Request for Letter of Authorization for Incidental Take of Marine Mammals

Shock Trial of the MESA VERDE (LPD 19)

Department of the Navy
June 2007

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Submitted to:
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Acronyms and Abbreviations

µPa	microPascal
AFIP	Armed Forces Institute of Pathology
Aug	August
CETAP	Cetacean and Turtle Assessment Program
dB	Decibel
DoN	Department of Navy
EIS	Environmental Impact Statement
EL	Energy Flux Density
ESA	Endangered Species Act
FSST	Full Ship Shock Trial
ft	Feet
FY	Fiscal Year
Hz	Hertz
Jan	January
kg	Kilogram
km/h	Kilometer per Hour
kts	Knots
lb	Pound
LOA	Letter of Authorization
m	Meters
MART	Marine Animal Response Team
MEB	Marine Expeditionary Brigade
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
nmi	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
Nov	November
OEIS	Overseas Environmental Impact Statement
PBR	Potential Biological Removal
psi-msec	Pounds per square inch-millisecond
PTS	Permanent threshold shift
TTS	Temporary threshold shift

SUMMARY OF INCIDENTAL TAKE REQUEST

(Item numbers refer to information required for an incidental take request under the Marine Mammal Protection Act)

(1) Description of Activities

The proposed action is to conduct a Full Ship Shock Trial (FSST) during a four-week period in the spring[1]/summer of 2008 utilizing the MESA VERDE (LPD 19), a new amphibious transport dock ship. The shock trial of the MESA VERDE would consist of up to four underwater detonations of a nominal[2] 4,536 kilogram (kg) (10,000 pound [lb]) charge at a rate of one detonation per week. The purpose of the proposed action is to generate data that the Navy would use to assess the survivability of SAN ANTONIO Class amphibious transport dock ships. An entire manned ship must undergo an at-sea shock trial to obtain survivability data that are not obtainable through computer modeling and component testing on machines or surrogates. Navy ship design, crew training, and survivability lessons learned during previous shock trials, and total ship survivability trials, have proven their value by increasing a ship's ability to survive battle damage.

Each new class of surface ships must undergo realistic survivability testing to assess the survivability of the hull and the ship's systems, and to evaluate the ship's capability to protect the crew from an underwater explosion. The Navy has developed the shock trial to meet its obligation to perform realistic survivability testing. A shock trial consists of a series of underwater detonations that propagate a shock wave through the ship's hull under deliberate and controlled conditions. The effects of the shock wave on the ship's hull, equipment, and personnel safety features are then evaluated. This information would be used by the Navy to validate or improve the survivability of the SAN ANTONIO Class, thereby reducing the risk of injury to the crew, and damage to or loss of a ship. The proposed shock trial qualifies as a military readiness activity as defined in Section 315(f) of the National Defense Authorization Act for fiscal year (FY) 2003 (Public Law 107-314).

(2) Duration and Location of Activities

The proposed action is to conduct a shock trial of the MESA VERDE at an offshore location over a four-week period in the spring/summer of 2008. The MESA VERDE Draft Environmental Impact Statement (EIS)/Overseas EIS (OEIS) (Department of Navy [DoN], 2007) analyzes three potential locations where the Navy could conduct the proposed shock trial: offshore of Naval Station Norfolk, Virginia; offshore of Naval Station Mayport, Florida; and offshore of Naval Air Station Pensacola, Florida. In consideration of the timeframe to conduct the proposed shock trial (spring/summer 2008), the shock trial is proposed to occur at the Mayport shock trial location.

[1] Shock trial operations would not be conducted in Mayport, Florida until after 1 May due to the migratory patterns and species presence of North Atlantic right whales in the area.
[2] ± 22.7 kg (± 50.0 lb)

A specific site within the proposed shock trial location has not been selected; however, the final site will be one of low observed marine mammal activity, as determined by aerial surveys conducted in advance of the shock trial. In addition, exclusionary mapping to avoid oil and gas pipelines, hard bottom areas, shipwrecks, etc. has been conducted to avoid potential environmental concerns.

(3 and 4) Marine Mammal Species, Status, Distribution, and Numbers

At the proposed Mayport shock trial location, up to 26 marine mammal species may occur, including four mysticetes (baleen whales), 19 odontocetes (toothed species), two pinnipeds (seals and sea lions), and one sirenian. With the exception of the North Atlantic right whale and minke whale in the winter, most mysticete (baleen) species are considered unlikely to occur at Mayport. In the spring and summer seasons, predominant odontocete species include dolphins, dwarf/pygmy sperm whales, and several species of beaked whales (Blainville's, Cuvier's, and Gervais').

(5) Letter of 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 a LOA is applicable to activities that may cause mortality, injury, and harassment to marine mammal species. The subsequent analyses in this analyses will identify Level B noise harassment as the primary form of take; however, there is a potential, before any protective measures, that small numbers of marine mammals may be injured or possibly killed due to noise generated from the explosive sources.

(6) Numbers and Species Taken

The Navy has developed a detailed marine mammal and sea turtle protective measures plan for the MESA VERDE shock trial that would minimize the risk of killing or injuring a marine mammal during the shock trial. However, recognizing that monitoring is not 100% effective, the Navy has developed the following estimates for potential exposures, using the best available scientific data and a series of conservative assumptions.

Total numbers of marine mammals potentially subject to mortality, injury, and harassment at Mayport for spring and summer are:

Spring - Number of Individuals
(Four detonations, with mitigation)

	Mortality		Injury		Harassment	
	Calc.	Round	Calc.	Round	Calc.	Round
MARINE MAMMALS						
Minke whale	0.000	0	0.000	0	0.000	0
North Atlantic right whale	0.000	0	0.000	0	0.000	0
Atlantic spotted dolphin	0.076	0	0.318	0	33.827	34
Beaked whales	0.179	0	2.824	3	50.383	50
Bottlenose dolphin	0.381	0	1.597	2	68.155	68
Common dolphin	0.000	0	0.000	0	0.000	0
Dwarf/pygmy sperm whale	0.063	0	0.264	0	5.487	5
False killer whale	0.000	0	0.003	0	0.095	0
Pilot whale	0.005	0	0.079	0	3.030	3
Risso's dolphin	0.265	0	1.111	1	36.714	37
Rough-toothed dolphin	0.000	0	0.001	0	0.048	0
Spinner dolphin	0.070	0	0.293	0	9.757	10
Total - Marine Mammals		**0**		**6**		**207**

Summer - Number of Individuals
(Four detonations, with mitigation)

	Mortality		Injury		Harassment	
	Calc.	Round	Calc.	Round	Calc.	Round
MARINE MAMMALS						
Minke whale	0.000	0	0.000	0	0.000	0
North Atlantic right whale	0.000	0	0.000	0	0.000	0
Atlantic spotted dolphin	0.133	0	0.321	0	71.706	72
Beaked whales	0.016	0	0.212	0	7.039	7
Bottlenose dolphin	0.508	1	1.227	1	110.124	110
Common dolphin	0.000	0	0.000	0	0.000	0
Dwarf/pygmy sperm whale	0.087	0	0.209	0	9.147	9
False killer whale	0.000	0	0.003	0	0.159	0
Pilot whale	0.006	0	0.078	0	5.568	6
Risso's dolphin	0.370	0	0.894	1	62.241	62
Rough-toothed dolphin	0.000	0	0.001	0	0.000	0
Spinner dolphin	0.096	0	0.233	0	16.266	16
Total - Marine Mammals		**1**		**2**		**282**

(7) Anticipated Impact to Marine Mammal Species and Stocks

The proportion of the minimum population potentially killed is predicted to be zero in spring and summer. For potential injury to marine mammals, only a small fraction are predicted for most species. As shown in the tables above, the highest values at Mayport are 2.824 (beaked whales in spring) and 1.227 (bottlenose dolphin in summer). An impact on such a small fraction of the minimum population would not be expected to adversely affect marine mammal species or stocks. Harassment numbers represent a higher proportion of the population, but due to the minor and temporary nature of the effect, the overall impact on marine mammal species or stocks is expected to be negligible.

(8) Anticipated Impact on Availability of Marine Mammals for Subsistence Uses

Potential impacts resulting from the proposed activity will be limited to individuals of marine mammal species located off the coast of Florida and will not affect Arctic marine mammals. Also, because the MESA VERDE shock trial will not take place in Arctic waters, it would not have an unmitigable adverse impact on the availability of marine mammals for subsistence uses identified in MMPA section 101(a)(5)(A)(i).

(9) Anticipated Impact on Marine Mammal Habitat and Likelihood of Restoration

Detonations would have short-term, localized impacts on water column physical, chemical, and biological characteristics. No lasting or significant impact on marine mammal habitat is anticipated, and no restoration would be necessary. Marine mammal habitat would not be affected.

(10) Anticipated Impact of Habitat Loss or Modification on Marine Mammal Populations

Due to the short-term and localized nature of water column effects from each detonation, no impact on marine mammal populations due to habitat loss or modification is anticipated. Marine mammal habitat will not be lost or modified.

(11 and 13) Monitoring and Reporting

A detailed marine mammal and sea turtle protective measures plan has been developed as discussed in Section 5.0 of the MESA VERDE Draft EIS (DoN, 2007). The plan includes the use of the same aerial and shipboard visual monitoring efforts that were employed successfully during the shock trial of the WINSTON S. CHURCHILL in 2001 (DoN, 1999). Those shock trial operations included three 4,536 kg (10,000 lb) detonations; no deaths or injuries of marine mammals were detected. The plan includes site selection, pre-detonation and post-detonation monitoring, and is designed to produce the least practicable adverse impact on marine mammals and sea turtles. The proposed Mayport location is not located within feeding or spawning grounds, nursery areas, or other locations of similar significance to marine mammals. Critical habitat for the North Atlantic right whale exists along the Florida coastline near Mayport but not within the proposed shock trial location. Biologically productive areas such as cold core rings and water mass boundaries would be avoided in the site selection process. Monitoring results

would be reported to National Oceanic and Atmospheric Administration (NOAA) Fisheries in accordance with requirements specified in the incidental take authorization.

(12) Plan to Minimize Effects on Subsistence Uses

Based on earlier discussions regarding subsistence uses (Section 8), there are no impacts on the availability of species or stocks for subsistence use. Potential impacts resulting from the proposed activity will be limited to individuals of marine mammal species located off the coast of Florida and will not affect Arctic marine mammals. Also, because the MESA VERDE shock trial will not take place in Arctic waters, it would not have an unmitigable adverse impact on the availability of marine mammals for subsistence uses identified in MMPA section 101(a)(5)(A)(i).

(14) Research Opportunities, Plans, and Activities

Site selection surveys, pre-detonation monitoring, and post-detonation monitoring will provide intensive, site-specific information about marine mammals within the proposed Mayport location. These efforts will add to the limited data available concerning cetacean distribution, abundance, and temporal variability in deep offshore waters. Post-detonation monitoring using aerial and shipboard surveillance will occur after each detonation. In addition, during post-detonation monitoring, if an injured or killed marine mammal is found, as explained in Section 5.0 of the MESA VERDE Draft EIS (DoN, 2007), necropsies and tissue analysis will provide an opportunity for learning about the effects of the shock trial detonations and blast injuries (if any occur). Notification and coordination with stranding networks, as detailed in Section 5.0 of the MESA VERDE Draft EIS (DoN, 2007), will provide an opportunity for learning more about blast injuries (if any occur) and the influence of currents on timing of any subsequent strandings.

INCIDENTAL TAKE REQUEST

(Item numbers refer to information required for an incidental take request under the Marine Mammal Protection Act)

(1) DESCRIPTION OF ACTIVITIES

The purpose of the proposed action is to generate data that the Navy would use to assess the survivability of SAN ANTONIO (LPD 17) Class amphibious transport dock ships. An entire manned ship must undergo an at-sea shock trial to obtain survivability data that are not obtainable through computer modeling and component testing on machines or surrogates. Navy ship design, crew training, and survivability lessons learned during previous shock trials, and total ship survivability trials, have proven their value by increasing a ship's ability to survive battle damage.

The MESA VERDE is the third ship in the new SAN ANTONIO (LPD 17) Class of nine planned amphibious transport dock ships being acquired by the Navy to meet Marine Air-Ground Task Force lift requirements. The ships of the SAN ANTONIO Class will be replacements for four classes of amphibious ships—two classes that have reached the end of their service life (LPD 4 and LSD 36) and two classes that have already been retired (LKA 113 and LST 1179)—replacing a total of 41 ships. These new LPDs are a means to support Marine Expeditionary Brigade (MEB) amphibious lift requirements. The mission of the SAN ANTONIO Class will be to operate in various scenarios, as a member of a three-ship, forward-deployed Amphibious Ready Group with a Marine Expeditionary Unit; in a variety of Expeditionary Strike Group scenarios; or as a member of a 12-14 ship MEB.

Each new class of surface ships must undergo realistic survivability testing to assess the survivability of the hull and the ship's systems, and to evaluate the ship's capability to protect the crew from an underwater explosion. The Navy has developed the at-sea shock trial to meet its obligation to perform realistic survivability testing. A shock trial consists of a series of underwater detonations that propagate a shock wave through the ship's hull under deliberate and controlled conditions. The effects of the shock wave on the ship's hull, equipment, and personnel safety features are then evaluated. This information would be used by the Navy to validate or improve the survivability of the SAN ANTONIO Class, thereby reducing the risk of injury to the crew, and damage to or loss of a ship. The proposed shock trial qualifies as a military readiness activity as defined in Section 315(f) of the National Defense Authorization Act for fiscal year (FY) 2003 (Public Law 107-314).

The designated test platform for the shock trial, the MESA VERDE (LPD 19), would be exposed to a series of underwater detonations designed to assess its survivability and vulnerability. The ship and the explosive charge will be brought closer together with each successive detonation to increase the severity of the shock to the ship. This approach ensures that the maximum shock intensity goal is achieved in a safe manner. A nominal[3] 4,536 kilogram (kg) (10,000 pound [lb])

[3] ± 22.7 kg (± 50.0 lb)

explosive charge would be used. This charge size is used to ensure that the entire ship is subjected to the desired level of shock intensity. The use of smaller charges would require many more detonations to excite the entire ship to the desired shock intensity level. The proposed shock trial would be conducted at a rate of one detonation per week to allow time to perform detailed inspections of the ship's systems prior to the next detonation.

Three detonations would be required to collect adequate data on survivability and vulnerability. The first detonation would be conducted to ensure that the ship's systems are prepared for the subsequent higher severity detonations. The second detonation would be conducted to ensure the safety of the ship's systems during the third detonation, and to assess the performance of system configuration changes implemented as a result of the first detonation. The third and most severe detonation would be conducted to assess system configuration changes from the previous detonations. In the event that one of the three detonations does not provide adequate data, a fourth detonation may be required. The proposed action will be described in the remainder of this document as consisting of up to four detonations.

The operations vessel would tow the explosive charge in parallel with the MESA VERDE using the parallel tow method, illustrated in Figure 1. The charge would be located approximately 610 meters (m) (2,000 feet [ft]) behind the operations vessel and suspended from a pontoon at a depth of 61 m (200 ft) below the water surface. Co-located with the charge would be a transponder used to track the exact location of the charge prior to detonation. Transponders of this type are used worldwide in both commercial (e.g., diving, offshore drilling) and military applications for precise underwater location determination. The transponder would be destroyed during the charge detonation. The largest possible unrecoverable fragment from the explosion that would settle to the seafloor is the top plate and crossbar (charge container components), which together weigh 204 kg (450 lb). After each detonation, the shock trial array and rigging debris would be recovered.

For each detonation, the MESA VERDE would cruise in the same direction as the operations vessel at a speed of up to 13 kilometers per hour (km/h) (up to 7 knots [kts]) with the charge directly abeam of it. After each detonation, an initial inspection for damage would be performed. The MESA VERDE would return to the shore facility for a detailed post-detonation inspection and to prepare for the next detonation. For each subsequent detonation, the MESA VERDE would move closer to the charge to experience a more intense shock level.

The MESA VERDE (LPD 19) will be delivered in spring 2007. A series of post-delivery operational tests and trials will be conducted before the ship would be available for the proposed shock trial, which is scheduled to occur over a four-week period in spring/summer of 2008.

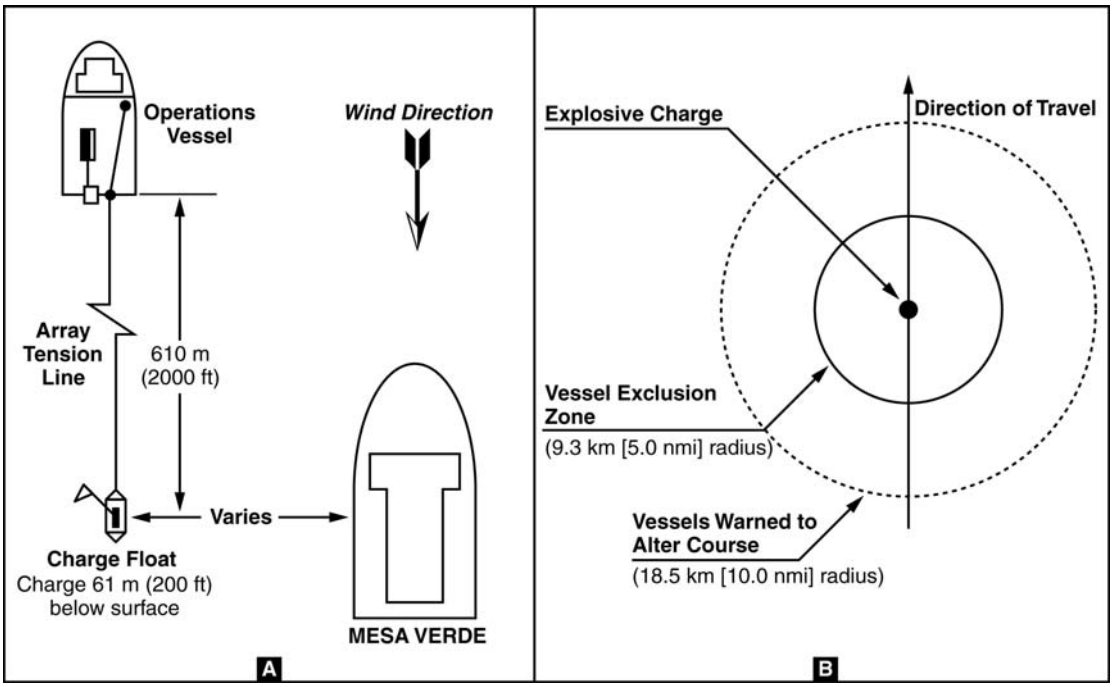

Figure 1: (A) Test Array Configuration and (B) Exclusion Zones

(2) DURATION AND LOCATION OF ACTIVITIES

The proposed action is to conduct a shock trial of the MESA VERDE at an offshore location over a four-week period in spring[4]/summer of 2008 (21 March to 20 September), based on the Navy's operational and scheduling requirements for the ship class. The MESA VERDE Draft Environmental Impact Statement (EIS)/Overseas EIS (OEIS) (Department of Navy [DoN], 2007) analyzes three potential locations where the Navy could conduct the proposed shock trial: offshore of Naval Station Norfolk, Virginia; offshore of Naval Station Mayport, Florida; and offshore of Naval Air Station Pensacola, Florida (Figure 2). In consideration of the timeframe to conduct the shock trial (spring/summer of 2008), the shock trial is proposed to occur at the Mayport shock trial location within the Jacksonville/Charleston (JAX/CHASN) Operating Area (OPAREA).

The operational site for the proposed shock trial would be a Safety Range centered on the explosive charge. The concept of Safety Range is an integral part of the protective measure plan, the purpose of which is prevent deaths and serious injuries to marine mammals and sea turtles. The Safety Range for the Mayport location would be greater than the predicted maximum ranges for mortality and injury to a marine mammal or sea turtle associated with detonation of a 4,536 kg (10,000 lb) explosive (otherwise known as the "zone of influence" [ZOI]). An exclusion zone of 9.3 km (5.0 nmi) radius would be established around the detonation point to exclude all non-shock trial traffic for up to 12 hours per detonation. This exclusion zone would be an electronic

[4] Shock trial operations would not be conducted in Mayport, Florida until after 1 May due to the migratory patterns and species presence of North Atlantic right whales in the area.

emissions control zone that virtually eliminates the possibility of an inadvertent detonation caused by radio/radar-induced electrical current in the explosive firing circuit. It also would provide an area of safe maneuvering for the charge-handling vessel and the explosive it is towing (referred to as the operations vessel). Notification would be published in *Notice to Airmen* and *Notices to Mariners* in advance of the shock test. Any traffic entering an 18.5 km (10.0 nmi) radius around the detonation point would be warned to alter course. Since the MESA VERDE and the operations vessel would be moving, the zones around the detonation point would also move.

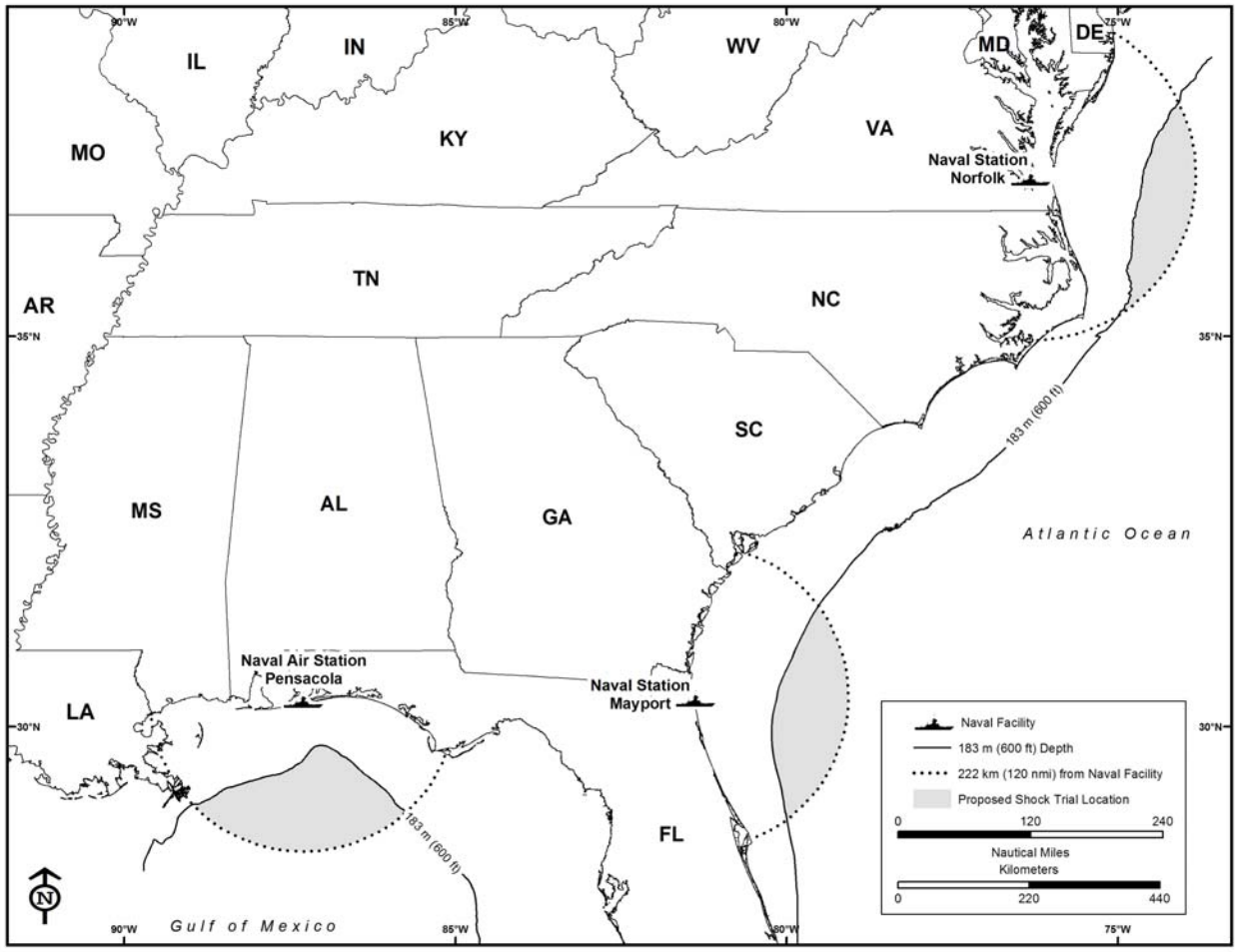

Figure 2: Potential MESA VERDE Shock Trial Locations

In consideration of the timeframe to conduct the shock trial (spring/summer), it is proposed to be conducted offshore of Naval Station Mayport, Florida. A specific site within the proposed shock trial location has not been selected; however, the final site will be one of low observed marine mammal activity, as determined by aerial surveys conducted in advance of the shock trial. In addition, exclusionary mapping to avoid hard bottom areas, shipwrecks, etc. has been conducted to avoid potential environmental concerns.

(3 AND 4) MARINE MAMMAL SPECIES, NUMBERS, STATUS, AND DISTRIBUTION

Marine mammals that may be found within the JAX/CHASN OPAREA are discussed in Section 3.2.1 and Appendix B of the MESA VERDE Draft EIS (DoN, 2007). The MESA VERDE Draft EIS (DoN, 2007) describes species presence, status, seasonal distribution, and estimated densities. Based on a review of historical sighting records during all seasons, there are a total of 26 marine mammal species with possible occurrence in the JAX/CHASN OPAREA (i.e., shelf, shelf edge, slope environments). Table 1 identifies the marine mammal species whose presence is (1) likely, (2) possible but unlikely, and (3) uncommon, for spring and summer at the proposed Mayport shock trial location (i.e., within the off-shelf depth zone). Of the baleen whales, only the North Atlantic right whale and minke whale are likely to occur (winter season only). Predominant odontocete species in spring and summer at Mayport include beaked whales (Blainsville's, Cuvier's, and Gervais'), and dwarf/pygmy sperm whales. Additional odontocetes that may be present include the short-finned pilot whale, false killer whale, and seven dolphin species. One sirenian species, the West Indian manatee, may be present nearshore but is unlikely to be found offshore at the shock trial location. Of the pinniped species, harbor and hooded seals are an uncommon occurrence.

Table 1 lists marine mammal species that may occur at or near the proposed Mayport location. Endangered, threatened, and candidate species under the Endangered Species Act (ESA) are indicated. (The Navy has separately submitted a Biological Assessment to National Oceanic and Atmospheric Administration [NOAA] Fisheries requesting formal consultation under Section 7 of the ESA.)

Table 1: Species of Marine Mammals Potentially Occurring in Waters within and adjacent to the Mayport Location with Expected Seasonal Presence in Spring and Summer (Adapted from: DoN, 2002).

Scientific Name	Common Name	Status[a]	Mayport Seasonal Presence	
			Spring	Summer
ORDER CETACEA				
SUBORDER MYSTICETI	**BALEEN WHALES**			
Family Balaenidae	**Right and Bowhead Whales**			
Eubalaena glacialis	North Atlantic right whale	E, S	**o**	**o**
Family Balaenopteridae	**Rorquals**			
Balaenoptera musculus	Blue whale	E, S	**-**	**-**
Balaenoptera edeni (=brydei)	Bryde's whale	none	**-**	**-**
Balaenoptera physalus	Fin whale	E, S	**o**	**o**
Megaptera novaeangliae	Humpback whale	E, S	**o**	**o**
Balaenoptera acutorostrata	Minke whale	none	**o**	**o**
Balaenoptera borealis (=boreali)	Sei whale	E, S	**-**	**-**
SUBORDER ODONTOCETI	**TOOTHED WHALES**			
Family Physeteridae [b]	**Sperm Whales**			
Physeter macrocephalus	Sperm whale	E, S	**o**	**o**

Family Kogiidae	**Dwarf/Pygmy Sperm Whales**			
Kogia simus	Dwarf sperm whale	none	**x**	**x**
Kogia breviceps	Pygmy sperm whale	S	**x**	**x**
Family Ziphiidae	**Beaked Whales**			
Mesoplodon densirostris	Blainville's beaked whale	S	**x**	**x**
Ziphius cavirostris	Cuvier's beaked whale	S	**x**	**x**
Mesoplodon europaeus	Gervais' beaked whale	S	**x**	**x**
Hyperoodon ampullatus	Northern bottlenose whale	none	**-**	**-**
Mesoplodon bidens	Sowerby's beaked whale	S	**o**	**o**
Mesoplodon mirus	True's beaked whale	S	**o**	**o**
Family Delphinidae	**Dolphins**			
Stenella frontalis	Atlantic spotted dolphin	none	**x**	**x**
Lagenorhynchus acutus	Atlantic white-sided dolphin	none	**-**	**-**
Tursiops truncates	Bottlenose dolphin	none	**x**	**x**
Stenella clymene	Clymene dolphin	none	**-**	**-**
Delphinus delphis	Common dolphin	none	**o**	**x**
Pseudorca crassidens	False killer whale	none	**x**	**x**
Lagenodelphis hosei	Fraser's dolphin	none	**-**	**-**
Orcinus orca	Killer whale	none	**-**	**-**
Peponocephala electra	Melon-headed whale	none	**-**	**-**
Stenella attenuate	Pantropical spotted dolphin	none	**x**	**x**
Globicephala melas	Pilot whale, long-finned	S	**-**	**-**
Globicephala macrorhynchus	Pilot whale, short-finned	S	**x**	**x**
Feresa attenuate	Pygmy killer whale	none	**o**	**o**
Grampus griseus	Risso's dolphin	none	**x**	**x**
Steno bredanensis	Rough-toothed dolphin	none	**x**	**x**
Stenella longirostris	Spinner dolphin	none	**x**	**x**
Stenella coeruleoalba	Striped dolphin	none	**o**	**o**
Lagenorhynchus albirostris	White-beaked dolphin	none	**-**	**-**
ORDER CARNIVORA				
SUBORDER PINNIPEDIA	**SEALS**			
Family Phocidae	**True Seals**			
Phoca vitulina	Harbor seal	none	**o**	**o**
Phoca groentandica	Harp seal	none	**-**	**-**
Cystophora cristata	Hooded seal	none	**o**	**o**
Halichoerus grypus	Gray seal	none	**-**	**-**
Family Otariidae	**Fur Seals and Sea Lions**			
Zalophus californicus	California sea lion	none	**-**	**-**
ORDER SIRENIA				
Family Trichechidae	**Manatees**			
Trichechus manatus latirostris	West Indian manatee, Florida manatee (subspecies)	E	**o**	**o**

[a] Status: E = endangered under the ESA; S = strategic stock under the MMPA, as indicated by Waring et al. (2004).

[b] Rice (1998) places dwarf and pygmy sperm whales in a separate family (Kogiidae) from sperm whales (Physeteridae).

Key: (X) presence likely; (o) presence possible but unlikely due to geographic range, water depth, season, or uncommon occurrence; (--) presence not expected.

Two endangered whale species may occur in the JAX/CHASN OPAREA region during the year. Principal among these are North Atlantic right whales, with designated critical habitat and the only known calving grounds located in the on-shelf depth zone of the JAX/CHASN OPAREA, inshore of the proposed Mayport location. North Atlantic right whales offshore of Florida and Georgia generally occur from December through March/April, although this species has been sighted in this region as early as November. Humpback whales also occur widely scattered in the on-shelf depth zone in small numbers in fall, winter, and spring. Two additional endangered species (fin and sperm whales) are considered occasional or rare species to the area.

A brief description of each marine mammal species potentially present in spring and/or summer near the proposed Mayport location is provided below.

3.1 SPECIES DESCRIPTIONS

Baleen Whales

Fin Whale [endangered] – Fin whales (*Balaenoptera physalus*) range from the Arctic to the Greater Antilles. They are usually found inshore of the 2,000 m (6,562 ft) contour. This species occurs widely in the middle Atlantic throughout the year, with concentrations from Cape Cod north in summer and from Cape Cod south in winter. Fin whales are frequently found along the New England coast from spring to fall in areas of fish concentration. It is thought that fin whales migrate north nearshore along the coast during spring and south offshore during winter. This species feeds on zooplankton, including krill and other planktonic crustaceans, and schooling fish such as herring and capelin. It is believed that fin whales breed in the mid-Atlantic, with mating and calving occurring from November to March. Gestation lasts approximately one year and calves are suckled for seven months. Fin whales off the eastern U.S. to Canada constitute a single stock (Donovan, 1991). The minimum population estimate for this species in the western North Atlantic is 2,362 individuals (Waring et al., 2004).

Humpback Whale [endangered] – In the North Atlantic, humpback whales (*Megaptera novaeangliae*), classified as endangered under the ESA, range from the West Indies, Caribbean, and Cape Verde islands in the south to Greenland, Iceland, and Norway in the north. They are generally found on feeding grounds located south of New England waters to northern Norway in the spring through fall seasons. Distribution of humpbacks has been largely correlated to abundance of prey species (e.g., sand lance, capelin, and herring). The most important feeding habitat lies in the shallow waters off the southwestern Gulf of Maine. During the winter, most western North Atlantic humpbacks travel south to calving grounds in the West Indies (Caribbean) from January to March (DoN, 2002). Recent analyses by Barco et al. (2002) support the hypothesis that humpback whales use U.S. mid-Atlantic waters primarily during the winter, with their presence also possible during other seasons. The minimum population estimate for the North Atlantic range of the humpback whale is 11,570 individuals (Waring et al., 2004).

Minke Whale – Minke whales (*Balaenoptera acutorostrata*) have a widespread distribution in polar, temperate, and tropical waters. There are four recognized minke whale populations in the North Atlantic. Minke whales off the U.S. eastern seaboard are considered part of the Canadian East Coast population which covers the area from the eastern half of the Davis Strait out to 45^{o}W

and south to the Gulf of Mexico (Waring et al., 2004). The best estimate of abundance for this species in the North Atlantic is 4,018 individuals (Waring et al., 2004).

North Atlantic Right Whale **[**endangered] – The North Atlantic right whale[5] (*Eubalaena glacialis*) is the world's rarest baleen whale species. North Atlantic right whales are found primarily in continental shelf waters off the U.S. east coast. North Atlantic right whales range from Iceland to eastern Florida. Coastal waters of the southeastern U.S. (off Georgia and northeast Florida) are important wintering and calving grounds for this species, while the waters around Cape Cod and Great South Channel are used for feeding, nursery, and mating during summer (Kraus et al., 1988; Schaeff et al., 1993). From June to September, most North Atlantic right whales are found feeding north of Cape Cod. Mating probably occurs during late summer (Knowlton and Kraus, 1989). A portion of the population migrates to the coastal waters off the southeastern U.S. to calve during the winter months. Southward migration occurs offshore from mid-October to early January, although North Atlantic right whales may arrive off the Florida coast as early as November and may stay into late March (Kraus et al., 1993). Migration northward along the coast of Florida takes place between early January and late March. Coastal waters off the Carolinas may represent a migratory corridor for this species (Winn et al., 1986; Kraus et al., 1993). This species usually occurs shoreward of the 200 m (656 ft) contour line. Preferred water depths during recent surveys off the Florida coast range from 3 to 73 m (10 to 240 ft), with a mean of 12.6 m (41.3 ft) (Kraus et al., 1993). Designated critical habitat for the North Atlantic right whale includes portions of Cape Cod Bay, Stellwagen Bank, and the Great South Channel (off Massachusetts) and waters adjacent to the coasts of Georgia and northeast Florida (59 FR 28793, 3 June 1994). The southernmost critical habitat encompasses waters between 31°15'N (i.e., near the mouth of Altamaha River, Georgia) and 30°15'N (i.e., near Jacksonville, Florida) from the shoreline out to 28 km (15 nmi) offshore, and the waters between 30o15'N and 28°00'N (i.e., near Sebastian Inlet, Florida) from the shoreline out to 2.7 km (5 nmi). The critical habitat off northeastern Florida is at least 37 km (20 nmi) inshore of the western edge of the proposed Mayport shock trial location. Based on a 1992 census of individual whales identified using photo-identification techniques, the population of North Atlantic right whales was estimated to be 295 individuals (Knowlton et al., 1994). A more recent published analysis, employing the same techniques, gave an estimate of 291 animals in 1998 (Kraus et al., 2001; Waring et al., 2004). It is assumed that this represents a minimum population size estimate (Waring et al., 2004).

Toothed Whales and Dolphins

Atlantic Spotted Dolphin – Atlantic spotted dolphins (*Stenella frontalis*) range from New Jersey to Venezuela, in warm temperate and tropical waters. It inhabits the continental shelf and slope, though southern populations occasionally venture into shallow coastal waters. Atlantic spotted dolphins often occur in groups of up to 50 individuals. Stock structure in the western North Atlantic is unknown. The minimum population estimate for Atlantic spotted dolphins in the western North Atlantic is 27,785 individuals (Waring et al., 2004). Sightings data for the

[5] For the purposes of this request for an Letter of Authorization, the North Atlantic population of the northern right whale (*Eubalaena glacialis*) is referred to as the North Atlantic right whale.

western North Atlantic evaluated by the Navy (DoN, 2002, 2003) did not differentiate between Atlantic spotted and pantropical spotted dolphins.

Blainville's Beaked Whale – Blainville's beaked whales (*Mesoplodon densirostris*) range from Nova Scotia to Florida and the Bahamas. This species is considered pelagic, inhabiting very deep waters. They are widely but sparsely distributed throughout tropical and warm temperate waters up to 45°N latitude in the western North Atlantic due to the presence of the Gulf Stream (Leatherwood et al., 1976). Data suggest that Blainville's beaked whales feed on squid and live in family groups of three to six individuals. Little is known about the life history of this species (Waring et al., 1999).

Bottlenose Dolphin – Bottlenose dolphins (*Tursiops truncatus*) occur in the western North Atlantic from Nova Scotia to Venezuela (Blaylock et al., 1995). This species is distributed worldwide in temperate and tropical inshore waters. Blaylock and Hoggard (1994), reporting results from the Southeast Cetacean Aerial Survey study (i.e., continental shelf waters; Cape Hatteras to mid-Florida), developed abundance estimates for the shallow, warm water Atlantic bottlenose dolphin ecotype (i.e., a population or subpopulation that has adapted to specific environmental parameters). The offshore distribution of coastal bottlenose dolphins south of Cape Hatteras has not been described. They are found in groups of up to several hundred individuals with group sizes increasing with distance from shore. Waring et al. (2004) cited a minimum abundance estimate for the offshore stock in the western North Atlantic of 24,199 individuals, although they also note that the best estimate of abundance for offshore bottlenose dolphins is 29,774 individuals.

Common Dolphin – Common dolphins (*Delphinus delphis*) range within the western North Atlantic from Newfoundland and Nova Scotia to northern South America. They are distributed in worldwide temperate, tropical, and subtropical offshore waters on the continental slope, shelf, and shelf edge (Blaylock et al., 1995). According to Kenney and Winn (1987), Cetacean and Turtle Assessment Program (CETAP) results indicate the temporal presence of common dolphins off the northeast U.S. coast in fall and winter, a trend which is the reverse of that exhibited by *Stenella* spp. and most other cetacean taxa, indicative of possible "resource partitioning" (i.e., when two or more species utilize different portions of the same resource, or utilize the resource at different times, reducing competition for that resource). The species is less common south of Cape Hatteras (Blaylock et al., 1995). Kenney and Winn (1987) also noted the possible co-occurrence of common dolphins with Atlantic spotted dolphins (*Stenella frontalis*).

Cuvier's Beaked Whale – Cuvier's beaked whales (*Ziphius cavirostris*) range from Massachusetts to the West Indies. Little is known about the life history of this species and its stock structure in the northwestern Atlantic (Waring et al., 1999). As with other beaked whales, it is believed that Cuvier's beaked whales inhabit pelagic waters and exhibit a wide distribution. Migration to higher latitudes during summer has been suggested. They feed primarily on squid and deep water fish, but are also known to eat crab and starfish. Cuvier's beaked whales form family groups of approximately 15 individuals. Sightings from the CETAP surveys (Winn, 1982) indicate the presence of Cuvier's beaked whales over the shelf break throughout the middle Atlantic region, with highest sightings recorded for late spring and summer.

Dwarf and Pygmy Sperm Whales – The pygmy sperm whale (*Kogia breviceps*) and the dwarf sperm whale (*Kogia simus*) appear to be distributed worldwide in temperate to tropical waters along the continental shelf edge and continental slope (Caldwell and Caldwell, 1989). These species are difficult to distinguish when sighted in the field, and are typically identified to the genus level only. *Kogia* are rarely seen alive at-sea because they dive in response to survey vessels and aircraft (Würsig et al., 1996), but their presence is indicated by frequent strandings (Schmidly, 1981; Odell, 1996). Waring et al. (2004) cited a minimum population estimate for dwarf and pygmy sperm whales of 470 individuals in the western North Atlantic.

False Killer Whale – False killer whales (*Pseudorca crassidens*) range within the western North Atlantic from Maryland to Venezuela. This species is distributed worldwide in tropical and temperate waters. False killer whales are generally considered to be oceanic but individuals have been observed in cool, nearshore waters. False killer whales are found in large groups composed of smaller family groups of four to six individuals. Stock definition and population estimates in the Atlantic are unknown (Waring et al., 2004).

Gervais' Beaked Whale – Gervais' beaked whales (*Mesoplodon europaeus*) are considered pelagic, and strandings have been reported from the mid-Atlantic Bight to Florida, into the Caribbean and the Gulf of Mexico (Leatherwood et al., 1976; Jefferson and Schiro, 1997). Data suggest that the preferred prey of Gervais' beaked whales is squid.

Pantropical Spotted Dolphin – Pantropical spotted dolphins (*Stenella attenuata*) range within the western North Atlantic from Massachusetts to the Lesser Antilles. They are distributed worldwide in subtropical and tropical oceans. They appear to prefer waters of the continental slope (Blaylock et al., 1995). Pantropical spotted dolphins occur in groups of five to 30 individuals. Little is known about the life history of this species and no information exists on stock differentiation for the Atlantic population (Waring et al., 1999, 2004). Sightings data for the western North Atlantic evaluated by the Navy (DoN, 2002) did not differentiate between pantropical spotted and Atlantic spotted dolphins. The minimum population estimate for pantropical spotted dolphins in the western North Atlantic is 8,450 individuals (Waring et al., 2004).

Pygmy Killer Whale – Pygmy killer whales (*Feresa attenuata*) range from North Carolina to the Lesser Antilles. This species is distributed worldwide in tropical and warm temperate waters. This species is typically found in groups of 10 individuals. Little is known about the life history of this species. The minimum population estimate of this species in the western North Atlantic is unknown (Waring et al., 2004).

Risso's Dolphin – Risso's dolphins (*Grampus griseus*) range within the western North Atlantic from eastern Newfoundland to the Lesser Antilles and Gulf of Mexico. This species is distributed worldwide in tropical to temperate waters. It is believed Risso's dolphins undergo north-south, summer-winter migrations. Off the northeast U.S. coast, Risso's dolphins are distributed along the shelf edge from Cape Hatteras northward to Georges Bank during spring, summer, and fall (Winn, 1982; Payne et al., 1984). In winter, this species ranges further offshore yet continues to occupy the shelf edge (Blaylock et al., 1995; NMFS, 2002a). Risso's dolphins are found in groups of three to 30 individuals, although groups of up to several hundred

individuals have been reported. Current data are insufficient to determine stock differentiation and population trends in the Atlantic. The minimum population estimate is 22,916 individuals for the western North Atlantic stock (Waring et al., 2004).

Rough-toothed Dolphin – Rough-toothed dolphins (*Steno bredanensis*) are distributed worldwide in tropical to warm temperate waters (Blaylock et al., 1995). Within the western North Atlantic, they range from Virginia and North Carolina to northeastern South America (Leatherwood and Reeves, 1983). This species is pelagic and usually found seaward of the continental slope edge. Little is known about the life history of this species, and no information exists on stock differentiation and population levels in the Atlantic (Waring et al., 2004).

Short-finned Pilot Whale – Short-finned pilot whales (*Globicephala macrorhynchus*) occur in the western North Atlantic from New Jersey to Venezuela. This species is found worldwide in warm temperate and tropical waters. Sightings of pilot whales typically occur seaward of the continental shelf edge and within waters of the Gulf Stream (Winn, 1982). Little is known about migration. There is no information on stock differentiation for the Atlantic population. The minimum population estimate is 11,343 individuals for the western North Atlantic stock (Waring et al., 2004).

Sowerby's Beaked Whale – Sowerby's beaked whales (*Mesoplodon bidens*) are known only from temperate to subarctic waters of the North Atlantic. Data suggest this species is more common in European than American waters (Leatherwood and Reeves, 1983). As with other *Mesoplodon* spp., little is known of their life history (Waring et al., 1999, 2004).

Sperm Whale [endangered] – Sperm whales (*Physeter macrocephalus*) are the largest toothed whale species. Sperm whales (*Physeter macrocephalus*) range from the Davis Straits to Venezuela. This species is pelagic, often found in deeper waters along the continental shelf edge and slope. Sperm whales exhibit lengthy dive times, often diving to depths over 2,000 m (6,562 ft) for durations of over an hour. North-south migratory routes observed through Mid-Atlantic areas are always inhabited. Females, calves, and juveniles remain south of 40^{o}N to 42^{o}N latitude throughout the year while mature males range to higher latitudes (68^{o}N) during summer. Older (larger) males are solitary, while females, calves, and juveniles form "breeding schools" with four to 150 individuals. Young males form segregated bachelor groups, or "schools," of up to 50 individuals. Sperm whales occurring along the eastern U.S. represent only a fraction of the total stock. The minimum population estimate for the North Atlantic stock is 3,505 individuals (Waring et al., 2004).

Spinner Dolphin – Spinner dolphins (*Stenella longirostris*) range within the western North Atlantic from North Carolina to southern Brazil. Though presumably an offshore, deep-water species, they occur in both oceanic and coastal tropical waters (Blaylock et al., 1995). Stock structure and population estimates of spinner dolphins in the western North Atlantic are unknown (Waring et al., 2004).

Striped Dolphin – Striped dolphins (*Stenella coeruleoalba*) range within the western North Atlantic from Nova Scotia to the Lesser Antilles. These dolphins are distributed worldwide in temperate and tropical waters. This species is considered to be found along the continental slope from the Gulf of Mexico to Georges Bank. There is no information on stock differentiation in

the Atlantic (Blaylock et al., 1995). The minimum population estimate is 44,500 individuals for the western North Atlantic (Waring et al., 2004).

True's Beaked Whale – True's beaked whales (*Mesoplodon mirus*) are a temperate water species that has been reported from Cape Breton Island, Nova Scotia to the Bahamas (Leatherwood et al., 1976). It is suggested that these whales are pelagic due to their infrequent stranding record. It is believed that True's beaked whales feed on squid as well as a variety of fish. As with other *Mesoplodon* spp., little is known about their life history.

Seals and Sea Lions

Two seal species whose presence is possible but unlikely include the harbor and hooded seals. While neither of the species more commonly sighted in colder northern waters are considered likely to be present in the proposed Mayport location, historical sighting data indicate rare or uncommon presence (e.g., migrants or wanderers).

Harbor Seal – Harbor seals (*Phoca vitulina*) are widely distributed from temperate to polar regions of the Northern Hemisphere. Within the western North Atlantic, they are found from the Canadian Arctic to the Mid-Atlantic states (Jefferson et al., 1993). At-sea, they are mainly found in coastal waters of the continental shelf and slope, and are unlikely to be found far offshore. The minimum population estimate for the western North Atlantic is 91,546 individuals (Waring et al., 2004).

Hooded Seal – Hooded seals (*Cystophora cristata*) inhabit the Arctic Ocean and northerly waters of the North Atlantic, typically in association with pack ice. Young adults of this species are known to travel great distances from their preferred breeding and foraging ground, with sightings as far south as the Caribbean Sea. This species has been recorded on three occasions off the North Carolina coast (Mignucci-Giannoni and Odell, 2001), usually between January and May. No minimum population estimate has been established for this species in the U.S. Atlantic (Waring et al., 2004).

Manatees

West Indian Manatee, Florida Manatee [endangered] – The Florida manatee (*Trichechus manatus latirostris*) occurs along the southeastern Atlantic and Gulf coasts. The manatee is a coastal species (U.S. Fish and Wildlife Service [USFWS], 1996) which may occur in the Jacksonville coastal area (e.g., within the entrance channel near Naval Station Mayport [USFWS, 1999]). In the southeastern U.S., manatees are limited primarily to Florida and Georgia. This group constitutes a separate subspecies called the Florida manatee that appears to be divided into at least two virtually separate populations—one centered along the Atlantic coast and the other on the Gulf coast of Florida (USFWS, 1996). Despite concerted research, it has not been possible to develop a reliable estimate of manatee abundance in Florida. The highest single-day count of manatees from an aerial survey is 1,856 animals in January 1992 (Ackerman, 1995). While the exact population size for Florida manatees is unknown, NMFS (1998) has cited a minimum population estimate of 1,822 individuals based on intensive statewide winter aerial surveys at warm-water refuges coordinated by the Florida Department of Environmental

Protection (FDEP, 1995) in early February 1995. During the winter months, the manatee population confines itself to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia (USFWS, 1996). The USFWS has designated critical habitat for the manatee. All of the critical habitat areas are located in peninsular Florida, predominantly along the southwest and southeast coasts (USFWS, 1996).

3.2 DENSITY ESTIMATES

The likelihood of occurrence of marine mammal species and their respective density estimates, as derived from historical sighting records (per DoN, 2003) within the off-shelf depth zone, are listed in Table 2. For the marine mammal species or species groups reported from the JAX/CHASN OPAREA, more than half provisionally have a low or zero estimated density during one or more seasons (see Appendix B of the MESA VERDE Draft EIS [DoN, 2007]). Highest marine mammal species diversity is evident during summer, with slightly lower diversity in spring. Highest densities are noted in summer, followed by fall, winter, and spring. Only slight seasonal variability in marine mammal species composition is evident.

Of the baleen whales, only the endangered North Atlantic right whale and minke whale are likely to occur and only during the winter season. Other baleen whales (i.e., fin and humpback whales) are not as likely to be found offshore of Mayport during any season. Among toothed whales, several species may be expected to occur during any season—dwarf/pygmy sperm whale, several beaked whales, short-finned pilot whale, and two dolphin species (Atlantic/pantropical spotted and Risso's). Several toothed whales species exhibit marked seasonality, with expected presence only during two or three seasons.

Table 2: Marine Mammal Species Densities for the Proposed Mayport Location

MAYPORT (JAX/CHASN)			
Off-Shelf Depth Zone (>91.4 m)			
Species/Species Group	Spring	Summer	Mean Group Size
	Individuals / 100 km²	Individuals/ 100 km²	Non- seasonal
MYSTICETES			
Blue whale	--	--	--
Bryde's whale	--	--	--
Fin whale	0.000	0.000	1.0
Humpback whale	0.000	0.000	1.1
Minke whale	0.000	0.000	1.4
North Atlantic right whale	0.000	0.000	1.5
Sei whale	--	--	--
ODONTOCETES			
Atlantic spotted dolphin	1.418	1.803	32.1**
Atlantic white-sided dolphin	--	--	--
Beaked whales*	4.224	0.354	3.9
Bottlenose dolphin	2.857	2.769	12.9
Clymene dolphin	--	--	--
Common dolphin	0.000	10.793	15.9
Dwarf/pygmy sperm whale	0.046	0.046	1.5
False killer whale	0.004	0.004	4.0
Fraser's dolphin	--	--	--
Harbor porpoise	--	--	--
Killer whale	--	--	--
Melon-headed whale	--	--	--
Pantropical spotted dolphin**	--	--	--
Pilot whale***	0.127	0.140	13.5
Pygmy killer whale	0.000	0.000	13.0
Risso's dolphin	1.539	1.565	8.5
Rough-toothed dolphin	0.002	0.002	3.0
Sperm whale	0.000	0.000	1.5
Spinner dolphin	0.409	0.409	9.0
Striped dolphin	0.000	0.000	25.8
White-beaked dolphin	--	--	--
TOTAL	10.626	17.885	

Footnotes:
* - includes *Mesoplodon* spp. and/or *Ziphius cavirostris*
** - pantropical spotted dolphin at Mayport included with Atlantic spotted dolphin
*** - includes long- and short-finned forms for Mayport

	species "may occur," per DoN (2002); no density data available
	seasonal assignment, per DoN (2002)
--	species not expected to occur

Group size means are depth strata-specific; region-specific group sizes rarely used

(5) LETTER OF 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 a LOA is applicable to activities that may cause mortality, injury, and harassment to marine mammal species. The subsequent analyses in this analyses will identify Level B noise harassment as the primary form of take; however, there is a potential, before any protective measures, that small numbers of marine mammals may be injured or possibly killed due to noise generated from the explosive sources.

(6) NUMBERS AND SPECIES TAKEN

Numbers of marine mammals predicted to be potentially killed, injured, or harassed are calculated in Appendix C of the MESA VERDE Draft EIS (DoN, 2007). The following discussion is excerpted from Section 4.2.1.1.3 of the MESA VERDE Draft EIS (DoN, 2007), which presents and summarizes the impact estimates. Total numbers of marine mammals potentially affected are listed in Table 3. Marine mammals may be killed or seriously injured if they are present within the Safety Range (radius of 6.5 km [3.5 nmi]) and not detected during pre-detonation monitoring. At greater distances, marine mammals may experience harassment.

6.1 ANALYTICAL APPROACH

Appendix C of the MESA VERDE Draft EIS (DoN, 2007) quantifies the risk of impacts to marine mammals during the shock trial in two ways: (1) in terms of probabilities of marine mammals occurring in the Safety Range (radius of 6.5 km [3.5 nmi]); and (2) in terms of numbers of marine mammals predicted to be killed, injured, or harassed.

Table 3: Mean Densities, Probabilities, and Predicted Exposure Calculations for Marine Mammals in Mayport

	Mayport Spring	Mayport Summer
Mean Density:		
▪ Groups/100 km^2	1.617	1.313
▪ Individuals/100 km^2	10.626	17.885
Probabilities:		
▪ "Clear Range" [a]	0.04	0.03
▪ "Delay" [b]	0.23	0.17
▪ "Injury or Mortality" [c]	0.73	0.81
Predicted Number of Individuals:		
▪ Killed	0	1
▪ Injured	6	2
▪ Harassed	207	282

Footnotes: a – zero groups in the Safety Range
b – one or more groups in the Safety Range but detected
c – one or more groups in the Safety Range but not detected

Ultimately, two quantities are of interest:

1. The probability of one or more groups being present in the Safety Range, but none detected. This is termed "probability of injury or mortality" since it means a detonation could occur with marine mammals in the Safety Range.

2. The expected number of marine mammals within various radii of the detonation point (i.e., ranges for mortality, injury, and harassment) after taking into account pre-detonation monitoring. This quantity is referred to as "incidental take."

Appendix C of the MESA VERDE Draft EIS (DoN, 2007) details how these two quantities were calculated. The probability of "injury or mortality" was calculated by first estimating the probability of one or more groups occurring in the Safety Range. Mean densities for each species were multiplied by the area of the Safety Range to predict expected numbers of groups in the Safety Range. Based on the assumption of an approximate random spatial distribution of groups, the probability of zero groups within the Safety Range was calculated using the Poisson distribution. By subtraction from 1.0, the probability of one or more groups being present in the Safety Range was calculated. The probability of detecting a group if present was estimated based on the design of the protective measures (numbers and spacing of transects), as well as estimates of detection probabilities for visual observations. Information about submergence intervals was used to estimate the proportion of the population on the surface and available for visual detection.

The following terminology is used:

- Criterion: specific impact that could be used to represent a broad type of impact (mortality, injury, harassment). For example, onset of severe lung injury is used as a criterion for the onset of mortality.
- Threshold: specific level of sound pressure, impulse, or energy needed to cause the specific impact stated in a criterion
- Range: maximum horizontal distance from the detonation point where the threshold level is predicted to occur.

Numbers of marine mammals potentially killed, injured, or harassed as a result of the proposed detonations were estimated using a series of steps and assumptions:

1. Ranges for mortality, injury, and harassment (Tables 4 and 5) were calculated using criteria and thresholds developed in Appendices D and E of the MESA VERDE Draft EIS (DoN, 2007). The mortality and injury criteria are based on tests conducted with terrestrial and marine mammals, and the criterion for harassment is based on Temporary Threshold Shift (TTS) in bottlenose dolphins.

2. These ranges were used to define concentric circles around the detonation point (Figure 3), and to calculate the area within each circle.

3. Mean densities of each species (from Appendix B in the MESA VERDE Draft EIS [DoN, 2007]) were multiplied by the area of the mortality, injury, and onset harassment ranges to estimate the number of marine mammals affected "without protective measures" for a single detonation.

4. The estimates for a single detonation were multiplied by four to account for up to four detonations that could occur during the proposed shock trial.

5. The probability of detecting each marine mammal species was estimated, taking into account aerial and surface observers (see MESA VERDE Draft EIS Appendix C [DoN, 2007]).

6. For mortality and injury, the numbers for each species ("without protective measures") were then multiplied by (1 minus detection probability). The resulting values are the expected number of undetected groups of each species within the mortality and injury ranges. The number of groups was multiplied by a group size for each species to predict the number of individuals affected. Results were summed over all species and then rounded up to the nearest whole number. In those cases where the number of individuals affected were <0.5, it was assumed that zero individuals would be affected.

7. For harassment, the numbers ("with protective measures") were assumed to be equal to the "without protective measures" numbers, because protective measures (i.e., postponement due to animals in Safety Range) apply to only a small proportion of the TTS area. Results for individual species were summed and then rounded up to the nearest whole number. In those cases where the number of individuals affected were <0.5, it was assumed that zero individuals would be affected.

Table 4: Marine Mammal Impact Criteria, Thresholds, and Ranges

Category of Effect	Criterion	Threshold	Species or Group
Mortality [a]	Onset Severe Lung Injury	537-723 pounds per square inch-millisecond (psi-msec)	Mysticetes and Sperm whale
		378-386 psi-msec	Large Odontocetes
		127-170 psi-msec	Small Odontocetes
Injury [b]	Onset Permanent Threshold Shift (PTS)	198 decibel (dB) re 1µPa^2 (microPascal)-sec	High Frequency Cetacean
		198 dB re 1µPa^2-sec	Mid-Frequency Cetacean
		198 dB re 1µPa^2-sec	Low Frequency Cetacean
Harassment [b]	Onset TTS	183 dB re 1µPa^2-sec	High Frequency Cetacean
		183 dB re 1µPa^2-sec	Mid-Frequency Cetacean
		183 dB re 1µPa^2-sec	Low Frequency Cetacean

Table 5: Predicted Impact Ranges for Marine Mammals

Criterion	Metric	Threshold/ Group	Mayport Max Range				Range Units
			Jan	May	Aug	Nov	
Mortality - *Onset Severe Lung Injury*	Impulse[a]	Mysticetes and Sperm whale	1,400	NA	NA	NA	ft
			0.427	NA	NA	NA	km
			0.230	NA	NA	NA	nmi
		Large odontocetes	2,100	2,000	2,050	2,320	ft
			0.640	0.610	0.625	0.707	km
			0.346	0.330	0.337	0.382	nmi
		Small odontocetes	3,520	3,600	4,220	4,020	ft
			1.073	1.097	1.286	1.225	km
			0.579	0.592	0.695	0.662	nmi
		Large sea turtle (1,102 lb [500 kg] Leatherback)	3,000	2,980	3,290	2,830	ft
			0.914	0.908	1.003	0.863	km
			0.494	0.490	0.541	0.466	nmi
		Small sea turtle (187 lb [85 kg] Loggerhead)	4,530	4,670	4,490	4,520	ft
			1.381	1.423	1.369	1.378	km
			0.746	0.769	0.739	0.744	nmi
Slight Injury - *Onset PTS*	Weighted Energy Flux Density[b]	High frequency cetaceans	7,000	7,100	6,800	6,500	ft
			2.134	2.164	2.073	1.981	km
			1.152	1.169	1.119	1.070	nmi
		Mid-frequency cetaceans	8,000	8,200	7,800	7,700	ft
			2.438	2.499	2.377	2.347	km
			1.317	1.350	1.284	1.267	nmi
		Low frequency cetaceans	19,000	19,000	21,000	20,600	ft
			5.792	5.791	6.401	6.279	km
			3.127	3.127	3.456	3.390	nmi
		Sea turtles (low frequency)	19,000	19,000	21,000	20,500	ft
			5.791	5.791	6.401	6.248	km
			3.127	3.127	3.456	3.374	nmi
Harassment -*Onset TTS*	Weighted Energy Flux Density[b]	High frequency cetaceans	35,000	28,000	36,000	33,800	ft
			10.668	8.534	10.973	10.302	km
			5.760	4.608	5.925	5.563	nmi
		Mid-frequency cetaceans	40,000	33,000	42,000	38,800	ft
			12.192	10.058	12.802	11.826	km
			6.583	5.431	6.912	6.386	nmi
		Low frequency cetaceans	105,000	102,000	143,000	135,000	ft
			32.004	31.090	43.586	41.148	km
			17.281	16.787	23.535	22.218	nmi
		Sea turtles (low frequency)	105,000	102,000	141,000	131,000	ft
			32.004	31.090	42.977	39.929	km
			17.281	16.787	23.206	21.560	nmi

a – Onset severe lung injury ranges calculated based on weighted average body mass, species present, and species densities, by season; thresholds change accordingly.

b – Onset PTS and harassment, marine animals grouped according to measured or estimated ranges of best hearing, per Ketten (1994):

- Low frequency: 12 Hertz (Hz) to 22,000 Hz
- Mid-frequency: 150 Hz to 160,000 Hz
- High frequency: 200 Hz to 180,000 Hz

Notes: NA – not applicable; species or species group not expected during this season; January (Jan) = winter; May = spring; August (Aug) = summer; November (Nov) = fall

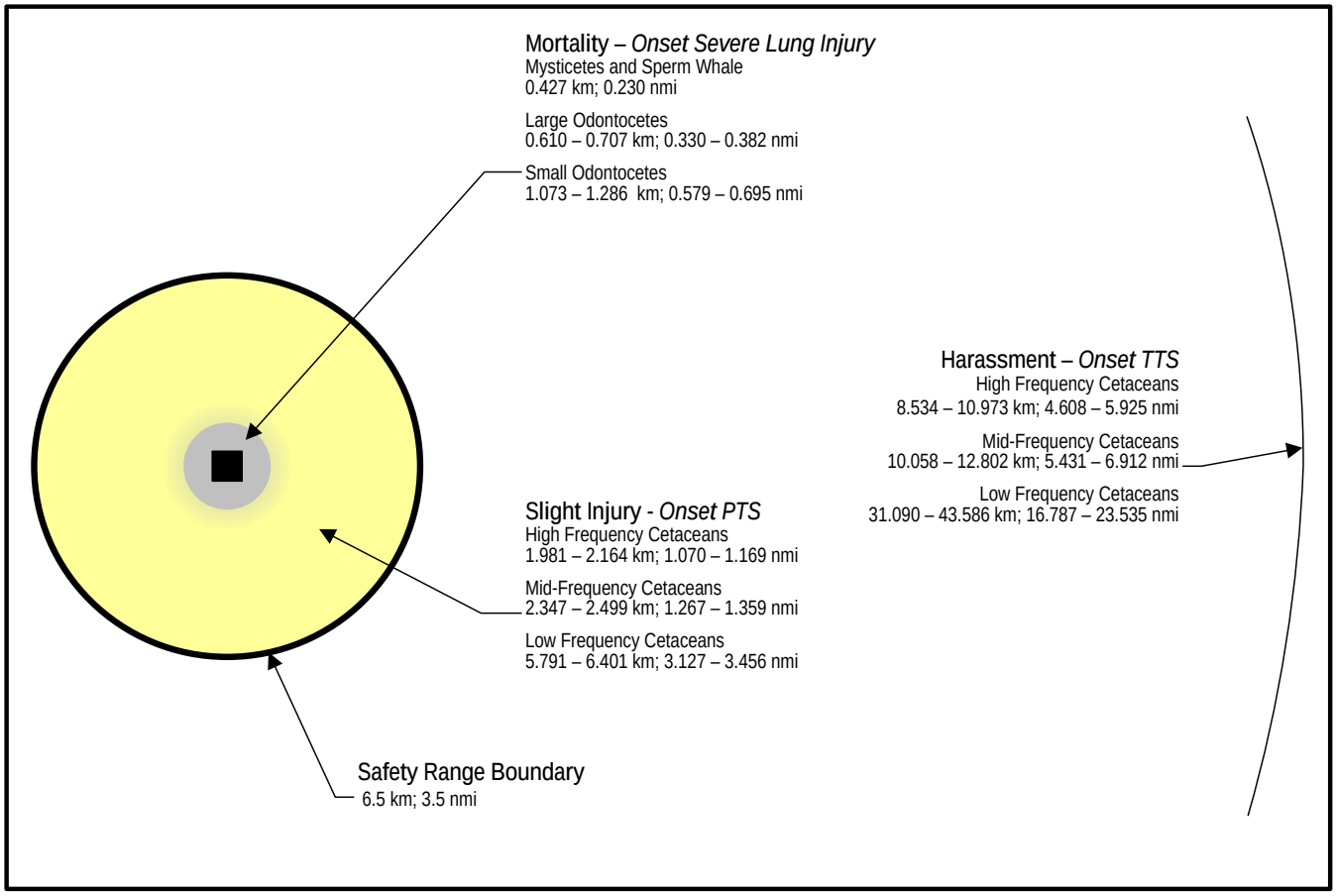

Figure 3: Predicted Ranges for Various Criteria in Relation to the Detonation Point at Mayport

6.2 MORTALITY AND INJURY

Marine mammals can be killed or injured by underwater explosions due to the response of air cavities, such as the lungs and bubbles in the intestines, to the shock wave (Office of the Surgeon General, 1991). The criterion for mortality used for the proposed MESA VERDE shock trial is the onset of extensive lung hemorrhage. In this analysis, the acoustic exposure associated with onset of severe lung injury (extensive lung hemorrhage) is used to define the outer limit of the zone within which species are considered to experience mortality. Extensive lung hemorrhage is considered debilitating and potentially fatal as a result of air embolism or suffocation. For the predicted impact ranges (zone), representative marine mammal body sizes (mean body mass values) and average lung volumes were established, relative densities identified, and species were subsequently grouped (i.e., mysticetes and sperm whale, large odontocetes, small odontocetes). Thresholds and associated ranges for the onset of severe lung injury criterion are variable for each group depending upon the presence and relative density of marine mammal species in a particular season, and their mean body mass and lung volume. The aforementioned Tables 4 and 5 provide a list of the criterion with thresholds and ranges for each grouping by mean body mass.

In this analysis, all marine mammals within the calculated radius for onset of extensive lung injury (i.e., onset of mortality) are counted as lethal takes. The range at which onset of extensive lung hemorrhage is expected to occur is greater than the ranges at which 50% to 100% lethality would occur from closest proximity to the charge or from presence within the bulk cavitation region (see Tables 4 and 5). The region of bulk cavitation is an area near the surface above the detonation point in which the reflected shock wave creates a region of cavitation within which smaller animals would not be expected to survive. Because the range for onset of extensive lung hemorrhage for smaller animals exceeds the range for bulk cavitation and all more serious injuries, all smaller animals within the region of cavitation and all animals (regardless of body mass) with more serious injuries than onset of extensive lung hemorrhage are accounted for in the lethal take estimate. The calculated maximum ranges for onset of extensive lung hemorrhage depend upon animal body mass, with smaller animals having the greatest potential for impact, as well as water column temperature and density. Appendix D of the MESA VERDE Draft EIS (DoN, 2007) presents calculations that estimate the range for the onset of extensive lung hemorrhage.

For injury, the criterion applied is permanent threshold shift (PTS), a non-recoverable injury that must result from the destruction of tissues within the auditory system (e.g., tympanic membrane rupture, disarticulation of the middle ear ossicles, and hair-cell damage). Onset-PTS is indicative of the minimum level of injury that can occur due to sound exposure. All other forms of trauma would occur closer to the sound source than the range at which the onset of PTS occurs. In this analysis, the smallest amount of PTS (onset PTS) is taken to be the indicator for the smallest degree of injury that can be measured. The acoustic exposure associated with onset-PTS is an energy flux density (EL) of 198 decibel (dB) re 1 μPa^2-sec or greater for all mean body mass sizes. Appendix D of the MESA VERDE Draft EIS (DoN, 2007) presents calculations that estimate the range for the onset of PTS in blast-exposed marine mammals.

Tables 6 and 7 summarize the mortality, injury, and harassment exposure estimates in spring and summer, respectively, for the proposed Mayport location. Results for individual species were summed and then rounded up to the nearest whole number. The calculations predict that for Mayport in spring, 0 marine mammals killed and 6 injured; in summer, 1 marine mammal (bottlenose dolphin) killed and 2 injured.

Table 6: Exposure Estimates at the Proposed Mayport Location in Spring

Spring - Number of Individuals
(Four detonations, with protective measures)

	Mortality		Injury		Harassment	
	Calc.	Round	Calc.	Round	Calc.	Round
MARINE MAMMALS						
Minke whale	0.000	0	0.000	0	0.000	0
North Atlantic right whale	0.000	0	0.000	0	0.000	0
Atlantic spotted dolphin	0.076	0	0.318	0	33.827	34
Beaked whales	0.179	0	2.824	3	50.383	50
Bottlenose dolphin	0.381	0	1.597	2	68.155	68
Common dolphin	0.000	0	0.000	0	0.000	0
Dwarf/pygmy sperm whale	0.063	0	0.264	0	5.487	5
False killer whale	0.000	0	0.003	0	0.095	0
Pilot whale	0.005	0	0.079	0	3.030	3
Risso's dolphin	0.265	0	1.111	1	36.714	37
Rough-toothed dolphin	0.000	0	0.001	0	0.048	0
Spinner dolphin	0.070	0	0.293	0	9.757	10
Total - Marine Mammals		**0**		**6**		**207**

Table 7: Exposure Estimates at the Proposed Mayport Location in Summer

Summer - Number of Individuals
(Four detonations, with protective measures)

	Mortality		Injury		Harassment	
	Calc.	Round	Calc.	Round	Calc.	Round
MARINE MAMMALS						
Minke whale	0.000	0	0.000	0	0.000	0
North Atlantic right whale	0.000	0	0.000	0	0.000	0
Atlantic spotted dolphin	0.133	0	0.321	0	71.706	72
Beaked whales	0.016	0	0.212	0	7.039	7
Bottlenose dolphin	0.508	1	1.227	1	110.124	110
Common dolphin	0.000	0	0.000	0	0.000	0
Dwarf/pygmy sperm whale	0.087	0	0.209	0	9.147	9
False killer whale	0.000	0	0.003	0	0.159	0
Pilot whale	0.006	0	0.078	0	5.568	6
Risso's dolphin	0.370	0	0.894	1	62.241	62
Rough-toothed dolphin	0.000	0	0.001	0	0.000	0
Spinner dolphin	0.096	0	0.233	0	16.266	16
Total - Marine Mammals		**1**		**2**		**282**

6.3 HARASSMENT

Harassment, as defined in the 1994 amendments to the MMPA, is "any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild" (Level A harassment); or "(ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering" (Level B harassment).

In this request and the accompanying MESA VERDE Draft EIS (DoN, 2007), TTS is used as the harassment for marine mammals. TTS is recoverable and, as in recent rules (NOAA, 2001, 2002), is considered to result from the temporary, non-injurious distortion of hearing-related tissues. The smallest measurable amount of TTS (onset-TTS) is taken as the best indicator for harassment. Because it is considered non-injurious, the acoustic exposure associated with onset-TTS is used to define the outer limit of the zone within which marine mammal species are predicted to experience harassment attributable to physiological effects. This follows from the concept that hearing loss potentially affects an animal's ability to react normally to the sounds around it; it potentially disrupts normal behavior by preventing it from occurring. Therefore, the potential for TTS qualifies as a Level B harassment that is mediated by physiological effects upon the auditory system.

In this analysis, a dual criterion for onset-TTS has been developed: (1) an energy-based TTS criterion of 183 dB re 1 μPa^2-sec EL, and (2) 224 dB re 1 µPa (23 psi) received peak pressure. If either threshold is met or exceeded, TTS is assumed. The thresholds are primarily based on cetacean TTS data from Finneran et al. (2002). Since these impulsive sound exposures are similar to the sounds of interest for this analysis, they provide the data that are most directly relevant to this action. The predicted impact ranges applied the more stringent criterion, 183 dB re 1 μPa^2-sec weighted energy flux density level.

Corresponding TTS ranges are listed in the aforementioned Tables 4 and 5. For onset-TTS, the more conservative of the two criteria was chosen for determining the range that defined the impact zone, regardless of water depth. Expected numbers of marine mammals within these radii were calculated using mean densities from Appendix B of the MESA VERDE Draft EIS (DoN, 2007). Mean density values were previously adjusted to account for submerged (undetectable) individuals. Because the range defining the zone in which onset-TTS is predicted is much larger than the range corresponding to mortality or injury, more individuals and more species could be affected. Species historically present at or near the proposed Mayport location, but not seen during aerial surveys used to develop density estimates, were not taken into account in these calculations. The results for individual species were rounded to the nearest whole number and then summed. For summations which were <0.5, calculations were rounded down to zero (see MESA VERDE Appendix C [DoN, 2007]).

Total predicted harassment numbers for marine mammals are summarized in the aforementioned Tables 6 and 7 for the proposed Mayport location. Estimated numbers of marine mammals predicted to experience harassment are 207 individuals at Mayport in spring, and 282 individuals in summer.

(7) ANTICIPATED IMPACT TO MARINE MAMMAL SPECIES AND 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 for the proposed shock trial conducted in spring (after 1 May) or summer. The proportion of the minimum population potentially killed is predicted to be zero in spring and 1 (bottlenose dolphin) in summer. For potential injury to marine mammals, only a small fraction are predicted for most species. The highest values at Mayport are 2.824 (beaked whales in spring) and 1.227 (bottlenose dolphin in summer). An impact on such a small fraction of the minimum population would not be expected to adversely affect marine mammal species or stocks. Harassment numbers represent a higher proportion of the population, but due to the minor and temporary nature of the effect, the overall impact on marine mammal species or stocks is expected to be negligible.

7.1 MORTALITY AND INJURY

Numbers of marine mammals potentially killed or injured during the proposed shock trial would represent a small fraction of the total population. Depending upon the season, a total of four to five taxa at Mayport had at least a 10% probability of injury or mortality – beaked whales, minke whale, dwarf/pygmy sperm whale, bottlenose dolphin, common dolphin, Risso's dolphin, and North Atlantic right whale. The only mortalities predicted were for bottlenose dolphin (i.e., single mortality in summer). Injuries were predicted for beaked whales, Risso's dolphin, and bottlenose dolphin in spring; bottlenose dolphin and Risso's in summer. Tables 8 and 9 compare predicted mortality and injury with stock size for all marine mammal species with a "probability of injury or mortality" greater than 0.01 for spring and summer, respectively. Stock size is represented by "minimum population" estimates developed by NOAA Fisheries (Blaylock et al., 1995; Waring et al., 2004).

The only strategic stocks likely to be present at Mayport are the North Atlantic right whale (winter only). It is estimated that there will be no mortalities of North Atlantic right whales as this species is not expected to occur in spring (after 1 May) or summer but may be present. North Atlantic right whales are of special concern due to their highly endangered status; less than 300 individuals remain (Blaylock et al., 1995; Waring et al., 2004). Right whales generally occur off Mayport from November/early December to April, with peak abundance between January and March (Kraus et al., 1993). According to aerial observations in the Mayport area during the calving season, North Atlantic right whales spend 15-87% of their time on the surface, with averages of 36% for single juveniles, 72% for mother/calf pairs, and 79% for surface active groups (Hain et al., 1999). Therefore, during the 2.5 hours preceding detonation, a North Atlantic right whale could be on the surface for a total of 22 minutes to over 2 hours. Mean dive times are a few minutes. If a North Atlantic right whale were present, there is greater than 81% chance that it would be detected during pre-detonation aerial and shipboard visual monitoring, as described in Section 5.0.

For the remaining strategic stock species, Potential Biological Removal (PBR) levels will not be exceeded. For beaked whales, as many as 3 individuals may be injured in spring (well below the PBR of 24 for this species group), while no individuals are predicted to be injured in summer. It is highly unlikely that any deaths or injuries of a protected species would occur.

Table 8: Comparison of Predicted Mortality and Injury with Stock Size for Cetacean Species at Mayport in Spring. Probability of injury or mortality and estimated numbers killed and injured from MESA VERDE Draft EIS (DoN, 2007). Minimum population and the loss the population can sustain (potential biological removal [PBR]) are from Waring et al. (2004)). Shaded areas indicate maximum injury estimates for strategic stock species which may be adversely affected (i.e., percentage of a strategic stock population >0.001). Arrow symbol (▲) indicates expected PBR exceedance.

	N_{min} Stock Size	PBR	Spring Number of Individuals (Four detonations, with protective measures)							Prob. Inj/ Mort
			Killed		Injured					
			Calc.	Round	Calc.	Round	Level A Total	PBR OK?	Pop. Aff.	
MARINE MAMMALS										
Minke whale	3,515	35	0.0000	0	0.0000	0	0.0000	0 OK	0.0000	0.0%
North Atlantic right whale	291	0	0.0000	0	0.0000	0	0.0000	0 OK	0.0000	0.0%
Atlantic spotted dolphin	27,785	278	0.0760	0	0.3185	0	0.3945	0 OK	0.0000	6.3%
Beaked whales	2,419	24	0.1789	0	2.8243	3	3.0033	3 OK	0.0012	68.9%
Bottlenose dolphin	24,199	249	0.3811	0	1.5968	2	1.9779	2 OK	0.0001	25.2%
Common dolphin	23,655	227	0.0000	0	0.0000	0	0.0000	0 OK	0.0000	0.0%
Dwarf/pygmy sperm whale	470	4.7	0.0630	0	0.2640	0	0.3271	0 OK	0.0007	30.2%
False killer whale	N/A	N/A	0.0002	0	0.0034	0	0.0036	0 OK	N/A	0.2%
Pilot whale	11,343	108	0.0050	0	0.0790	0	0.0840	0 OK	0.0000	1.4%
Risso's dolphin	22,916	220	0.2649	0	1.1096	1	1.3744	1 OK	0.0001	21.6%
Rough-toothed dolphin	N/A	N/A	0.0003	0	0.0014	0	0.0018	0 OK	N/A	0.1%
Spinner dolphin	N/A	N/A	0.0700	0	0.2933	0	0.3633	0 OK	N/A	6.4%
Total - Marine Mammals				**0**		**6**		**6**		

Abbreviations:
N_{min} – minimum population estimate
Proportion of Population Affected – maximum percentage of the population affected
Shaded cells are strategic stock species – Endangered, threatened, and depleted species are automatically designated as strategic stocks even if annual mortality does not exceed PBR

Table 9: Comparison of Predicted Mortality and Injury with Stock Size for Cetacean Species at Mayport in Summer. Probability of injury or mortality and estimated numbers killed and injured are from MESA VERDE Draft EIS (DoN, 2007). Minimum population and the loss the population can sustain ([PBR) are from Waring et al. (2004). Shaded areas indicate maximum injury estimates for those strategic stock species which may be adversely affected (i.e., percentage of a strategic stock population >0.001). Arrow symbol (▲) indicates expected PBR exceedance.

			Summer Number of Individuals (Four detonations, with protective measures)								
	N_{min} Stock Size	PBR	Killed		Injured						Prob. Inj/
			Calc.	Round	Calc.	Round	Level A Total		PBR OK?	Pop. Aff.	Mort
MARINE MAMMALS											
Minke whale	3,515	35	0.0000	0	0.0000	0	0.0000	0	OK	0.0000	0.0%
North Atlantic right whale	291	0	0.0000	0	0.0000	0	0.0000	0	OK	0.0000	0.0%
Atlantic spotted dolphin	27,785	278	0.1328	0	0.3210	0	0.4538	0	OK	0.0000	7.8%
Beaked whales	2,419	24	0.0157	0	0.2120	0	0.2277	0	OK	0.0001	10.2%
Bottlenose dolphin	24,199	249	0.5077	1	1.2267	1	1.7344	2	OK	0.0001	24.6%
Common dolphin	23,655	227	0.0000	0	0.0000	0	0.0000	0	OK	0.0000	47.2%
Dwarf/pygmy sperm whale	470	4.7	0.0866	0	0.2093	0	0.2959	0	OK	0.0006	30.2%
False killer whale	N/A	N/A	0.0002	0	0.0030	0	0.0032	0	OK	N/A	0.2%
Pilot whale	11,343	108	0.0058	0	0.0780	0	0.0838	0	OK	0.0000	1.5%
Risso's dolphin	22,916	220	0.3701	0	0.8944	1	1.2645	1	OK	0.0001	21.9%
Rough-toothed dolphin	N/A	N/A	0.0005	0	0.0011	0	0.0016	0	OK	N/A	0.1%
Spinner dolphin	N/A	N/A	0.0962	0	0.2325	0	0.3287	0	OK	N/A	6.4%
Total - Marine Mammals				**1**		**2**		**3**			

Abbreviations:
N_{min} – minimum population estimate
Proportion of Population Affected – maximum percentage of the population affected
Shaded cells are strategic stock species – Endangered, threatened, and depleted species are automatically designated as strategic stocks even if annual mortality does not exceed PBR

7.2 HARASSMENT

Table 10 includes harassment numbers with cetacean stock sizes for spring and summer, respectively. In most cases, these numbers represent a small fraction of the minimum population. In a few cases, these numbers approach or exceed the minimum population estimates. However, the actual proportion of the population affected is likely to be much smaller than the calculations indicate, due to the very conservative nature of both the minimum population estimates and harassment numbers. The minimum population estimates are developed based on a lower confidence limit, and the mean population size is considerably larger. Harassment numbers are likely overestimates due to numerous conservative assumptions as explained in Appendix E of the MESA VERDE Draft EIS (DoN, 2007). Harassment calculations used mean densities (rather than a lower confidence limit) and took into account the worst-case water depth, animal depth, and sound velocity profile.

Harassment would be expected to have a negligible impact on stocks of marine mammals. The impact which is the basis for the harassment estimate (i.e., TTS) is temporary and reversible, and a given animal is unlikely to experience more than one

detonation and thus, unlikely to experience TTS more than once. Further, only a portion of the exposed population is likely to experience TTS to a high enough degree to experience harassment by this temporary hearing impairment. Aside from the temporary disruption and its risks to the individual animal, neither a long-term adverse impact on health or survival nor a lasting disruption of behavioral patterns, such as migration, breathing, nursing, breeding, feeding, or sheltering is anticipated.

Table 10: Comparison of Harassment with Stock Size for Cetacean Species at the Proposed Mayport Location in Spring and Summer. Probability of harassment is from MESA VERDE Draft EIS (DoN, 2007). Minimum population estimates are from Waring et al. (2004).

	Spring		Summer		
Mayport Spring	Harassment	Level B	Harassment	Level B	N_{min} Stock Size
Minke whale	0.000	0	0.000	0	3,515
North Atlantic right whale	0.000	0	0.000	0	291
Atlantic spotted dolphin	33.827	34	71.706	72	27,785
Beaked whales	50.383	50	7.039	7	2,419
Bottlenose dolphin	68.155	68	110.124	110	24,199
Common dolphin	0.000	0	0.000	0	23,655
Dwarf/pygmy sperm whale	5.487	5	9.147	9	470
False killer whale	0.095	0	0.159	0	NA
Pilot whale	3.030	3	5.568	6	11,343
Risso's dolphin	36.714	37	62.241	62	22,916
Rough-toothed dolphin	0.478	0	0.080	0	NA
Spinner dolphin	9.757	10	16.266	16	NA
Total		207		282	

NA – Not applicable

(8) IMPACT ON SUBSISTENCE USE

Potential impacts resulting from the proposed activity will be limited to individuals of marine mammal species located off the coast of Florida and will not affect Arctic marine mammals. Also, because the MESA VERDE shock trial will not take place in Arctic waters, it would not have an unmitigable adverse impact on the availability of marine mammals for subsistence uses identified in MMPA section 101(a)(5)(A)(i).

(9) ANTICIPATED IMPACT ON MARINE MAMMAL HABITAT AND LIKELIHOOD OF RESTORATION

The primary source of marine mammal habitat impact is noise resulting from the explosive detonation. 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. Each detonation would have short-term impacts on water column physical and chemical properties near the detonation point, persisting for minutes to hours. Effects of chemical products of the explosions are considered negligible because the initial

concentrations are not hazardous to marine life and the products are rapidly dispersed in the ocean (see Section 4.2.1.4 of the MESA VERDE Draft EIS [DoN, 2007]). The effects of each of these components were considered in the MESA VERDE Draft EIS and were determined to be insignificant (DoN, 2007). Marine mammal habitat would not be affected.

(10) IMPACTS TO MARINE MAMMALS FROM HABITAT LOSS OR MODIFICATION

Due to the short-term and localized nature of water column effects from each detonation, no impact on marine mammal populations due to habitat loss or modification is anticipated. Marine mammal habitat will not be lost or modified.

(11 AND 13) MONITORING AND REPORTING

A detailed marine mammal and sea turtle protective measures plan is presented in Section 5.0 of the MESA VERDE Draft EIS (DoN, 2007). The plan includes the same aerial and shipboard visual monitoring efforts that were used successfully during the shock trial of the USS WINSTON S. CHURCHILL in 2001 (DoN, 1999). Those shock trial operations included three 4,536 kg (10,000 lb) detonations; no marine mammal deaths or injuries were detected. The MESA VERDE plan is designed to produce the least practicable adverse impact on marine mammals and sea turtles. Results would be reported to NOAA Fisheries in accordance with requirements specified in the incidental take authorization.

The MESA VERDE protective measures plan represents the final step in a sequence of actions to avoid or reduce environmental impacts. Three locations were initially selected – Mayport, Norfolk, and Pensacola – based on the Navy's operational requirements (see Section 2.2.2 of the MESA VERDE Draft EIS [DoN, 2007]). Then, portions of each proposed location were excluded based on environmental considerations (see Section 2.2.3 of the MESA VERDE Draft EIS [DoN, 2007]). Finally, the proposed locations were compared to the risk of impacts to marine mammals at each location (see Section 2.4 of the MESA VERDE Draft EIS [DoN, 2007]). The MESA VERDE protective measures plan would build upon these efforts to avoid and further reduce potential environmental impacts. One primary and two secondary test sites would be selected within the proposed Mayport location where marine mammal and sea turtle populations are the lowest, based on the results of aerial surveys conducted one day prior to the first detonation. This would ensure that the final test site selected poses the least possible risk to the marine environment.

Pre-detonation monitoring would be conducted on the day of each detonation to evaluate the test site and verify that the Safety Range was free of visually detectable marine mammals and sea turtles, large *Sargassum* rafts, drift lines, or concentrations of jellyfish (possible indicators of sea turtle presence), large schools of fish, and flocks of seabirds. Finally, post-detonation monitoring would be conducted to determine the effectiveness of

the monitoring efforts. A ship-based Marine Animal Response Team (MART) and aerial observers would monitor the test site and surrounding waters for injured or dead animals after each detonation. Communications with stranding network personnel would be maintained throughout the shock trial period.

As discussed previously, the purpose of the Safety Range is to prevent deaths and serious injuries to marine mammals. Detonation would not occur until the Safety Range is clear of detectable marine mammals and sea turtles, as well as indicators of sea turtle presence such as large *Sargassum* rafts, drift lines or jellyfish aggregations. The Safety Range radius of 6.5 km (3.5 nmi) around the detonation point exceeds the estimated ranges for mortality and injury to marine mammals associated with detonation of a 4,536 kg (10,000 lb) explosive.

Based on the analysis presented in Appendix D of the MESA VERDE Draft EIS (DoN, 2007), the maximum range for mortality (onset of extensive lung injury) at Mayport in spring is 1.10 km (0.59 nmi) with summer as 1.29 km (0.70 nmi); maximum range for injury (onset of PTS) is 5.79 km (3.13 nmi) in spring, and 6.40 km (3.46 nmi) in summer. These are conservative ranges and take into account the worst-case depth effects. The Safety Range extends well beyond these ranges to encompass the maximum area that can be effectively monitored. The probability of serious injury at a range of 6.5 km (3.5 nmi) and beyond is considered to be minimal (see Appendix D of the MESA VERDE Draft EIS [DoN, 2007]).

As described in Section 5.0 of the MESA VERDE Draft EIS (DoN, 2007), the protective measures plan includes aerial surveys/monitoring, as well as shipboard monitoring from the MESA VERDE and the MART vessel. Aerial and shipboard monitoring teams would identify and locate animals on the surface. This monitoring would be used to detect marine mammals within the Safety Range and to minimize the risk of impacts to these animals. The proposed Mayport location is not situated near feeding or spawning grounds, nursery areas, or other locations of similar significance to marine mammals. Biologically productive areas such as cold core rings and water mass boundaries would be avoided in the site selection process (see Section 5.0 of the MESA VERDE Draft EIS [DoN, 2007]).

(12) PLAN TO MINIMIZE EFFECTS ON SUBSISTENCE USES

Potential impacts resulting from the proposed activity will be limited to individuals of marine mammal species located off the coast of Florida and will not affect Arctic marine mammals. Also, because the MESA VERDE shock trial will not take place in Arctic waters, it would not have an unmitigable adverse impact on the availability of marine mammals for subsistence uses identified in MMPA section 101(a)(5)(A)(i).

(14) RESEARCH OPPORTUNITIES, PLANS, AND ACTIVITIES

The following aspects of the shock trial provide opportunities for research to evaluate the predicted effects of the detonations and, in the future, to reduce the potential for incidental takes from similar activities.

14.1 SURVEYS AND MONITORING

Site selection surveys, pre-detonation monitoring, and post-detonation monitoring will provide intensive, site-specific information about marine mammals within the proposed Mayport location. These efforts will add to the limited data available concerning cetacean distribution, abundance, and temporal variability in deep offshore waters.

14.2 POST-DETONATION MONITORING

Post-detonation monitoring will provide an opportunity for learning about the effects of shock trial detonations and blast injuries (if any occur). As explained in Section 5.0 of the MESA VERDE Draft EIS (DoN, 2007), the scientists onboard the MART would attempt to document any marine mammals or sea turtles that were killed or injured as a result of the shock test and, if practicable, recover and examine any dead animals. The species, number, location, and behavior of any animals observed by the MART and the aerial team would be documented and reported to the Lead Scientist. Any dead small marine mammals (<5 m [15 ft]) would be lifted aboard the MART vessel, weather permitting, and immediately necropsied. Tissues collected would include the head, heart, and samples of both lungs (cranial, middle, caudal). On larger whales, if it were not possible to collect the entire head, eardrums, tympanic bulla, and samples from the brain would be collected. The tissues would be preserved onboard the MART vessel and sent to the Armed Forces Institute of Pathology (AFIP) for analyses of effects from blast injury once the MART returns to port. Large marine mammals (>5 m [15 ft]) that are dead would be pulled alongside the MART vessel and necropsied as possible (weather permitting). The preserved tissues would also be sent to AFIP. Marine mammals and sea turtles that appear to be lethally injured, based on observations by the veterinarian and the marine mammal behavioral specialist, would be collected by MART and euthanized. These animals would also be immediately necropsied, with tissues preserved and sent to AFIP for analysis. Marine mammals and sea turtles that appear to be injured but not lethally would be observed by the marine mammal behavior specialist, who would note identifying marks (if any) and take photographs. Marine mammal and sea turtle stranding networks would be notified.

Coordination with Stranding Networks: Notification and coordination with stranding networks will provide an opportunity for learning more about blast injuries if any occur (see Section 5.0 of the MESA VERDE Draft EIS [DoN, 2007]) and the influence of currents on timing of any subsequent strandings. Any dead marine mammals that cannot be recovered by the MART would be tagged. This information would be relayed to the NOAA Fisheries marine mammal stranding network coordinator. Marine mammals and sea turtles that strand after a detonation will be necropsied, if the condition of the animal

allows, to determine if any indications of blast injury are present. The coordinator would contact the appropriate stranding network representative (based on the animal's possible point of landfall given the prevailing current). Each network has qualified technicians who have been trained at NMFS-sponsored workshops in correct necropsy and preservation techniques. Any tagged marine mammal that strands would be necropsied under the direction of a veterinarian with knowledge of blast effects, and a Marine Mammal Stranding Report would be completed and forwarded to both the NOAA Fisheries stranding coordinator and the AFIP. Tissues would be sent to AFIP for analyses. The AFIP would attempt to provide the MART veterinarian a preliminary report on their findings prior to subsequent detonations. AFIP results would be incorporated into subsequent shot day protocols, as possible. Specific information about the stranding would be relayed from the coordinator to the Lead Scientist for inclusion in reports.

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