Based on GulfCet II Surveys

Species	Individuals/ 100 km^2	Dive profile - % at surface	Mean Group Size	Adjusted density (Groups/km^2)	Adjusted density (Individuals/km^2)
Bryde's whale	0.035	20	4	0.0004	0.007
Sperm whale	0.052	10	2	0.0034	0.011
Dwarf/pygmy sperm whale	0.267	20	2	0.0074	0.024
Cuvier's beaked whale	0.031	10	2	0.0016	0.010
Mesoplodon spp.	0.084	10	2	0.0038	0.019
Pygmy killer whale	0.309	30	15	0.0007	0.030
False killer whale	0.213	30	31	0.0002	0.026
Short-finned pilot whale	0.227	30	33	0.0002	0.027
Rough-toothed dolphin	0.234	30	34	0.0002	0.028
Bottlenose dolphin	14.798	30	7	0.069	0.810
Risso's dolphin	1.87	30	9	0.0070	0.113
Atlantic spotted dolphin	8.89	30	32	0.009	0.677
Pantropical spotted dolphin	19.369	30	67	0.0095	1.077
Striped dolphin	3.119	30	67	0.0015	0.237
Spinner dolphin	12.302	30	63	0.0064	0.915
Clymene dolphin	3.253	30	97	0.0011	0.253
Unidentified dolphin*	0.665	30	4	0.002	0.053
Unidentified whale	0.023	10	4	0.002	0.008
Totals	**65.74**				**4.325**

km^2 = square kilometers
*Bottlenose dolphin/Atlantic spotted dolphin

Table A-5. Yearly Estimated Number of Marine Mammals Affected by the Gunnery Mission Noise

Species	Adjusted Density (#/km^2)	Level A Harassment Injurious 205 dB* EFD for Ear Rupture	Level B Harassment Non-Injurious 182 dB* EFD for TTS	Level B Harassment Non-Injurious 176 dB* EFD for Behavior
Bryde's whale	0.007	<0.001	0.010	0.041
Sperm whale	0.011	<0.001	0.016	0.064
Dwarf/pygmy sperm whale	0.024	<0.001	0.035	0.139
Cuvier's beaked whale	0.10	<0.001	0.015	0.058
Mesoplodon spp.	0.019	<0.001	0.028	0.110
Pygmy killer whale	0.030	<0.001	0.044	0.174
False killer whale	0.026	<0.001	0.038	0.151
Short-finned pilot whale	0.027	<0.001	0.039	0.157
Rough-toothed dolphin	0.028	<0.001	0.041	0.163
Bottlenose dolphin	0.810	0.006	1.177	4.706
Risso's dolphin	0.113	0.001	0.164	0.657
Atlantic spotted dolphin	0.677	0.005	0.984	3.934
Pantropical spotted dolphin	1.077	0.008	1.565	6.258
Striped dolphin	0.237	0.002	0.344	1.377
Spinner dolphin	0.915	0.007	1.330	5.316
Clymene dolphin	0.253	0.002	0.368	1.470
Unidentified dolphin**	0.053	<0.001	0.077	0.308
Unidentified whale	0.008	<0.001	0.012	0.046
All marine mammals	4.325	0.032	6.29	25.13

km^2 = square kilometers
*dB= dB re 1 μPa^2-s
**Bottlenose dolphin/Atlantic spotted dolphin

Gunnery noise resulting from aircraft shooting at in-water targets is a key element of the EGTTR PEA and EGTTR Biological Assessment (BA). Potential noise exposures can be reduced through daytime monitoring and the implementation of a nighttime reduced high-explosive content training round. Level A and B harassment thresholds were assessed, including injurious hearing impacts, as well as non-injurious impacts such as TTS and long-term behavioral modification responses. NOAA Fisheries 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.

Table A-5 shows that gunnery noise is anticipated to affect some marine mammal species. Less than 6.3 marine mammals would potentially be exposed (annually) to a non-injurious (TTS) Level B harassment noise level (182 decibels [dB] re 1 μPa^2-s). Although approximately 25 animals would potentially experience (annually) noise at the behavioral threshold, (176 dB re 1 μPa^2-s), no behavioral impacts would result because repetitive exposures to the same animals are highly unlikely due to the variability in target location selection and the continuous movement of the animals. No marine mammal species would be exposed to injurious Level A harassment or greater noise levels (205 dB re 1 μPa^2-s or higher).