APPENDIX F
Military Expended Materials and Direct Strike
Impact Analyses

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Final

Environmental Impact Statement/Overseas Environmental Impact Statement Atlantic Fleet Training and Testing

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APPENDIX F   MILITARY EXPENDED MATERIAL AND DIRECT STRIKE IMPACT ANALYSIS

F.1   ESTIMATING THE IMPACT OF MILITARY EXPENDED MATERIALS AND IN-WATER EXPLOSIONS ON ABIOTIC SUBSTRATES AS A HABITAT FOR BIOLOGICAL RESOURCES

This section discusses the methods and results for quantifying two scenarios under Alternative 1 and Alternative 2 of the Proposed Action: (1) the highly improbable worst-case scenario of all military expended materials or in-water explosions occurring on one particular substrate type, and (2) the unlikely, but slightly more realistic, scenario of uniform or proportional impact distribution within a particular area. Training and testing typically occurs in areas that are not called out or linked to specific activities for various reasons (e.g., flexibility and national security). Because training and testing activities would not be conducted under the No Action Alternative, it will not be discussed in this appendix.

This section describes the calculation of the disturbance footprint (i.e., military expended material footprint or explosive crater footprint) of an instantaneous impact of military expended materials or explosions on the substrate. The actual instantaneous impact on the bottom will depend on the number and location of military expended materials expended and not recovered, which is likely much lower and more concentrated than either scenario being analyzed. Longer term impacts on the bottom are far more difficult to quantify – refer to Section 3.5 (Habitats) for qualitative discussion.

The analysis requires two data elements: (1) a tabular summary of the military expended material or crater (in-water explosions) footprints expected in training and testing areas, and (2) a tabular summary of analysis dimensions, which includes abiotic substrate areas. The data for (1) comes from the Atlantic Fleet Training and Testing (AFTT) action proponents and represents the most locational flexibility with regard to expenditure of military expended materials and in-water explosions. The data for both expended and recovered material is reported in Table F-1 through Table F-17. Appendix A (Navy Activity Descriptions) of the AFTT Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) provides basic descriptions of military expended materials and Section 3.0.3.3.2 (Explosive Stressors) provides basic descriptions of explosive categories. The data for number of military expended materials and in-water explosions are then multiplied by an estimate of the footprint size documented in Table F-1. The data for (2) comes from a compilation of abiotic substrate mapping presented in Section 3.5 (Habitats).

To determine the potential level of disturbance of military expended materials on marine substrates, it was assumed that the impact footprint of the expended material on the seafloor is twice the size of its footprint (unless specified otherwise in the notes for Table F-1 through Table F-38). By doubling the footprint, the results should more accurately reflect the potential disturbance to soft bottom habitats (i.e., to account for sediment plumes), but should overestimate disturbance to hard bottom habitats (i.e., because sediment plumes are not expected) based on mitigation requirements. Items with casings (e.g., small-, medium-, and large-caliber munitions; flares; sonobuoys; etc.) have their impact footprints further doubled to account for both the item and its casing. To be conservative, items and their casings were assumed to be the same size, although in reality the items are a smaller size in order to fit in their casing.

Table F-1: Categories and Footprints for Various Materials and In-Water Explosions

Material Group	Material Category	Bottom Frequency*	Crater Footprint (ft.²)	MEM Size (ft.²)	MEM Footprint (ft.²)	Material Specific Notes
Bomb	Bombs (Explosive)	NA	NA	8.1203	112.9048	The MEM footprint was calculated using the bomb with the largest footprint in terms of material fragments, which in this case is the Rockeye which disperses 247 bomblets.
	Bombs (Non-explosive)	NA	NA	8.1203	112.9048	
Countermeasure	Acoustic Countermeasures	NA	NA	0.31107	1.2432	Includes all type of non-recoverable Acoustic Countermeasures
	Chaff- Air Cartridge	NA	NA	0.0012	0.0022	Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths to elicit frequency responses, which deceive enemy radars. Chaff-Air is fired from an aircraft using a small cartridge.
	Chaff-Ship Cartridge	NA	NA	2.000	4.000	Chaff-ship serves the same purpose of chaff-air. It is fired from a ship in cartridges.
	Anti-torpedo Torpedo	NA	NA	4.5424	9.0847	The Countermeasure Anti-torpedo consists of an anti-torpedo torpedo enclosed within All Up Round Equipment canister. The anti-torpedo torpedo is a 6.75-inch diameter high-maneuverability hard-kill torpedo designed to rapidly intercept and engage an incoming threat torpedo. The All Up Round Equipment consists of a nose sabot, ram plate, launch tube, muzzle cover, and breech mechanism to encapsulate, protect, and ultimately launch the anti-torpedo torpedo. Anti-torpedo torpedo s are frequently recovered; assume all are non-recoverable for worst-case.
	Flares	NA	NA	1.2196	4.8782	Assumed to not have parachutes
Explosive Charge	0.5 lb. HE charges	50%	12	NA	NA	None
	10 lb. HE charges	50%	85	NA	NA	None
	20 lb. HE charges	50%	135	NA	NA	None
	5 lb. HE charges	50%	54	NA	NA	None
	60 lb. HE charges	50%	281	NA	NA	None
	650 lb. HE charges	50%	14800.3763	25.7903	51.5806	Another name for an explosive mine including material based on the footprint of a mine shape.
	Line Charges	100%	4324	NA	NA	None

Table F-1: Categories and Footprints for Various Materials and In-water Explosions (continued)

Material Group	Material Category	Bottom Frequency*	Crater Footprint (ft²)	MEM Size (ft²)	MEM Footprint (ft²)	Material Specific Notes
Missiles	Missiles (Explosive)	NA	NA	37.3669	74.7338	MEM size based on SM-6
	Missile (Non-explosive)	NA	NA	14.1771	28.3543	MEM size based on Harpoon
	Rockets (Explosive)	NA	NA	0.7987	1.5974	MEM sized based on Hydra 70
	Rockets (Non-explosive)	NA	NA	0.7987	1.5974	MEM size based on Hydra 70. Also include flechette rockets.
	Rockets (Non-explosive): Flechette	NA	NA	0.7987	1.5974	MEM size based on Hydra 70. Included flechette darts in warhead.
Other	Air-launched lightweight (Explosive) torpedo	NA	NA	19.1199	38.2399	MEM size based on MK50/MK54
	Air-launched lightweight (Non-explosive) torpedo	NA	NA	19.1199	38.2399	MEM size based on MK50/MK54. Typically recovered
	AMNS/EMNS Neutralizer (Explosive)	50%	430.5564	1.6286	3.2572	AMNS is air deployed whereas EMNS is ship deployed
	Anti- torpedo Torpedo Accessories	**NA**	NA	1.0107	2.0215	MEM includes ballast weights, flex tubing (parachute size not included)
	Anchor - Other	NA	NA	3.1248	6.2495	Sand bags, concrete blocks, or weights, typically associated with equipment recovered using an acoustic release (anchor remains). This does not include anchors use for mine shapes.
	Anchor -Mine	NA	NA	6.2495	12.5001	Associated primarily with mine shapes.
	Biodegradable Polymer	NA	NA	NA	NA	A substance composed of molecules that degrade as a result of microorganisms and/or enzymes. Footprint is not applicable because the material breaks up within a couple of hours, depending on the type of material out of which the polymer is made. Reference: Karlsson and Albertsson. 1998. Biodegradable polymers and environmental interaction. Polymer Engineering and Science 38(8): 1251-1253.
	Bottom Placed	NA	NA	2.0000	4.000	Likely moored tracking beacons, so the footprint on the

Table F-1: Categories and Footprints for Various Materials and In-water Explosions (continued)

Material Group	Material Category	Bottom Frequency*	Crater Footprint (ft²)	MEM Size (ft²)	MEM Footprint (ft²)	Material Specific Notes
	Instruments					bottom would be approximately 2 square feet. It would weight approximately 50 pounds.
	Buoy (Explosive)	NA	NA	0.9752	3.8987	Explosive buoys including mini-sound source and SUS. MEM-size based on Marine Marker.
	Buoy (Non-explosive)	NA	NA	0.9752	3.8987	These buoys are separate from sonobuoys, and are included for DWADS (expendable) or IMPASS (recovered). MEM size based on Marine Marker. Can be expended or recovered.
	Canister-Miscellaneous	NA	NA	2.0000	4.0000	The specific description is classified. Applies only to where it cannot be associated to another object (e.g., canister associated with chaff would be covered by 'chaff')
	Compression Pad or Plastic Piston	NA	NA	0.0043	0.0086	Assumed similar 2-dimensional footprint as endcaps and pistons, but made of floating material
	Concrete slugs	NA	NA	0.0011	0.0022	Assume similar in dimensions to a chaff cartridge
	Endcaps & Pistons – Non Chaff & Flare	NA	NA	0.0043	0.0086	Applies only to where it cannot be associated to another object (e.g., endcaps and pistons associated with chaff would be covered by 'chaff'). Used for testing.
	Endcaps –Chaff & Flare	NA	NA	0.00215	0.0043	Applies only to Chaff-Air and Flares. 1 Endcap is expended per chaff-air or flare.
	Flare O-Ring	NA	NA	0.0043	0.0086	Assumed similar 2-dimensional footprint as endcaps and pistons. Associated with flares. Assumed 1 Flare O-Ring per flare.
	Fiber Optic Can	NA	NA	0.0011	0.0022	Assumed similar 2-dimensional footprint as chaff-air cartridge. Associated with AMNS Neutralizer fiber optic cable. Can that holds fiber optic cable is expended.
	Expended Bathythermograph	NA	NA	0.0258	0.0516	An instrument that is deployed from a ship to record temperature and depth measurements. Small wires transmit the temperature data from the probe to the ship. This item is fairly standard in terms of footprint; these are off the shelf Commercial products. Reference: NOAA 2015.

Table F-1: Categories and Footprints for Various Materials and In-water Explosions (continued)

Material Group	Material Category	Bottom Frequency*	Crater Footprint (ft²)	MEM Size (ft²)	MEM Footprint (ft²)	Material Specific Notes
						http://www.aoml.noaa.gov/goos/uot/xbt-what-is.php. Accessed November 3, 2015.
	Fiber optic cables	NA	NA	NA	NA	Associated with some rockets and AMNS neutralizers
	Guidance wires	NA	NA	0	0	Fragments created for relatively small portion associated with explosive devices (associated with heavyweight torpedoes).
	Expended Bathythermograph Wire	NA	NA	NA	NA	Single vertical wire
	Heavyweight (Explosive) torpedo	NA	NA	39.6155	79.2299	MEM size based on MK-48
	Heavyweight torpedo accessories	NA	NA	0.1615	3.2367	MEM includes ballast weights, flex tubing
	Heavyweight (Non-explosive) torpedo	NA	NA	NA	NA	Typically recovered
	Illumination flares	NA	NA	1.2196	4.8782	Flares that have a large parachute; MEM size based on half the surface area of an 18 ft diameter parachute used with an LUU-2 illumination flare.
	Lightweight Torpedo Accessories	NA	NA	1.0107	2.0215	MEM includes ballast weights, flex tubing (parachute size not included)
	Marine marker	NA	NA	0.9752	3.8987	MEM footprint based on two Navy marine markers (MK25 and MK58
	Mine (Explosive)	50%	14800.376	25.7903	51.5806	Another name for a 650 lb. HE explosive charge including material based on the footprint of a mine shape.
	Decelerator/Parachute – Extra Large	NA	NA	5,026.50	10,053.09	MEM size based on diameter of Air Target- Drone parachute (BQM 34S [80-ft in diameter])
	Decelerator/Parachute - Large	NA	NA	1,963.50	3,926.90	
	Decelerator/Parachute	NA	NA	254.5	508.9	MEM size based on diameter of LUU-2 illumination flare

Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-1: Categories and Footprints for Various Materials and In-water Explosions (continued)

Material Group	Material Category	Bottom Frequency*	Crater Footprint (ft²)	MEM Size (ft²)	MEM Footprint (ft²)	Material Specific Notes
	- Medium					parachute (18 ft. diameter).
	Decelerator/Parachute - Small	NA	NA	9.0417	18.0834	Associated with launched sonobuoys and air-launched torpedoes.
	Sabot	NA	NA	1.2195	4.8782	An accessory used during projectile firing. Footprint similar in size to the projectile.
	Sonobuoys (Non-explosive)	NA	NA	1.2206	2.4413	Sonobuoys have an extra item footprint (half the dimensions of the sonobuoy) added in addition to the actual sonobuoy and casing to account for the items that are discarded from the sonobuoy following its release. MEM size does not include the associated Small Decelerator/Parachute (noted in table above)
	Sonobuoys (Explosive)	0	NA	1.2206	2.4413	
	Sonobuoy wires	NA	NA	NA	NA	One wire is associated with each sonobuoy
	Surface-Launched Lightweight (Explosive) Torpedo	0	NA	10.0782	20.1576	MEM size based on MK50/MK54
	Surface-Launched Lightweight (Non-Explosive) Torpedo	NA	NA	10.0782	20.1576	Typically recovered
Projectile	Grenades (Explosive)	0	NA	0.1044	0.2088	None
	Large Caliber (Explosive)	NA	NA	1.0097	4.0386	Item assumed to have a projectile and casing
	Large Caliber (Non-explosive)	NA	NA	1.0097	4.0386	Item assumed to have a projectile and casing
	Large caliber (Casing only)	NA	NA	0.5048	1.0097	Used when the target is on land; no MEM from projectile
	Medium Caliber (Explosive)	NA	NA	0.0560	0.2239	Item assumed to have a projectile and casing
	Medium Caliber (Non-explosive)	NA	NA	0.0560	0.2239	Item assumed to have a projectile and casing

Table F-1: Categories and Footprints for Various Materials and In-water Explosions (continued)

Material Group	Material Category	Bottom Frequency*	Crater Footprint (ft²)	MEM Size (ft²)	MEM Footprint (ft²)	Material Specific Notes
	Small Caliber (Non-explosive)	NA	NA	0.0301	0.1216	Item assumed to have a projectile and casing
	Small Caliber (Casing only)	NA	NA	0.0151	0.0301	Used only for small caliber 'blanks'. All other small caliber rounds are included under NEPM
	JATO bottles	NA	NA	3.60607	7.2134	MEM size: Length: 30.6"; Diameter: 5". Infor provided by USFF
	Kinetic Energy Round	NA	NA	0.5048	1.0097	Item assumed to only have a projectile (no casing) - size of Large Caliber round.
Target	Air Target – Drone	NA	NA	95.64	191.28	MEM when specifically known it is an aerial drone; MEM size based on Firebee (BQM-34). Can be expended or recovered
	Air Target – Decoy	NA	NA	14.0216	28.0432	MEM when specifically known it is an air launched decoy. MEM size based on dimensions of Tactical Air Launched Decoy or Miniature Air-Launched Decoy. Can be expended or recovered
	Metal Plates	NA	NA	2.7782	5.5563	Charges are secured to a 20" X 20" X 1/2" ferrous metal plate The target unit (concrete blocks, metal plate, and any debris) is brought to the surface and analyzed.
	Surface Target (Mobile)	NA	NA	5.7522	11.5034	Includes remote controlled or towed targets. Can be expended or recovered
	Surface Target (Stationary)	NA	NA	96.8752	193.7504	MEM when specifically known it is a stationary surface target. MEM size based on Killer Tomato. Can be expended or recovered
	Subsurface Target (Mobile)	NA	NA	1.2206	2.4412	MEM when specifically known it is a sub-surface Motorized Autonomous Target. Can be expended or recovered
	Subsurface Target (Stationary)	NA	NA	5.7522	11.5034	MEM when specifically known it is a sub-surface and stationary. Can be expended or recovered
	Mine Shape (Non-explosive)	NA	NA	25.7903	51.5807	Mine shapes that were specifically identified as non-recoverable; Footprint based on size of explosive mine; size not including anchor. Can be expended or recovered

Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-1: Categories and Footprints for Various Materials and In-water Explosions (continued)

Material Group	Material Category	Bottom Frequency*	Crater Footprint (ft²)	MEM Size (ft²)	MEM Footprint (ft²)	Material Specific Notes
	Mine Shape – (Explosive)	NA	NA	25.7903	51.5807	Another name for a 650 lb HE explosive charge including material based on the footprint of a mine shape. The vast majority of practice mines have built-in anchors for placing on the bottom; relatively few are moored/floating, and none are drifting.
	Ship Hulk	NA	NA	316136.0367	632272.0734	None.

Note: * Bottom frequencies (%) are only listed for in-water explosions; crater footprints are only listed for material that may be detonated on the bottom.
   MEM = Military Expended Materials; AMNS/EMNS = Airborne Mine Neutralization System/ Expendable Mine Neutralization System; lb. = pound; HE = High Explosive

Additionally, highly explosive munitions that explode either at the surface or in the water column were treated in the same manner as non-explosive practice munitions, although in reality, the explosions would result in smaller fragments reaching the substrate than expected by the fully intact non-explosive practice munitions.

The data for analysis dimensions (data element 2) comes from the Aquatic Habitat Database technical report and supporting databases (U.S. Department of the Navy, 2018a), in addition to spatial data depicting training and testing areas.

The combined analysis dimensions data was used to create a table of substrate category acreage by training and testing areas, and large marine ecosystems. Within the AFTT Study Area, there are acreages of substrate that are included under Protective Measures Assessment Protocol categories from the Phase II AFTT EIS/OEIS. These Protective Measures Assessment Protocol categories indicate the amount of mapped substrate that may be protected by Navy mitigation measures. However, the Protective Measures Assessment Protocol areas were not excluded from the quantitative impacts analysis due to how Protective Measures Assessment Protocol is implemented. For more information on the substrates protected under the Protective Measures Assessment Protocol see Chapter 5 (Mitigation).

The percentage of impacted substrate (Scenario 1) was calculated by totaling the impact footprint of individual activities divided by the total area of a given substrate in the training or testing area for which the impacts could occur. The results are provided in Table F-18 through Table F-26.

Assumptions used in the Scenario 1 analysis included:

- Areas of unknown substrate type were not included in the analysis.
- The analysis focused on substrates that are likely to have habitat for sedentary benthic organisms; therefore, areas that are not likely to have substrate inhabited by these organisms (i.e., the Atlantic Basin and Abyssal Zone open ocean areas) were excluded from the analysis.
- Artificial substrate was removed from the analysis because it was inconsistently mapped or mapped with a degree of uncertainty considered too high for quantitative analysis.

The above assumptions also applied to Scenario 2 (Proportional Impacts), which used the proportion of a substrate type in an analysis dimension (i.e., training or testing area) multiplied by the total military expended material or crater footprints. The resulting acres indicated the impact area expected if the military expended materials or bottom explosions were distributed uniformly across the training or testing area. In other words, a majority proportion of the military expended material footprint would impact soft substrate if the majority of the analysis dimension was soft substrate. The results are provided in Table F-27 through Table F-30. This scenario is considered more realistic than Scenario 1, yet still unlikely as it does not account for areas of concentrated training, nor does it account for the clumping of military expended materials and explosives in a particular area and over a particular substrate type where a training or testing activity occurs.

F.1.1 MILITARY EXPENDED AND RECOVERED MATERIAL – TRAINING ACTIVITIES

Table F-2 through Table F-13 show military expended and recovered materials and impact footprints within the AFTT Study Area for both a Single Year and Five Year totals.

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Table F-2: Number and Impacts* of Military Expended Materials Proposed for Use During Training Activities in a Single Year Under Alternatives 1 and 2

Military Expended Materials	Size (ft.²)	Impact Footprint (ft.²)	Northeast Number	Northeast Impact (Acre)	VACAPES Number	VACAPES Impact (Acre)	Navy Cherry Point Number	Navy Cherry Point Impact (Acre)	JAX Number	JAX Impact (Acre)	Key West Number	Key West Impact (Acre)	GOMEX Number	GOMEX Impact (Acre)	Other AFTT Area Number	Other AFTT Area Impact (Acre)	SINKEX Area Number	SINKEX Area Impact (Acre)
Bombs																		
Bombs (Explosive)	8.1203	112.9048	0	0.0000	88	0.2281	0	0.0000	56	0.1451	0	0.0000	4	0.0104	0	0.0000	12	0.0311
Bombs (Non-Explosive)	8.1203	112.9048	0	0.0000	2,188	5.6712	596	1.5448	1,360	3.5250	0	0.0000	270	0.6998	0	0.0000	0	0.0000
Projectiles																		
Small-Caliber (Non-Explosive)	0.0301	0.1216	27,000	0.0754	2,262,000	6.3145	393,000	1.0971	1,026,000	2.8641	0	0.0000	83,000	0.2317	100,000	0.2792	0	0.0000
Small-Caliber (Casing Only)	0.0151	0.0301	0	0.0000	5,000	0.0035	0	0.0000	5,000	0.0035	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Medium-Caliber (Explosive)	0.056	0.2239	0	0.0000	46,100	0.2370	20,000	0.1028	45,600	0.2344	0	0.0000	6,000	0.0308	0	0.0000	0	0.0000
Medium Caliber (Non-Explosive)	0.056	0.2239	1,000	0.0051	658,561	3.3850	328,149	1.6867	383,861	1.9731	28,000	0.1439	28,950	0.1488	21,150	0.1087	0	0.0000
Large-Caliber (Explosive)	1.0097	4.0386	0	0.0000	762	0.0706	210	0.0195	642	0.0595	0	0.0000	114	0.0106	114	0.0106	200	0.0185
Large-Caliber (Non-Explosive)	1.0097	4.0386	0	0.0000	4,930	0.4571	1,234	0.1144	2,534	0.2349	0	0.0000	498	0.0462	210	0.0195	0	0.0000
Large-Caliber (Casing only)	0.5048	1.0097	0	0.0000	0	0.0000	1,040	0.0241	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Missiles																		
Missiles (Explosive)	37.6691	74.7338	0	0.0000	32	0.0007	4	0.0001	4	0.0001	0	0.0000	4	0.0001	4	0.0001	0	0.0000
Rockets (Explosive)	0.7987	1.5974	2	0.0034	199	0.3414	187	0.3208	192	0.3294	8	0.0137	2	0.0034	0	0.0000	4	0.0069
Rockets (Non-Explosive)	0.7987	1.5974	0	0.0000	1,748	0.0641	76	0.0028	1,824	0.0669	0	0.0000	190	0.0070	0	0.0000	0	0.0000
Rockets (Non-Explosive): Flechette	0.7987	1.5974	1	0.0000	1,835	0.0673	304	0.0111	2,095	0.0768	0	0.0000	191	0.0070	0	0.0000	0	0.0000
Countermeasures																		
Chaff-Air Cartridges	0.0011	0.0022	0	0.0000	2,080	0.0001	25,760	0.0013	47,840	0.0024	48,000	0.0024	288	0.0000	0	0.0000	0	0.0000
Chaff - Ship Cartridges	2.0000	4.0000	0	0.0000	264	0.0242	480	0.0441	516	0.0474	0	0.0000	120	0.0110	0	0.0000	0	0.0000
Flares	1.2196	4.8782	0	0.0000	1,000	0.1120	22,300	2.4973	38,000	4.2555	31,000	3.4716	1,840	0.2061	0	0.0000	0	0.0000
Targets																		
Air Target (Decoy)	14.0216	28.0432	2	0.0013	81	0.0521	52	0.0335	61	0.0393	9	0.0058	2	0.0013	0	0.0000	0	0.0000
Air Target (Drone)	95.64	191.2	0	0.0000	18	0.0790	28	0.1229	7	0.0307	2	0.0088	0	0.0000	0	0.0000	0	0.0000
Surface Target (Mobile)	5.7522	11.5034	0	0.0000	70	0.0185	23	0.0061	78	0.0206	0	0.0000	3	0.0008	0	0.0000	0	0.0000
Surface Target (Stationary)	96.8752	193.7504	20	0.0890	4,512	20.0689	1,298	5.7734	3,013	13.4015	0	0.0000	334	1.4856	200	0.0890	0	0.0000
Mine Shapes (Non-Explosive)	25.7903	51.5807	0	0.0000	221	0.2617	78	0.0924	78	0.0924	2	0.0024	93	0.1101	0	0.0000	0	0.0000
Ship Hulk	316,136	632,272	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	1	14.5150
Other																		
Grenades (Explosive)	0.1044	0.2088	56	0.0003	4,070	0.0195	28	0.0001	28	0.0001	0	0.0000	28	0.0001	0	0.0000	0	0.0000
AMNS Neutralizer (Explosive)	1.6286	3.2572	0	0.0000	62	0.0046	1	0.0001	2	0.0001	0	0.0000	22	0.0016	0	0.0000	0	0.0000
Anchor - Other	3.1248	6.2495	0	0.0000	11	0.0016	10	0.0014	4	0.0006	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Compression Pad or Plastic Piston	0.0043	0.0086	0	0.0000	1,000	0.0002	22,300	0.0044	38,000	0.0075	31,000	0.0061	1,840	0.0004	0	0.0000	0	0.0000
Endcap – Chaff and Flare	0.0022	0.0043	0	0.0000	3,120	0.0003	48,108	0.0047	85,888	0.0085	79,008	0.0078	2,128	0.0002	0	0.0000	0	0.0000
Fiber Optic Can	0.0011	0.0022	0	0.0000	62	0.0000	1	0.0000	2	0.0000	0	0.0000	22	0.0000	0	0.0000	0	0.0000
Flare O-Ring	0.0043	0.0086	0	0.0000	1,040	0.0002	22,348	0.0044	38,048	0.0075	31,008	0.0061	1,840	0.0004	0	0.0000	0	0.0000
Illumination Flare	1.2196	4.8782	0	0.0000	40	0.0045	48	0.0054	48	0.0054	8	0.0009	0	0.0000	0	0.0000	0	0.0000
Heavyweight Torpedo (Explosive)	39.6155	79.2299	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	1	0.0018
Heavyweight Torpedo Accessories	0.1615	3.2367	24	0.0018	8	0.0006	0	0.0000	48	0.0036	0	0.0000	0	0.0000	0	0.0000	1	0.0001
Lightweight Torpedo Accessories	1.1011	2.0215	0	0.0000	13	0.0006	0	0.0000	44	0.0020	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Marine Marker	0.9752	3.8987	0	0.0000	1,022	0.0915	332	0.0297	1,060	0.0949	30	0.0027	53	0.0047	24	0.0021	0	0.0000
Decelerator/Parachute - Medium	254.5000	508.9000	0	0.0000	40	0.4673	48	0.5608	48	0.5608	8	0.0935	0	0.0000	0	0.0000	0	0.0000
Decelerator/Parachute- Large	1,963.5000	3,926.9000	1	0.0901	30	2.7045	0	0.0000	1	0.0901	0	0.0000	1	0.0901	0	0.0000	0	0.0000
Decelerator/Parachute – Extra-Large	5,026.5000	10,053.0900	0	0.0000	5	1.1539	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
JATO Bottles	3.6067	7.2134	1	0.0002	35	0.0058	0	0.0000	1	0.0002	0	0.0000	1	0.0002	0	0.0000	0	0.0000
Total			**28,107**	**0.27**	**3,002,374**	**41.92**	**888,047**	**14.11**	**1,722,097**	**28.19**	**248,083**	**3.77**	**127,842**	**3.11**	**121,706**	**0.42**	**219**	**14.57**

Notes: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; ft.²=square feet; GOMEX= Gulf of Mexico; JAX=Jacksonville; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; VACAPES=Virginia Capes

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-3: Number and Impacts* of Military Expended Materials Proposed for Use During Training Activities in a Single Year Under Alternatives 1 and 2–Inshore Waters

	Military Expended Materials											
	Projectiles		Targets		Other						Countermeasure	
	Small Caliber (Non-explosive)		Mine Shapes		Marine Marker		Flare O-Ring		Compression Pad/Piston		Flare	
Location	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Narragansett Bay, RI	8,320	0.0232	0	0.0000	64	0.0058	0	0.0000	0	0.0000	0	0.0000
James River and Tributaries, VA	97,920	0.2733	0	0.0000	728	0.652	20,400	0.0040	20,400	0.0040	20,400	2.2846
York River, VA	0	0.0000	0	0.0000	20	0.0018	0	0.0000	0	0.0000	0	0.0000
Lower Chesapeake Bay, VA	78,000	0.2177	2	0.0024	230	0.0206	0	0.0000	0	0.0000	0	0.0000
Cooper River, SC	5,100	0.0142	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Port Canaveral, FL	12,800	0.0357	0	0.000	64	0.0057	0	0.0000	0	0.0000	0	0.0000

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

    ac=acres

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-4: Number and Impacts* of Military Expended Materials Proposed for Use During Training Activities in a Single Year with Differences between Alternatives 1 and 2

Military Expended Materials	Size (ft.²)	Impact Footprint (ft.²)	Northeast Number	Northeast Impact (Acre)	VACAPES Number	VACAPES Impact (Acre)	Navy Cherry Point Number	Navy Cherry Point Impact (Acre)	JAX Number	JAX Impact (Acre)	Key West Number	Key West Impact (Acre)	GOMEX Number	GOMEX Impact (Acre)	Other AFTT Area Number	Other AFTT Area Impact (Acre)
Alternative 1																
Countermeasures																
Acoustic Countermeasures	0.3311	1.2432	84	0.0024	51	0.0015	24	0.0007	184	0.0053	0	0.0000	0	0.0000	88	0.0025
Targets																
Subsurface Target (Mobile)	1.2206	2.4413	82	0.0046	304	0.0170	98	0.0045	1,057	0.0621	0	0.0000	3	0.0001	134	0.0075
Other																
Buoy (Non-Explosive)	0.9752	3.8987	0	0.0000	24	0.002148	17	0.0015	116	0.0104	0	0.0000	0	0.0000	0	0.0000
Sonobuoys (Non-Explosive)	1.2207	2.4413	2,882	0.1615	7,484	0.4194373	2,542	0.1425	27,237	1.5265	0	0.0000	0	0.0000	432	0.0242
Expended Bathythermograph	0.2771	0.5554	142	0.0018	414	0.0052786	108	0.0014	1,353	0.0173	0	0.0000	5	0.0000	154	0.0020
Decelerator/Parachute - Small	9.0417	18.0834	2,882	1.1964	7,497	3.1122876	2,542	1.0553	27,265	11.3187	0	0.0000	0	0.0000	432	0.1793
Total			**6,072**	**1.3668**	**15,774**	**3.5576**	**5,331**	**1.2058**	**57,212**	**12.9402**	**0**	**0.0000**	**8**	**0.0001**	**1,240**	**0.2155**
Alternative 2																
Countermeasures																
Acoustic Countermeasures	0.3311	1.2432	84	0.0024	51	0.0015	24	0.0007	184	0.0053	0	0.0000	6	0.0002	88	0.0025
Targets																
Subsurface Target (Mobile) - Expended	1.2206	2.4413	84	0.0047	414	0.0225	125	0.0061	1,269	0.0744	0	0.0000	5	0.0003	134	0.0075
Other																
Buoy (Non-Explosive)	0.9752	3.8987	0	0.0000	34	0.0030	22	0.0020	186	0.0166	0	0.0000	16	0.0014	0	0.0000
Sonobuoys (Non-Explosive)	1.2207	2.4413	2,882	0.1615	7,484	0.4194	2,542	0.1425	27,237	1.5265	0	0.0000	702	0.0393	432	0.0242
Bathythermograph - Expended	0.2771	0.5554	142	0.0018	439	0.0056	113	0.0014	1,391	0.0177	0	0.0000	128	0.0016	154	0.0020
Small Decelerator/Parachute	2.8438	5.6876	2,882	1.1964	7,492	3.1102	2,542	1.0553	27,265	11.3187	0	0.0000	702	0.2914	432	0.1793
Total			**6,074**	**1.3669**	**15,914**	**3.5622**	**5,368**	**1.2079**	**57,532**	**12.9592**	**0**	**0.0000**	**1,559**	**0.3343**	**1,240**	**0.2155**

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; ft.²=square feet; GOMEX= Gulf of Mexico; JAX=Jacksonville; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; VACAPES=Virginia Capes

Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2.

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-3: Number and Impacts* of Military Expended Materials Proposed for Use During Training Activities in Five Years Under Alternatives 1 and 2

Military Expended Materials	Size (ft²)	Impact Footprint (ft²)	Northeast Number	Impact (Acre)	VACAPES Number	Impact (Acre)	Navy Cherry Point Number	Impact (Acre)	JAX Number	Impact (Acre)	Key West Number	Impact (Acre)	GOMEX Number	Impact (Acre)	Other AFTT Area Number	Impact (Acre)	SINKEX Area Number	Impact (Acre)
Bombs																		
Bombs (Explosive)	8.1203	112.9048	0	0.0000	500	1.2960	0	0.0000	250	0.6480	0	0.0000	20	0.0518	0	0.0000	60	0.1555
Bombs (Non-Explosive)	8.1203	112.9048	0	0.0000	10,940	28.3558	2,980	7.7240	6,800	17.6252	0	0.0000	1,350	3.4991	0	0.0000	0	0.0000
Projectiles																		
Small-Caliber (Non-Explosive)	0.0301	0.1216	135,000	0.3769	11,310,000	31.5725	1,965,000	5.4854	5,130,000	14.3207	0	0.0000	415,000	1.1585	500,000	1.3958	0	0.0000
Small-Caliber (Casing Only)	0.0151	0.0301	0	0.0000	25,000	0.0173	0	0.0000	25,000	0.0173	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Medium-Caliber (Explosive)	0.056	0.2239	0	0.0000	230,500	1.1848	100,000	0.5140	228,000	1.1719	0	0.0000	30,000	0.1542	0	0.0000	0	0.0000
Medium Caliber (Non-Explosive)	0.056	0.2239	5,000	0.0257	3,292,805	16.9251	1,640,745	8.4335	1,919,305	9.8653	140,000	0.7196	144,750	0.7440	100,750	0.5179	0	0.0000
Large-Caliber (Explosive)	1.0097	4.0386	0	0.0000	3,810	0.3532	1,050	0.0973	3,210	0.2976	0	0.0000	570	0.0528	570	0.0528	1,000	0.0927
Large-Caliber (Non-Explosive)	1.0097	4.0386	0	0.0000	24,650	2.2854	6,170	0.5720	12,670	1.1747	0	0.0000	2,490	0.2309	1,050	0.0973	0	0.0000
Large-Caliber (Casing only)	0.5048	1.0097	0	0.0000	0	0.0000	5,200	0.1205	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Kinetic Energy Round	0.5048	1.0100	0	0.0000	160	0.0037	20	0.0005	20	0.0005	0	0.0000	20	0.0005	20	0.0005	0	0.0000
Missiles																		
Missiles (Explosive)	37.6691	74.7338	10	0.0172	995	1.7071	935	1.6041	960	1.6470	40	0.0686	10	0.0172	0	0.0000	20	0.0343
Rockets (Explosive)	0.7987	1.5974	0	0.0000	8,740	0.3205	380	0.0139	9,120	0.3344	0	0.0000	950	0.0348	0	0.0000	0	0.0000
Rockets (Non-Explosive)	0.7987	1.5974	5	0.0002	9,175	0.3365	1,520	0.0557	10,474	0.3841	0	0.0000	955	0.0350	0	0.0000	0	0.0000
Rockets (Non-Explosive): Flechette	0.7987	1.5974	0	0.0000	475	0.0174	0	0.0000	551	0.0202	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Countermeasures																		
Chaff-Air Cartridges	0.0011	0.0022	0	0.0000	10,400	0.0005	128,800	0.0065	239,200	0.0121	240,000	0.0121	1,440	0.0001	0	0.0000	0	0.0000
Chaff - Ship Cartridges	2.0000	4.0000	0	0.0000	1,320	0.1212	2,400	0.2204	2,580	0.2369	0	0.0000	600	0.0551	0	0.0000	0	0.0000
Flares	1.2196	4.8782	0	0.0000	5,000	0.5599	111,500	12.4867	190,000	21.2777	155,000	17.3581	9,200	1.0303	0	0.0000	0	0.0000
Targets																		
Air Target - Decoy	14.0216	28.0432	10	0.0064	405	0.2607	460	0.2961	305	0.1964	47	0.0303	10	0.0064	0	0.0000	0	0.0000
Air Target - Drone	95.64	191.2	2	0.0088	92	0.4038	138	0.6057	34	0.1492	8	0.0351	2	0.0088	0	0.0000	0	0.0000
Surface Targets (Mobile)	5.7522	11.5034	0	0.0000	348	0.0919	114	0.0301	388	0.1025	0	0.0000	12	0.0032	0	0.0000	0	0.0000
Surface Targets (Stationary)	96.8752	193.7504	100	0.4448	22,560	100.3445	6,490	28.8668	15,065	67.0076	0	0.0000	1,670	7.4280	980	4.3589	0	0.0000
Mine Shapes (Non-Explosive)	25.7903	51.5807	0	0.0000	1,105	1.3085	390	0.4618	390	0.4618	8	0.0095	466	0.5518	0	0.0000	0	0.0000
Ship Hulk	316,136	632,272	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	5	72.5748
Other																		
Grenades (Explosive)	0.1044	0.2088	280	0.0013	20,350	0.0975	140	0.0007	140	0.0007	0	0.0000	140	0.0007	0	0.0000	0	0.0000
ANMS Neutralizer (Explosive)	1.6286	3.2572	0	0.0000	306	0.0229	5	0.0004	6	0.0004	0	0.0000	106	0.0079	0	0.0000	0	0.0000
Anchor - Other	3.1248	6.2495	0	0.0000	55	0.0079	50	0.0072	20	0.0029	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Compression Pad or Plastic Piston	0.0043	0.0086	0	0.0000	5,000	0.0010	111,500	0.0220	190,000	0.0375	155,000	0.0306	9,200	0.0018	0	0.0000	0	0.0000
Endcap - Chaff and Flare	0.0022	0.0043	0	0.0000	15,600	0.0015	240,540	0.0237	429,440	0.0424	395,040	0.0390	10,640	0.0011	0	0.0000	0	0.0000
Fiber Optic Can	0.0011	0.0022	0	0.0000	306	0.0000	5	0.0000	6	0.0000	0	0.0000	106	0.0000	0	0.0000	0	0.0000
Flare O-Ring	0.0043	0.0086	0	0.0000	5,200	0.0010	111,740	0.0221	190,240	0.0376	155,040	0.0306	9,200	0.0018	0	0.0000	0	0.0000
Illumination Flare	1.2196	4.8782	0	0.0000	200	0.0224	240	0.0269	240	0.0269	40	0.0045	0	0.0000	0	0.0000	0	0.0000
Heavyweight Torpedo (Explosive)	39.6155	79.2299	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	5	0.0091
Heavyweight Torpedo Accessories	0.1615	3.2367	120	0.0089	40	0.0030	0	0.0000	240	0.0178	0	0.0000	0	0.0000	0	0.0000	5	0.0004
Lightweight Torpedo Accessories	1.1011	2.0215	0	0.0000	65	0.0030	0	0.0000	220	0.0102	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Marine Marker	0.9752	3.8987	0	0.0000	5,110	0.4574	1,660	0.1486	5,300	0.4744	150	0.0134	265	0.0237	120	0.0107	0	0.0000
Decelerator/Parachute - Medium	254.5000	508.9000	0	0.0000	200	2.3365	240	2.8039	240	2.8039	40	0.4673	0	0.0000	0	0.0000	0	0.0000
Decelerator/Parachute - Large	1,963.5000	3,926.9000	5	0.4507	150	13.5224	0	0.0000	5	0.4507	0	0.0000	5	0.4507	0	0.0000	0	0.0000
Decelerator/Parachute - Extra-Large	5,026.5000	10,053.0900	0	0.0000	25	5.7697	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Sabot - Kinetic Energy Round	1.2196	4.8782	0	0.0000	160	0.0179	20	0.0022	20	0.0022	0	0.0000	20	0.0022	20	0.0022	0	0.0000
JATO bottles	3.6067	7.2134	5	0.0008	175	0.0290	0	0.0000	5	0.0008	0	0.0000	5	0.0008	0	0.0000	0	0.0000
Total			140,537	1.3417	15,011,922	209.7595	4,440,432	70.6528	8,610,444	140.8594	1,240,413	18.8188	639,202	15.5533	603,510	6.4362	1,095	72.8669

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; ft.²=square feet; GOMEX= Gulf of Mexico; JAX=Jacksonville; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; VACAPES=Virginia Capes

Appendix F Military Expended Material and Direct Strike Impact Analysis

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-6: Number and Impacts* of Military Expended Materials Proposed for Use During Training Activities in Five Years Under Alternatives 1 and 2 – Inshore Waters

	Military Expended Materials														
	Projectiles		Targets		Other										Countermeasure	
	Small Caliber (non-explosive)		Mine Shape (non-explosive)		Marine Marker		Endcap – Chaff & Flare		Flare O-Ring		Compression Pad or Plastic Piston		Flare	
Location	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Narragansett Bay, RI	41,600	0.1161	0	0.0000	320	0.0286	0	0.0000	0	0.0000	0	0.0000	0	0.0000
James River and Tributaries, VA	489,600	1.3667	0	0.0000	3,640	0.3258	102.000	0.0101	102,000	0.0201	102,000	0.0201	102,000	11.4228
York River, VA	0	0.0000	8	0.0095	100	0.0090	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Lower Chesapeake Bay, VA	390,000	1.0887	0	0.0000	1,150	0.1029	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Cooper River, SC	25,500	0.0712	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Port Canaveral, FL	64,000	0.1787	0	0.0000	320	0.0286	0	0.0000	0	0.0000	0	0.0000	0	0.0000

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-7: Number and Impacts* of Military Expended Materials Proposed for Use During Training Activities in Five Years with Differences between Alternatives 1 and 2

Military Expended Materials	Size (ft.²)	Impact Footprint (ft.²)	Range Complex												Other AFTT Area	
			Northeast		VACAPES		Navy Cherry Point		JAX		Key West		GOMEX			
			Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Alternative 1																
Countermeasures																
Acoustic Countermeasures	0.3311	1.2432	420	0.0120	255	0.0073	120	0.0034	920	0.0263	0	0.0000	0	0.0000	441	0.0126
Targets																
Subsurface Target (Mobile)	1.2206	2.4413	408	0.0229	1,520	0.0852	488	0.0226	5,303	0.2972	0	0.0000	13	0.0007	670	0.0375
Other																
Buoy (Non-Explosive)	0.9752	3.8987	0	0.0000	114	0.0102	73	0.0065	550	0.0492	0	0.0000	0	0.0000	0	0.0000
Sonobuoys (Non-Explosive)	1.2207	2.4413	14,410	0.8076	37,204	2.0851	12,332	0.6911	134,673	7.5477	0	0.0000	0	0.0000	2,160	0.1211
Expended Bathythermograph	0.2771	0.5554	708	0.0090	2,065	0.0263	535	0.0068	6,402	0.0816	0	0.0000	25	0.0003	771	0.0098
Decelerator/Parachute - Small	9.0417	18.0834	14,410	5.9821	37,244	15.4614	12,332	5.1195	134,813	55.9660	0	0.0000	0	0.0000	2,160	0.8967
Total			**30,356**	**6.8336**	**78,402**	**17.6755**	**25,880**	**5.8500**	**282,661**	**63.9680**	**0**	**0.0000**	**38**	**0.0010**	**6,202**	**1.0777**
Alternative 2																
Countermeasures																
Acoustic Countermeasures	0.3311	1.2432	420	0.0120	255	0.0073	120	0.0034	920	0.0263	0	0.0000	30	0.0009	441	0.0126
Targets																
Subsurface Target (Mobile)	1.2206	2.4413	420	0.0286	2,070	0.1124	625	0.0303	6,362	0.3566	0	0.0000	25	0.0014	670	0.0375
Other																
Buoy (Non-Explosive)	0.9752	3.8987	0	0.0000	170	0.0152	110	0.0098	930	0.0832	0	0.0000	80	0.0072	0	0.0000
Sonobuoys (Non-Explosive)	1.2207	2.4413	14,410	0.8076	37,420	2.0972	12,710	0.7123	136,185	7.6324	0	0.0000	3,510	0.1967	2,160	0.1211
Expended Bathythermograph	0.2771	0.5554	708	0.0090	2,193	0.0280	563	0.0072	6,953	0.0887	0	0.0000	640	0.0082	771	0.0098
Decelerator/Parachute - Small	9.0417	18.0834	14,410	5.9821	37,460	15.5511	12,710	5.2764	136,325	56.5937	0	0.0000	3,510	1.4571	2,160	0.8967
Total			**30,368**	**6.8393**	**79,568**	**17.8111**	**26,838**	**6.0394**	**287,675**	**64.7808**	**0**	**0.0000**	**7,795**	**1.6714**	**6,202**	**1.0777**

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; AMNS = Airborne Mine Neutralization System; ft.²=square feet; GOMEX= Gulf of Mexico; JAX=Jacksonville; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; VACAPES=Virginia Capes

Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2.

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-8: Number of Recovered Materials Proposed for Use During Training Activities In a Single Year Under Alternatives 1 and 2

	Range Complex						Other Training Locations
	Northeast	VACAPES	Navy Cherry Point	JAX	Key West	GOMEX	Other AFTT Area
Recovered Materials	Number	Number	Number	Number	Number	Number	Number
Other							
Air-Launched Lightweight Torpedo (Non-Explosive)	0	8	0	28	0	0	0
Heavyweight Torpedo (Non-explosive)	24	8	0	48	0	0	0
Surface-Launched Lightweight Torpedo (Non-Explosive)	0	5	0	16	0	0	0
Targets							
Air Target (Decoy)	0	570	61	211	69	0	10
Air Target (Drones)	2	58	48	51	6	2	0
Surface Targets (Mobile)	40	6,547	2,047	4,206	0	400	150
Surface Targets (Stationary)	0	38	4	12	0	4	0
Subsurface Targets (Mobile)	0	0	0	46	0	0	0
Total	**66**	**7,234**	**2,160**	**4,618**	**75**	**406**	**160**

Note: ac=acre; GOMEX= Gulf of Mexico; JAX=Jacksonville; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; VACAPES=Virginia Capes

Table F-9: Number and Impacts* of Recovered Bottom Placed Materials Proposed for Use During Training Activities In a Single Year Under Alternatives 1 and 2

			Range Complex												Other Training Locations	
			Northeast		VACAPES		Navy Cherry Point		JAX		Key West		GOMEX		NSWC Panama City	
Recovered Materials	Size (ft.²)	Impact Footprint (ft.²)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Mine Shape (Non-explosive)	25.7903	51.5807	0	0.0000	3,777	4.4725	812	0.9615	1,402	1.6602	13	0.0154	764	0.9047	244	0.2889
Metal Plates	2.7782	5.5563	0	0.0000	0	0.0000	0	0.0000	0	0.0000	5	0.0006	0	0.0000	0	0.0000
Bottom Placed Instruments	2.0000	4.0000	0	0.0000	96	0.0088	0	0.0000	48	0.0044	48	0.0044	96	0.0088	0	0.0000
Total			**0**	**0.0000**	**3,873**	**4.4813**	**812**	**0.9615**	**1,450**	**1.6646**	**66**	**0.0204**	**860**	**0.9135**		

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; ft.²=square feet; GOMEX= Gulf of Mexico; JAX=Jacksonville; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; VACAPES=Virginia Capes

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-10: Number and Impacts* of Recovered Bottom Placed Materials Proposed for Use During Training Activities in a Single Year Under Alternatives 1 and 2 - Inshore Waters

	Military Recovered Materials					
	Projectiles		Targets		Other	
	Metal Plates		Mine Shapes (Non-Explosive)		I-Beam Demolition Structure	
Location	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Beaumont, TX	0	0.0000	8	0.0095	0	0
Boston, MA	0	0.0000	4	0.0047	0	0
Corpus Christi, TX	0	0.0000	4	0.0047	0	0
Delaware Bay, DE	0	0.0000	4	0.0047	0	0
Earle, NJ	0	0.0000	4	0.0047	0	0
Hampton Roads, VA	0	0.0000	8	0.0095	0	0
James River, VA	0	0.0000	75	0.0888	0	0
Kings Bay, GA	0	0.0000	26	0.0308	0	0
Lower Chesapeake Bay, VA	6	0.0008	6	0.0071	0	0
Mayport, FL	0	0.0000	4	0.0047	0	0
Morehead City, NC	0	0.0000	4	0.0047	0	0
Port Canaveral, FL	0	0.0000	4	0.0047	0	0
Savannah, GA	0	0.0000	4	0.0047	0	0
Truman Harbor	0	0.0000	0	0.0000	42	0.0056
Demolition Key	0	0.0000	0	0.0000	42	0.0056
Tampa, FL	0	0.0000	4	0.0047	0	0
Wilmington,, DE	0	0.0000	4	0.0047	0	0
York River, VA	0	0.0000	19	0.0225	0	0

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560; ac=acre

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-11: Number of Recovered Materials Proposed for Use During Training Activities In Five Years Under Alternatives 1 and 2

Recovered Materials		Range Complex						Other Training Locations
		Northeast	VACAPES	Navy Cherry Point	JAX	Key West	GOMEX	Other AFTT Area
		Number	Number	Number	Number	Number	Number	Number
Other								
Air-Launched Lightweight Torpedo (Non-Explosive)		0	40	0	140	0	0	0
Surface-Launched Lightweight Torpedo (Non-Explosive)		0	25	0	80	0	0	0
Heavyweight Torpedo (Non-explosive)		120	40	0	240	0	0	0
Targets								
Air Target - Decoy		0	2,850	305	1,055	343	0	50
Air Target - Drone		8	288	238	257	32	8	0
Surface Target (Mobile)		200	32,732	10,236	21,032	0	1,998	730
Surface Target (Stationary)		0	190	20	60	0	20	0
Subsurface Targets (Mobile)	Alternative 1	0	0	0	232	0	0	0
	Alternative 2				272			
Total	**Alternative 1**	**328**	**36,165**	**10,799**	**23,096**	**375**	**2,026**	**780**
	Alternative 2				**23,136**			

Note: ac=acre; GOMEX= Gulf of Mexico; JAX=Jacksonville; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; VACAPES=Virginia Capes

Blue shading indicates numbers of recovered materials that differ between Alternatives 1 and 2.

Table F-12: Number and Impacts* of Recovered Bottom Placed Materials Proposed for Use During Training Activities In Five Years Under Alternatives 1 and 2

Recovered Materials	Size (ft.²)	Impact Footprint (ft.²)	Northeast		VACAPES		Navy Cherry Point		JAX		Key West		GOMEX		Other Training Locations NSWC Panama City	
			Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Mine Shape (Non-explosive)	25.7903	51.5807	0	0.0000	18,881	22.3576	4,060	4.8076	7,002	8.2913	63	0.0746	3,811	4.5127	1,220	1.4446
Metal Plates	2.7782	5.5563	0	0.0000	0	0.0000	0	0.0000	0	0.0000	25	0.0032	0	0.0000	0	0.0000
Bottom Placed Instruments	2.0000	4.0000	0	0.0000	480	0.0441	0	0.0000	240	0.0220	240	0.0220	480	0.0441	0	0.0000
Total			**0**	**0.0000**	**105,670**	**124.6027**	**24,990**	**29.5914**	**24,970**	**29.3055**	**295**	**0.0607**	**8,095**	**9.0612**	**14,640**	**17.3357**

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; ft.²=square feet; GOMEX= Gulf of Mexico; JAX=Jacksonville; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; VACAPES=Virginia Capes

Appendix F Military Expended Material and Direct Strike Impact Analysis

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-13: Number and Impacts* of Recovered Bottom Placed Materials Proposed for Use During Training Activities in Five Years Under Alternatives 1 and 2 – Inshore Waters

Location	Recovered Materials					
	Projectiles		*Targets*		*Other*	
	Metal Plates		*Mine Shapes (Non-Explosive)*		*I-Beam Demolition Structure*	
	Number	*Impact (Acre)*	*Number*	*Impact (Acre)*	*Number*	*Impact (Acre)*
Beaumont, TX	0	0.0000	24	0.0284	0	0.0000
Boston, MA	0	0.0000	12	0.0142	0	0.0000
Corpus Christi, TX	0	0.0000	12	0.0142	0	0.0000
Delaware Bay, DE	0	0.0000	12	0.0142	0	0.0000
Earle, NJ	0	0.0000	12	0.0142	0	0.0000
Hampton Roads, VA	0	0.0000	24	0.0284	0	0.0000
James River, VA	0	0.0000	425	0.5033	0	0.0000
Kings Bay, GA	0	0.0000	122	0.1445	0	0.0000
Lower Chesapeake Bay, VA	30	0.0038	1,503	1.7797	0	0.0000
Mayport, FL	0	0.0000	12	0.0142	0	0.0000
Morehead City, NC	0	0.0000	12	0.0142	0	0.0000
Port Canaveral, FL	0	0.0000	12	0.0142	0	0.0000
Savannah, GA	0	0.0000	12	0.0142	0	0.0000
Truman Harbor	0	0.0000	0	0.0000	210	0.0281
Demolition Key	0	0.0000	0	0.0000	210	0.0281
Tampa, FL	0	0.0000	12	0.0142	0	0.0000
Wilmington, DE	0	0.0000	12	0.0142	0	0.0000
York River, VA	0	0.0000	95	0.1125	0	0.0000

Note: * Calculation for "Impact (ac)" Column = ([Impact Footprint] x [Number]) / 43560; ac=acre

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Appendix F Military Expended Material and Direct Strike Impact Analysis

F.1.2   MILITARY EXPENDED AND RECOVERED MATERIALS – TESTING ACTIVITIES

Table F-14 through Table F-21 show military expended and recovered materials and impact footprints within the AFTT Study Area for both Single Year and Five Year totals.

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Table F-14: Number and Impacts* of Military Expended Materials Proposed for Use During Testing Activities in a Single Year Under Alternatives 1 and 2

Military Expended Materials	Size (ft.²)	Impact Footprint (ft.²)	Range Complex Northeast Number	Impact (Acre)	VACAPES Number	Impact (Acre)	Navy Cherry Point Number	Impact (Acre)	JAX Number	Impact (Acre)	Key West Number	Impact (Acre)	GOMEX Number	Impact (Acre)	Testing Ranges NUWC Newport Number	Impact (Acre)	SFOMF Number	Impact (Acre)	NSWC Panama City Number	Impact (Acre)
Bombs																				
Bombs (Explosive)	8.1203	112.9048	0	0.0000	4	0.0104	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Bombs (Non-Explosive)	8.1203	112.9048	0	0.0000	916	2.3742	0	0.0000	12	0.0311	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Projectiles																				
Small-Caliber (Non-Explosive)	0.0301	0.1216	4,800	0.0134	77,800	0.2172	4,800	0.0134	4,800	0.0134	4,800	0.0134	17,800	0.0497	0	0.0000	0	0.0000	7,000	0.0195
Medium-Caliber (Explosive)	0.056	0.2239	3,860	0.0198	17,270	0.0888	3,360	0.0173	14,860	0.0764	3,360	0.0173	3,360	0.0173	0	0.0000	0	0.0000	0	0.0000
Medium-Caliber (Non-Explosive)	0.056	0.2239	9,060	0.0466	234,665	1.2062	8,160	0.0419	237,360	1.2200	32,660	0.1679	22,860	0.1175	0	0.0000	0	0.0000	5,100	0.0262
Large-Caliber (Explosive)	1.0097	4.0386	1,632	0.1513	4,763	0.4416	1,632	0.1513	7,876	0.7302	2,332	0.2162	2,423	0.2246	0	0.0000	0	0.0000	100	0.0093
Large-Caliber (Non-Explosive)	1.0097	4.0386	1,761	0.1633	8,147	0.7553	1,440	0.1335	14,524	1.3466	3,190	0.2958	2,774	0.2572	0	0.0000	0	0.0000	280	0.0260
Kinetic Energy Round	0.5048	1.0100	33,503	0.7768	33,503	0.7768	33,503	0.7768	33,503	0.7768	33,503	0.7768	33,503	0.7768	4	0.0001	4	0.0001	4	0.0001
Missiles																				
Missiles (Explosive)	37.6691	74.7228	10	0.0172	222	0.3808	0	0.0000	70	0.1201	0	0.0000	12	0.0206	0	0.0000	0	0.0000	0	0.0000
Missiles (Non-Explosive)	14.1771464	28.3543	25	0.0163	1,663	1.0825	25	0.0163	594	0.3866	32	0.0208	42	0.0273	0	0.0000	0	0.0000	0	0.0000
Rockets (Explosive)	0.7987	1.5974	0	0.0000	206	0.0076	0	0.0000	200	0.0073	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Rockets (Non-Explosive)	0.7987	1.5974	1	0.0000	759	0.0278	0	0.0000	407	0.0149	0	0.0000	1	0.0000	0	0.0000	0	0.0000	0	0.0000
Rockets (Non-Explosive): Flechette	0.7987	1.5974	0	0.0000	249	0.0091	0	0.0000	136	0.0050	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Countermeasures																				
Acoustic Countermeasures	0.3311	1.2432	843	0.0241	1,163	0.0332	708	0.0202	1,508	0.0430	0	0.0000	697	0.0199	64	0.0018	17	0.0005	0	0.0000
Chaff - Air Cartridge	0.0011	0.0022	0	0.0000	20,595	0.0010	0	0.0000	400	0.0000	0	0.0000	1,200	0.0001	0	0.0000	0	0.0000	0	0.0000
Chaff - Ship Cartridge	2.0000	4.0000	144	0.0132	1,019	0.0936	144	0.0132	480	0.0441	144	0.0132	144	0.0132	0	0.0000	0	0.0000	0	0.0000
Anti-Torpedo Torpedo	4.524	9.0847	78	0.0163	96	0.0200	36	0.0075	104	0.0217	0	0.0000	72	0.0150	0	0.0000	0	0.0000	0	0.0000
Flares	1.2196	4.8782	0	0.0000	20,195	2.2616	0	0.0000	0	0.0000	0	0.0000	600	0.0672	0	0.0000	0	0.0000	0	0.0000
Targets																				
Air Targets (Decoy)	14.0216	28.0432	0	0.0000	5	0.0032	0	0.0000	2	0.0013	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Air Targets (Drone)	95.64	191.2	6	0.0263	200	0.8779	8	0.0351	62	0.2721	6	0.0263	16	0.0702	6	0.0263	6	0.0263	6	0.0263
Surface Target (Mobile)	5.7522	11.5034	1	0.0003	153	0.0404	0	0.0000	19	0.0050	2	0.0005	2	0.0005	450	0.1188	0	0.0000	0	0.0000
Surface Target (Stationary)	96.8752	193.7504	172	0.7650	832	3.7007	172	0.7650	545	2.4241	178	0.7917	248	1.1031	484	2.1528	56	0.2491	0	0.0000
Subsurface Target (Stationary)	5.7522	11.5034	2,228	0.5884	1,142	0.3016	81	0.0214	320	0.0845	32	0.0085	960	0.2535	374	0.0988	84	0.0222	0	0.0000
Mine Shape (Non-explosive)	25.7903	51.5807	0	0.0000	127	0.1504	0	0.0000	122	0.1445	0	0.0000	232	0.2747	0	0.0000	40	0.0474	370	0.4381
Other																				
Air-Launched Lightweight Torpedo (Explosive)	19.1199	38.2399	1	0.0009	1	0.0009	1	0.0009	1	0.0009	1	0.0009	1	0.0009	0	0.0000	0	0.0000	0	0.0000
Anchor - Other	3.1248	6.2495	685	0.0983	343	0.0492	0	0.0000	20	0.0029	0	0.0000	338	0.0485	70	0.0100	654	0.0938	0	0.0000
Expended Bathythermograph	0.2771	0.5554	21,104	0.2691	9,740	0.1242	277	0.0035	561	0.0072	10	0.0001	9,813	0.1251	0	0.0000	4	0.0001	0	0.0000
Buoy (Explosive)	0.97521	3.8987	736	0.0659	368	0.0329	152	0.0136	152	0.0136	202	0.0181	368	0.0329	0	0.0000	0	0.0000	0	0.0000
Canister-Miscellaneous	2.0000	4.0000	240	0.0220	240	0.0220	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Compression Pad or Plastic Piston	0.0043	0.0086	0	0.0000	20,195	0.0040	0	0.0000	0	0.0000	0	0.0000	600	0.0001	0	0.0000	0	0.0000	0	0.0000
Concrete Slugs	0.0011	0.0022	38	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	38	0.0000	0	0.0000	0	0.0000	0	0.0000
Endcaps and Pistons - Non Chaff and Flare	0.0043	0.0860	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	379	0.0007	0	0.0000	0	0.0000
Endcap - Chaff and Flare	0.0022	0.0043	0	0.0000	40,790	0.0040	0	0.0000	400	0.0000	0	0.0000	1,800	0.0002	0	0.0000	0	0.0000	0	0.0000
Flare O-Ring	0.0043	0.0086	0	0.0000	20,195	0.0040	0	0.0000	0	0.0000	0	0.0000	600	0.0001	0	0.0000	0	0.0000	0	0.0000
Heavyweight Torpedo (Explosive)	39.6155	79.2299	1	0.0018	1	0.0018	1	0.0018	1	0.0018	1	0.0018	1	0.0018	0	0.0000	0	0.0000	0	0.0000
Anti-torpedo torpedo Accessories	1.1011	2.0215	78	0.0036	96	0.0045	36	0.0017	104	0.0048	0	0.0000	72	0.0033	0	0.0000	0	0.0000	0	0.0000
Heavyweight Torpedo Accessories	1.1615	3.2367	98	0.0073	128	0.0095	42	0.0031	134	0.0100	2	0.0001	84	0.0062	20	0.0015	6	0.0004	0	0.0000
Lightweight Torpedo Accessories	1.1011	2.0215	54	0.0025	225	0.0104	50	0.0023	213	0.0099	2	0.0001	54	0.0025	20	0.0009	0	0.0000	192	0.0089
Sabot - Kinetic Energy Round	1.2196	4.8782	33,503	3.7519	33,503	3.7519	33,503	3.7519	33,503	3.7519	33,503	3.7519	33,503	3.7519	4	0.0004	4	0.0004	4	0.0004
Sonobuoy (Explosive)	1.2207	2.4413	0	0.0000	0	0.0000	0	0.0000	0	0.0000	36	0.0020	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Surface-Launched Lightweight Torpedo (Explosive)	10.0782	20.1576	5	0.0023	5	0.0023	1	0.0005	5	0.0023	1	0.0005	5	0.0023	0	0.0000	0	0.0000	12	0.0056
Decelerator/Parachute- Large	1,963.5000	3,926.9000	1	0.0901	14	1.2621	0	0.0000	1	0.0901	0	0.0000	1	0.0901	0	0.0000	0	0.0000	0	0.0000
JATO Bottles	3.6067	7.2134	1	0.0002	14	0.0023	0	0.0000	1	0.0002	0	0.0000	1	0.0002	0	0.0000	0	0.0000	0	0.0000
Total			**114,669**	**6.95**	**551,552**	**20.15**	**88,132**	**5.79**	**353,000**	**11.66**	**113,997**	**6.12**	**134,225**	**7.37**	**1,875**	**2.41**	**875**	**0.44**	**13,068**	**0.6**

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; ft.²=square feet; GOMEX=Gulf of Mexico; JAX=Jacksonville; NSWC Panama City=Naval Surface Warfare Center Panama City; NUWC Newport=Naval Undersea Warfare Center Newport; SFOMF=South Florida Ocean Measurement Facility; VACAPES=Virginia Capes

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-15: Number and Impacts* of Military Expended Materials Proposed for Use During Testing Activities in a Single Year with Differences between Alternatives 1 and 2

Military Expended Materials	Size (ft.²)	Impact Footprint (ft.²)	Northeast		VACAPES		Navy Cherry Point		JAX		Key West		GOMEX		NUWC Newport		SFOMF		NSWC Panama City	
			Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Alternative 1																				
Targets																				
Subsurface Target (Mobile)	**1.2206**	2.4415	54	0.0030	57	0.0032	7	0.0004	184	0.0103	3	0.0002	208	0.0117	516	0.0289	95	0.0053	0	0.0000
Other																				
Anchor - Mine	6.2495	12.5001	0	0.0000	2	0.0006	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	4	0.0011
Fiber Optic Can	0.0011	0.0022	0	0.0000	250	0.0000	0	0.0000	50	0.0000	0	0.0000	100	0.0000	0	0.0000	0	0.0000	328	0.0000
Buoy (Non-Explosive)	0.97521	3.8987	247	0.0221	217	0.0194	127	0.0114	218	0.0195	408	0.0365	127	0.0114	0	0.0000	0	0.0000	0	0.0000
Sonobuoys (Non-Explosive)	1.2207	2.4413	3,596	0.2015	5,505	0.3085	2,144	0.1202	5,847	0.3277	3,007	0.1685	2,027	0.1136	1,200	0.0673	32	0.0018	192	0.0108
ANMS Neutralizer (Explosive)	1.6286	3.2572	0	0.0000	250	0.0187	0	0.0000	50	0.0037	0	0.0000	100	0.0075	0	0.0000	0	0.0000	328	0.0245
Mines (Explosive)	25.7903	51.5807	0	0.0000	2	0.0024	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	4	0.0047
Decelerator/Parachute - Small	9.0417	18.0834	3,637	1.0040	5,711	2.3709	2,185	0.9071	6,037	2.5062	3,008	1.2487	2,068	0.8585	1,200	0.4982	32	0.0133	192	0.0797
Total			**7,534**	**1.2307**	**11,994**	**2.7236**	**4,463**	**1.0390**	**12,386**	**2.8674**	**6,426**	**1.4539**	**4,630**	**1.0026**	**2,916**	**0.5943**	**159**	**0.0204**	**1,048**	**0.1209**
Alternative 2																				
Targets																				
Subsurface Target (Mobile)	1.2206	2.4412	55	0.0031	58	0.0033	8	0.0004	184	0.0103	3	0.0002	208	0.0117	516	0.0289	95	0.0053	0	0.0000
Other																				
Anchor - Mine	6.2495	12.5001	0	0.0000	7	0.0020	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	9	0.0026
Fiber Optic Can	0.0011	0.0022	0	0.0000	255	0.0000	0	0.0000	50	0.0000	0	0.0000	100	0.0000	0	0.0000	0	0.0000	333	0.0000
Buoy (Non-Explosive)	0.97521	3.8987	262	0.0234	222	0.0199	132	0.0118	244	0.0218	408	0.0365	127	0.0114	0	0.0000	0	0.0000	0	0.0000
Sonobuoys (Non-Explosive)	1.2207	2.4413	3,715	0.2082	5,548	0.3109	2,187	0.1226	6,062	0.3397	3,007	0.1685	2,027	0.1136	1,200	0.0673	32	0.0018	192	0.0108
ANMS Neutralizer (Explosive)	1.6286	3.2572	0	0.0000	255	0.0191	0	0.0000	50	0.0037	0	0.0000	100	0.0075	0	0.0000	0	0.0000	333	0.0249
Mines (Explosive)	25.7903	51.5807	0	0.0000	7	0.0083	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	9	0.0107
Decelerator/Parachute - Small	9.0417	18.0834	3,756	1.5593	5,754	2.3887	2,228	0.9249	6,252	2.5954	3,008	1.2487	2,068	0.8585	1,200	0.1567	32	0.0042	192	0.0797
Total			**7,788**	**1.7940**	**12,106**	**2.7521**	**4,555**	**1.0598**	**12,842**	**2.9711**	**6,426**	**1.4539**	**4,630**	**1.0026**	**2,916**	**0.2529**	**159**	**0.0113**	**1,068**	**0.1286**

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; AMNS = Airborne Mine Neutralization System; ft.²=square feet; GOMEX=Gulf of Mexico; JAX=Jacksonville; NSWC Panama City=Naval Surface Warfare Center Panama City; NUWC Newport=Naval Undersea Warfare Center Newport; SFOMF=South Florida Ocean Measurement Facility; VACAPES=Virginia Capes

Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2.

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-16: Number and Impacts* of Military Expended Materials Proposed for Use During Testing Activities in Five Years Under Alternatives 1 and 2

Military Expended Materials	Size (ft.²)	Impact Footprint (ft.²)	Northeast Number	Northeast Impact (Acre)	VACAPES Number	VACAPES Impact (Acre)	Navy Cherry Point Number	Navy Cherry Point Impact (Acre)	JAX Number	JAX Impact (Acre)	Key West Number	Key West Impact (Acre)	GOMEX Number	GOMEX Impact (Acre)	NUWC Newport Number	NUWC Newport Impact (Acre)	SFOMF Number	SFOMF Impact (Acre)	NSWC Panama City Number	NSWC Panama City Impact (Acre)
Bombs																				
Bombs (Explosive)	8.1203	112.9048	0	0.0000	20	0.0518	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Bombs (Non-Explosive)	8.1203	112.9048	0	0.0000	4,580	11.8711	0	0.0000	60	0.1555	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Projectiles																				
Small-Caliber (Non-Explosive)	0.0301	0.1216	24,000	0.0670	389,000	1.0859	24,000	0.0670	24,000	0.0670	24,000	0.0670	89,000	0.2484	0	0.0000	0	0.0000	35,000	0.0977
Large-Caliber (Explosive)	1.0097	4.0386	8,160	0.7565	23,815	2.2080	8,160	0.7565	39,380	3.6511	11,660	1.0810	12,115	1.1232	0	0.0000	0	0.0000	500	0.0464
Large-Caliber (Non-Explosive)	1.0097	4.0386	8,805	0.8163	40,735	3.7767	7,200	0.6675	72,620	6.7329	15,950	1.4788	13,870	1.2859	0	0.0000	0	0.0000	1,400	0.1298
Kinetic Energy Round	0.5048	1.0100	167,504	3.8838	167,504	3.8838	167,504	3.8838	167,504	3.8838	167,504	3.8838	167,504	3.8838	4	0.0001	4	0.0001	4	0.0001
Countermeasures																				
Acoustic Countermeasures	0.3311	1.2432	4,018	0.1147	5,814	0.1659	3,540	0.1010	7,145	0.2039	0	0.0000	3,484	0.0994	320	0.0091	84	0.0024	0	0.0000
Chaff-Air Cartridges	0.0011	0.0022	0	0.0000	102,975	0.0052	0	0.0000	2,000	0.0001	0	0.0000	6,000	0.0003	0	0.0000	0	0.0000	0	0.0000
Chaff - Ship Cartridges	2.0000	4.0000	720	0.0661	4,955	0.4550	720	0.0661	2,400	0.2204	720	0.0661	720	0.0661	0	0.0000	0	0.0000	0	0.0000
Flares	1.2196	4.8782	0	0.0000	100,975	11.3080	0	0.0000	0	0.0000	0	0.0000	3,000	0.3360	0	0.0000	0	0.0000	0	0.0000
Targets																				
Air Targets (Decoy)	14.0216	28.0432	0	0.0000	22	0.0142	0	0.0000	6	0.0039	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Air Target (Drone)	95.64	191.2	6	0.0263	976	4.2840	8	0.0351	286	1.2554	6	0.0263	56	0.2458	6	0.0263	6	0.0263	6	0.0263
Other																				
Air-Launched Lightweight Torpedo (Explosive)	19.1199	38.2399	3	0.0026	3	0.0026	3	0.0026	3	0.0026	3	0.0026	3	0.0026	0	0.0000	0	0.0000	0	0.0000
Anchor - Other	3.1248	6.2495	3,425	0.4914	1,713	0.2458	0	0.0000	100	0.0143	0	0.0000	1,688	0.2422	350	0.0502	3,270	0.4691	0	0.0000
Buoy (Explosive)	0.97521	3.8987	3,680	0.3294	1,840	0.1647	760	0.0680	760	0.0680	1,010	0.0904	1,840	0.1647	0	0.0000	0	0.0000	0	0.0000
Canister - Miscellaneous	2.0000	4.0000	1,200	0.1102	1,200	0.1102	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Compression Pad or Plastic Piston	0.0043	0.0086	0	0.0000	100,975	0.0199	0	0.0000	0	0.0000	0	0.0000	3,000	0.0006	0	0.0000	0	0.0000	0	0.0000
Concrete Slugs	0.0011	0.0022	190	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	190	0.0000	0	0.0000	0	0.0000	0	0.0000
Endcap - Chaff and Flare	0.0022	0.0043	0	0.0000	203,950	0.0201	0	0.0000	2,000	0.0002	0	0.0000	9,000	0.0009	0	0.0000	0	0.0000	0	0.0000
End Caps and Pistons - Non Chaff and Flare	0.0043	0.0860	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	1,895	0.0037	0	0.0000	0	0.0000
Flare O-Ring	0.0043	0.0086	0	0.0000	100,975	0.0199	0	0.0000	0	0.0000	0	0.0000	3,000	0.0006	0	0.0000	0	0.0000	0	0.0000
Heavyweight Torpedo (Explosive)	39.6155	79.2299	4	0.0073	4	0.0073	4	0.0073	4	0.0073	4	0.0073	4	0.0073	0	0.0000	0	0.0000	0	0.0000
Sabot - Kinetic Energy Round	1.2196	4.8782	167,054	18.7081	167,054	18.7081	167,054	18.7081	167,054	18.7081	167,054	18.7081	167,054	18.7081	4	0.0004	4	0.0004	4	0.0004
Sonobuoy (Explosive)	1.2207	2.4413	0	0.0000	0	0.0000	0	0.0000	0	0.0000	180	0.0101	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Surface-Launched Lightweight Torpedo (Explosive)	10.0782	20.1576	22	0.0102	22	0.0102	2	0.0009	22	0.0102	2	0.0009	22	0.0102	0	0.0000	0	0.0000	60	0.0278
Decelerator/Parachute - Large	1,963	3,926	5	0.4507	70	6.3104	0	0.0000	5	0.4507	0	0.0000	5	0.4507	0	0.0000	0	0.0000	0	0.0000
JATO Bottles	3.6067	7.2134	5	0.0008	70	0.0116	0	0.0000	5	0.0008	0	0.0000	5	0.0008	0	0.0000	0	0.0000	0	0.0000
Total			**388,801**	**25.8415**	**1,419,247**	**64.7404**	**378,955**	**24.3641**	**485,354**	**35.4361**	**388,093**	**25.4225**	**481,560**	**26.8777**	**2,579**	**0.0900**	**3,368**	**0.4984**	**36,974**	**0.3285**

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; ft.²=square feet; GOMEX=Gulf of Mexico; JAX=Jacksonville; NSWC Panama City=Naval Surface Warfare Center Panama City; NUWC Newport=Naval Undersea Warfare Center Newport; SFOMF=South Florida Ocean Measurement Facility; VACAPES=Virginia Capes

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Table F-17: Number and Impacts* of Military Expended Materials Proposed for Use During Testing Activities in a Five Years with Differences between Alternatives 1 and 2

Military Expended Materials	Size (ft.²)	Impact Footprint (ft.²)	Northeast Number	Northeast Impact (Acre)	VACAPES Number	VACAPES Impact (Acre)	Navy Cherry Point Number	Navy Cherry Point Impact (Acre)	JAX Number	JAX Impact (Acre)	Key West Number	Key West Impact (Acre)	GOMEX Number	GOMEX Impact (Acre)	NUWC Newport Number	NUWC Newport Impact (Acre)	SFOMF Number	SFOMF Impact (Acre)	NSWC Panama City Number	NSWC Panama City Impact (Acre)
Alternative 1																				
Other																				
Medium-Caliber (Explosive)	0.056	0.2239	19,300	0.0992	80,350	0.4130	16,800	0.0864	62,300	0.3202	16,800	0.0864	16,800	0.0864	0	0.0000	0	0.0000	0	0.0000
Medium Caliber (Non-Explosive)	0.056	0.2239	45,300	0.2328	1,155,325	5.9384	40,800	0.2097	1,150,800	5.9152	163,300	0.8394	114,300	0.5875	0	0.0000	0	0.0000	25,500	0.1311
Missiles (Explosive)	37.6691	74.7228	50	0.0858	1,033	1.7720	0	0.0000	327	0.5609	0	0.0000	30	0.0515	0	0.0000	0	0.0000	0	0.0000
Missiles (Non-Explosive)	14.1771	28.3543	122	0.0794	3,962	2.5790	122	0.0794	814	0.5299	157	0.1022	207	0.1347	0	0.0000	0	0.0000	0	0.0000
Rockets (Explosive)	0.7987	1.5974	0	0.0000	900	0.0330	0	0.0000	800	0.0293	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Rockets (Non-Explosive)	0.7987	1.5974	5	0.0002	3,713	0.1362	0	0.0000	1,950	0.0715	0	0.0000	5	0.0002	0	0.0000	0	0.0000	0	0.0000
Rockets (Non-Explosive): Flechette	0.7987	1.5974	0	0.0000	1,215	0.0446	0	0.0000	648	0.0238	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Targets																				
Surface Target (Mobile)	5.7522	11.5034	5	0.0013	763	0.2015	0	0.0000	96	0.0254	11	0.0029	11	0.0029	2,250	0.5942	0	0.0000	0	0.0000
Surface Target (Stationary)	96.8752	193.7504	858	3.8163	4,015	17.8583	858	3.8163	2,576	11.4578	890	3.9586	1,212	5.3909	2,421	10.7684	282	1.2543	0	0.0000
Subsurface Target (Mobile)	1.2206	2.4413	198	0.0111	237	0.0133	32	0.0018	867	0.0486	15	0.0008	983	0.0551	2,581	0.1447	0	0.0000	0	0.0000
Mine Shapes -Expended	25.7903	51.5807	0	0.0000	536	0.6347	0	0.0000	610	0.7223	0	0.0000	1,158	1.3712	0	0.0000	200	0.2368	1,815	2.1492
Countermeasures																				
Anti-Torpedo Torpedo	4.524	9.0847	330	0.0688	432	0.0901	180	0.0375	448	0.0934	0	0.0000	312	0.0651	0	0.0000	0	0.0000	0	0.0000
Other																				
ANMS Neutralizer (Explosive)	1.6286	3.2572	0	0.0000	1,090	0.0815	0	0.0000	250	0.0187	0	0.0000	500	0.0374	0	0.0000	0	0.0000	1,584	0.1184
Anchor - Mine	6.2495	12.5001	0	0.0000	10	0.0029	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	20	0.0057
Expended Bathythermograph	0.2771	0.5554	105,516	1.3454	48,667	0.6205	1,385	0.0177	2,775	0.0354	50	0.0006	49,063	0.6256	0	0.0000	20	0.0003	0	0.0000
Buoy (Non-Explosive)	0.97521	3.8987	1,077	0.0964	1,082	0.0968	617	0.0552	1,052	0.0942	2,007	0.1796	557	0.0499	0	0.0000	0	0.0000	0	0.0000
Fiber Optic Can	0.0011	0.0022	0	0.0000	1,090	0.0001	0	0.0000	250	0.0000	0	0.0000	500	0.0000	0	0.0000	0	0.0000	1,584	0.0001
Anti-Torpedo Torpedo Accessories	1.1011	2.0215	330	0.0153	432	0.0200	180	0.0084	448	0.0208	0	0.0000	312	0.0145	0	0.0000	0	0.0000	0	0.0000
Heavyweight Torpedo Accessories	0.1615	3.2367	421	0.0313	591	0.0439	210	0.0156	579	0.0430	10	0.0007	371	0.0276	100	0.0074	29	0.0022	0	0.0000
Lightweight Torpedo Accessories	1.1011	2.0215	267	0.0124	867	0.0402	247	0.0115	981	0.0455	7	0.0003	267	0.0124	100	0.0046	0	0.0000	960	0.0446
Sonobuoys (Non-Explosive)	1.2207	2.4413	15,911	0.8917	24,329	1.3635	10,606	0.5944	27,845	1.5606	14,807	0.8299	9,550	0.5352	6,000	0.3363	160	0.0090	960	0.0538
Mines (Explosive)	25.7903	51.5807	0	0.0000	10	0.0118	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	20	0.0237
Decelerator/Parachute - Small	9.0417	18.0834	16,116	6.6904	25,180	10.4532	10,811	4.4881	28,718	11.9219	14,812	6.1490	9,755	4.0497	6,000	2.4908	160	0.0664	960	0.3985
Total			**1,355,829**	**42.4485**	**82,848**	**9.4219**	**1,285,134**	**33.5383**	**212,866**	**12.1505**	**205,893**	**13.0975**	**19,452**	**14.3464**	**851**	**1.5689**	**33,403**	**2.9251**	**1,355,829**	**42.4485**
Alternative 2																				
Projectiles																				
Medium-Caliber (Explosive)	0.056	0.2239	19,300	0.0992	86,350	0.4438	16,800	0.0864	74,300	0.3819	16,800	0.0864	16,800	0.0864	0	0.0000	0	0.0000	0	0.0000
Medium Caliber (Non-Explosive)	0.056	0.2239	45,300	0.2328	1,173,325	6.0309	40,800	0.2097	1,186,800	6.1002	163,300	0.8394	114,300	0.5875	0	0.0000	0	0.0000	25,500	0.1311
Missiles (Explosive)	37.6691	74.7228	50	0.0858	1,110	1.9041	0	0.0000	350	0.6004	0	0.0000	60	0.1029	0	0.0000	0	0.0000	0	0.0000
Missiles (Non-Explosive)	14.1771	28.3543	122	0.0794	3,994	2.5998	122	0.0794	822	0.5351	157	0.1022	207	0.1347	0	0.0000	0	0.0000	0	0.0000
Rockets (Explosive)	0.7987	1.5974	0	0.0000	1,030	0.0378	0	0.0000	1,000	0.0367	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000
Rockets (Non-Explosive)	0.7987	1.5974	5	0.0002	3,797	0.1392	0	0.0000	2,034	0.0746	0	0.0000	5	0.0002	0	0.0000	0	0.0000	0	0.0000
Rockets (Non-Explosive): Flechette	0.7987	1.5974	0	0.0000	1,243	0.0456	0	0.0000	676	0.0248	0	0.0000	0	0.0000	0	0.0000	0	0.0000		0.0000
Targets																				
Surface Target (Mobile)	5.7522	11.5034	5	0.0013	764	0.2018	0	0.0000	97	0.0256	11	0.0029	11	0.0029	2,250	0.5942	0	0.0000	0	0.0000
Surface Target (Stationary)	96.8752	193.7504	858	3.8163	4,160	18.5033	858	3.8163	2,727	12.1294	890	3.9586	1,242	5.5243	2,421	10.7684	282	1.2543	0	0.0000
Subsurface Target (Mobile)	1.2206	2.4413	272	0.0152	290	0.0163	40	0.0022	917	0.0514	15	0.0008	1,040	0.0583	2,581	0.1447	0	0.0000	0	0.0000
Mine Shapes -Expended	25.7903	51.5807	0	0.0000	636	0.7531	0	0.0000	610	0.7223	0	0.0000	1,158	1.3712	0	0.0000	200	0.2368	1,850	2.1906

Appendix F Military Expended Material and Direct Strike Impact Analysis

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-17: Number and Impacts* of Military Expended Materials Proposed for Use During Testing Activities in a Five Years with Differences between Alternatives 1 and 2 (continued)

| Military Expended Materials | Size (ft.²) | Impact Footprint (ft.²) | Range Complex | | | | | | | | | | | | Testing Ranges | | | | | |
| | | | Northeast | | VACAPES | | Navy Cherry Point | | JAX | | Key West | | GOMEX | | NUWC Newport | | SFOMF | | NSWC Panama City | |
			Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Countermeasures																				
Anti-Torpedo Torpedo	4.524	9.0847	378	0.0788	480	0.1001	180	0.0375	496	0.1034	0	0.0000	360	0.0751	0	0.0000	0	0.0000	0	0.0000
Other																				
ANMS Neutralizer (Explosive)	1.6286	3.2572	0	0.0000	1,275	0.0953	0	0.0000	250	0.0187	0	0.0000	500	0.0374	0	0.0000	0	0.0000	1,665	0.1245
Anchor - Mine	6.2495	12.5001	0	0.0000	35	0.0100	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	45	0.0129
Expended Bathythermograph	0.2771	0.5554	105,516	1.3454	48,697	0.6209	1,385	0.0000	2,805	0.0358	50	0.0006	49,063	0.6256	0	0.0000	20	0.0003	0	0.0000
Buoy (Non-Explosive)	0.97521	3.8987	1,287	0.1152	1,107	0.0991	656	0.0000	1,177	0.1053	2,037	0.1823	632	0.0566	0	0.0000	0	0.0000	0	0.0000
Fiber Optic Can	0.0011	0.0022	0	0.0000	1,275	0.0001	0	0.0000	250	0.0000	0	0.0000	500	0.0000	0	0.0000	0	0.0000	1,665	0.0001
Anti-Torpedo Torpedo Accessories	1.1011	2.0215	378	0.0175	480	0.0223	180	0.0000	496	0.0230	0	0.0000	360	0.0167	0	0.0000	0	0.0000	0	0.0000
Heavyweight Torpedo Accessories	0.1615	3.2367	469	0.0348	639	0.0475	210	0.0156	627	0.0466	10	0.0007	419	0.0311	100	0.0074	29	0.0022	0	0.0000
Lightweight Torpedo Accessories	1.1011	2.0215	267	0.0124	1,110	0.0515	247	0.0000	981	0.0455	7	0.0003	267	0.0124	100	0.0046	0	0.0000	960	0.0446
Sonobuoys (Non-Explosive)	1.2207	2.4413	18,375	1.0298	27,740	1.5547	10,935	0.0000	29,910	1.6763	15,035	0.8426	10,135	0.5680	6,000	0.3363	160	0.0090	960	0.0538
Mines (Explosive)	25.7903	51.5807	0	0.0000	35	0.0414	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	45	0.0533
Decelerator/Parachute - Small	9.0417	18.0834	18,580	7.7133	28,762	11.9402	11,140	0.0000	30,852	12.8078	15,310	6.3558	10,340	4.2925	6,000	2.4908	160	0.0664	960	0.3985
Total			211,162	14.6775	1,388,334	45.2587	83,553	4.2472	1,338,177	35.5449	213,622	12.3727	207,399	13.5838	19,452	14.3464	851	1.5689	33,650	3.0094

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; AMNS = Airborne Mine Neutralization System; ft.²=square feet; GOMEX=Gulf of Mexico; JAX=Jacksonville; NSWC Panama City=Naval Surface Warfare Center Panama City; NUWC Newport=Naval Undersea Warfare Center Newport; SFOMF=South Florida Ocean Measurement Facility; VACAPES=Virginia Capes

Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2.

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-18: Number of Recovered Materials Proposed for Use During Testing Activities in a Single Year Under Alternatives 1 and 2

	Range Complexes						Testing Ranges		
	Northeast	VACAPES	Navy Cherry Point	JAX	Key West	GOMEX	NUWC Newport	SFOMF	NSWC Panama City
Recovered Materials	Number	Number	Number	Number	Number	Number	Number	Number	Number
Other									
Air-Launched Lightweight Torpedo (Non-Explosive)	33	198	33	174	1	33	0	0	0
Heavyweight Torpedo (Non-Explosive)	97	127	42	133	1	83	125	6	0
Surface-Launched Lightweight Torpedo (Non-Explosive)	17	50	45	63	1	17	190	0	180
Targets									
Air Targets (Decoy)	0	26	0	0	0	0	0	0	0
Air Targets (Drone)	134	324	144	152	129	138	1,008	33	33
Surface Targets (Mobile)	314	562	306	481	325	325	462	12	12
Surface Targets (Stationary)	37	223	37	95	38	98	520	81	36
Subsurface Target (Mobile)	29	35	4	300	0	168	516	95	0
Subsurface Target (Mobile)	12,480	6,240	3,120	9,427	0	3,220	344	84	0
Total	**13,141**	**7,785**	**3,731**	**10,825**	**495**	**4,082**	**3,165**	**311**	**261**

Note: AMNS/EMNS = Airborne Mine Neutralization System/Expendable Mine Neutralization System; GOMEX=Gulf of Mexico; JAX=Jacksonville; NSWC Panama City=Naval Surface Warfare Center Panama City; NUWC Newport=Naval Undersea Warfare Center Newport;
SFOMF=South Florida Ocean Measurement Facility; VACAPES=Virginia Capes

Table F-19: Number and Impacts* of Recovered Bottom Placed Materials Proposed for Use During Testing Activities in a Single Year Under Alternatives 1 and 2

			Range Complexes												Testing Ranges					
			Northeast		VACAPES		Navy Cherry Point		JAX		Key West		GOMEX		NUWC Newport		SFOMF		NSWC Panama City	
Recovered Materials	Size (ft.²)	Impact Footprint (ft.²)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Anchor -Other	3.1248	6.2495	3,600	0.5165	1,800	0.2582	0	0.0000	100	0.0143	0	0.0000	1,916	0.2749	170	0.0244	15	0.0022	0	0.0000
Bottom Placed Instruments	2.0000	4.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	600	0.0551	0	0.0000	0	0.0000
Mine Shape (Non-explosive)	25.7903	51.5807	0	0.0000	1,148	1.3594	1,200	1.4210	22,271	26.3718	0	0.0000	1,633	1.9337	1,167	1.3819	845	1.0006	31,686	37.5203
Total			**3,600**	**0.5165**	**2,948**	**1.6176**	**1,200**	**1.4210**	**22,371**	**26.3861**	**0**	**0.0000**	**3,549**	**2.2086**	**1,937**	**1.4614**	**860**	**1.0027**	**31,686**	**37.5203**

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; ft.²=square feet; GOMEX=Gulf of Mexico; JAX=Jacksonville; NSWC Panama City=Naval Surface Warfare Center Panama City; NUWC Newport=Naval Undersea Warfare Center Newport; SFOMF=South Florida Ocean Measurement Facility; VACAPES=Virginia Capes

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Appendix F Military Expended Material and Direct Strike Impact Analysis

Table F-20: Number of Recovered Materials Proposed for Use During Testing Activities in Five Years Under Alternatives 1 and 2

| | | Range Complexes | | | | | | Testing Ranges | | |
| | | Northeast | VACAPES | Navy Cherry Point | JAX | Key West | GOMEX | NUWC Newport | SFOMF | NSWC Panama City |
Recovered Materials		Number	Number	Number	Number	Number	Number	Number	Number	Number
Other										
Air-Launched Lightweight Torpedo (Non-Explosive)	Alternative 1	163	737	163	791	3	163	0	0	0
	Alternative 2		980		860					
Heavyweight Torpedo (Non-Explosive)	Alternative 1	416	586	206	575	6	366	625	29	0
	Alternative 2	464	634		623		414			
Surface-Launched Lightweight Torpedo (Non-Explosive)		82	248	222	307	2	82	950	0	900
Targets										
Air Target (Decoy)		0	132	0	0	0	0	0	0	0
Air Target (Drone)		614	1,565	669	707	590	638	4,988	113	113
Surface Target (Mobile)	Alternative 1	1,549	2,790	1,509	2,375	1,603	1,603	2,289	39	39
	Alternative 2				2,382					
Surface Target (Stationary)		131	583	131	424	134	437	2,545	350	124
Subsurface Target (Mobile)	Alternative 1	145	175	20	1,495	0	838	2,581	475	0
	Alternative 2				1,497					
Subsurface Target (Stationary)		62,400	31,200	15,600	47,133	0	16,102	1,718	419	0
Total	**Alternative 1**	**65,500**	**38,016**	**18,520**	**53,500**	**2,338**	**20,229**	**15,696**	**1,425**	**1,176**
	Alternative 2	**65,548**	**38,307**		**53,933**		**20,277**			

Note: AMNS=Airborne Mine Neutralization System; GOMEX=Gulf of Mexico; JAX=Jacksonville; NSWC Panama City=Naval Surface Warfare Center Panama City; NUWC Newport=Naval Undersea Warfare Center Newport; SFOMF=South Florida Ocean Measurement Facility; VACAPES=Virginia Capes

Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2.

Table F-21: Number and Impacts* of Recovered Bottom Placed Materials Proposed for Use During Testing Activities in Five Years as Part of Alternatives 1 and 2

| | | | | Range Complexes | | | | | | | | | | | | Testing Ranges | | | | | |
| | | | | Northeast | | VACAPES | | Navy Cherry Point | | JAX | | Key West | | GOMEX | | NUWC Newport | | SFOMF | | NSWC Panama City | |
Recovered Materials		Size (ft.²)	Impact Footprint (ft.²)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Anchor -Other		3.1248	6.2495	18,000	2.5824	9,000	1.2912	0	0.0000	501	0.0719	0	0.0000	9,576	1.3739	851	0.1221	75	0.0108	0	0.0000
Bottom Placed Instruments		2.0000	4.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	3,000	0.2755	0	0.0000	0	0.0000
Mine Shape (Non-explosive)	Alternative 1	25.7903	51.5807	0	0.0000	5,151	6.0995	6,000	7.1048	83,994	99.4598	0	0.0000	8,164	9.6672	5,354	6.3398	4,223	5.0006	115,389	136.6356
	Alternative 2					5,739	6.7957													115,878	137.2146
Total	**Alternative 1**			**18,000**	**2.5824**	**14,151**	**7.3907**	**6,000**	**7.1048**	**84,495**	**99.5317**	**0**	**0.0000**	**17,740**	**11.0411**	**9,205**	**6.7374**	**4,298**	**5.0113**	**115,389**	**136.6356**
	Alternative 2					**14,739**	**8.0869**													**115,878**	**137.2146**

Note: * Calculation for "Impact (Acre)" Column = ([Impact Footprint] x [Number]) / 43560

ac=acre; ft.²=square feet; GOMEX=Gulf of Mexico; JAX=Jacksonville; NSWC Panama City=Naval Surface Warfare Center Panama City; NUWC Newport=Naval Undersea Warfare Center Newport; SFOMF=South Florida Ocean Measurement Facility; VACAPES=Virginia Capes

Blue shading indicatesnumbers and impacts of MEM that differ between Alternatives 1 and 2.

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Appendix F Military Expended Material and Direct Strike Impact Analysis

F.2 IMPACTS TO ABIOTIC SUBSTRATE – TRAINING AND TESTING ACTIVITIES

Table F-22 through Table F-34 show impacts to abiotic substrate within the AFTT Study Area for both Single Year and Five Year totals.

Table F-22: Potential Impact from Explosives On or Near the Bottom for Training Activities Under Alternative 1 and 2 in a Single Year

Training Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (Acre)	Hard Substrate		Intermediate Substrate		Soft substrate		Unknown substrate	
				Acre	% Impact	Acre	% Impact	Acre	% Impact	Acre	% Impact
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone											
VACAPES RC	5	8	0.0534	559,734	0.000010	1,874,186	0.000003	22,262,693	0.000000	N/A	
	10	224	2.3524		0.000420		0.000126		0.000011		
	20	288	4.8037		0.000858		0.000256		0.000022		
	60	4	0.1389		0.000025		0.000007		0.000001		
	AMNS Neutralizer	62	0.3064		0.000055		0.000016		0.000001		
		Total	*7.6548*		*0.001382*		*0.001368*		*0.0004084*		
Northeast U.S. Continental Shelf Large Marine Ecosystem											
Lower Chesapeake Bay	5	12	0.0801	0	0	2,134	0.003752	362,740	0.000022	445	0.0179910
		Total	*0.0801*		*0*		*0.003752*		*0.000022*		*0.0179910*
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem											
Navy Cherry Point RC	5	4	0.0267	1,081,358	0.000002	214,657	0.0000124	14,611,417	0.0000002	N/A	
	20	12	0.0667		0.000006		0.0000311		0.0000005		
	AMNS Neutralizer	1	0.0049		0.000000		0.0000023		0.0000000		
		Total	*0.098270*		*0.000009*		*0.0000458*		*0.0000007*		
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone											
JAX RC	0.5	2	0.0030	9,306,697	0.0000000	6,530,477	0.0000000	26,485,602	0.0000000	0.083623	3.5456443
	5	4	0.0267		0.0000003		0.0000004		0.0000001		31.928736
	10	8	0.0840		0.0000009		0.0000013		0.0000003		100.44995
	20	8	0.1334		0.0000014		0.0000020		0.0000005		159.52409
	AMNS Neutralizer	2	0.0099		0.0000001		0.0000002		0.0000000		11.819611
		Total	*0.256949*		*0.0000028*		*0.0000039*		*0.0000010*		*307.268044*

Table F-22: Potential Impact from Explosives On or Near the Bottom for Training Activities Under Alternative 1 and 2 in a Single Year (continued)

Training Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (Acre)	Hard Substrate		Intermediate Substrate		Soft substrate		Unknown substrate	
				Acre	% Impact	Acre	% Impact	Acre	% Impact	Acre	% Impact
Caribbean and Gulf of Mexico Large Marine Ecosystem											
Key West RC	5	14	0.0934	4,493,152	0.0000021	1,472,965	0.0000063	14,163,039	0.0000007	1,324,082	0.0000071
	10	4	0.0420		0.0000009		0.0000029		0.0000003		0.0000032
	20	4	0.0667		0.0000015		0.0000045		0.0000005		0.0000050
		Total	**0.202100**		**0.0000045**		**0.0000137**		**0.0000014**		**0.0000153**
Gulf of Mexico Large Marine Ecosystem											
GOMEX RC	0.5	2	0.0030	2,955,100	0.0000001	3,418,643	0.0000001	56,370,160	0.0000000	971	0.0003054
	5	4	0.0267		0.0000009		0.0000008		0.0000000		0.0027497
	10	4	0.0420		0.0000014		0.0000012		0.0000001		0.0043254
	20	8	0.1334		0.0000045		0.0000039		0.0000002		0.0137384
	AMNS Neutralizer	22	0.1087		0.0000037		0.0000032		0.0000002		0.0111977
		Total	**0.313795**		**0.0000106**		**0.0000092**		**0.0000006**		**0.0111977**

Note: ac=acre; AMNS=Airborne Mine Neutralization System; GOMEX=Gulf of Mexico; JAX=Jacksonville; lb.=pounds; RC=Range Complex; VACAPES=Virginia Capes

Table F-23: Potential Impact from Explosives On or Near the Bottom for Testing Activities Under Alternative 1 in a Single Year

Training Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (Acre)	Hard Substrate		Intermediate Substrate		Soft substrate		Unknown substrate	
				Acre	% Impact	Acre	% Impact	Acre	% Impact	Acre	% Impact
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone											
VACAPES RC	650	2	0.3398	559,734	0.0000607	1,874,186	0.0000181	22,262,693	0.0000015	N/A	
	AMNS Neutralizer	250	1.2355		0.0002207		0.0000659		0.0000055		
		Total	1.5753		0.0002814		0.0000841		0.0000071		
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone											
JAX RC	AMNS Neutralizer	50	0.2471	9,306,697	0.0000027	6,530,477	0.0000038	26,485,602	0.0000009	0.08362373	295.49626
		Total	0.2471		0.0000027		0.0000038		0.0000009		295.4962664
Gulf Of Mexico Large Marine Ecosystem											
GOMEX RC	AMNS Neutralizer	100	0.4942	2,955,100	0.0000167	3,418,643	0.0000145	56,370,160	0.0000009	971	0.0508971
		Total	0.4942		0.0000167		0.0000145		0.0000009		0.0508971
NSWC Panama City Testing Range	650	4	0.6795	1,260,458	0.0000539	2,368,180	0.0000287	15,776,970	0.0000043	224	0.3033661
	AMNS Neutralizer	328	1.6201		0.0001285		0.0000684		0.0000103		0.7232594
	Line Charge	4	4.2739		0.0003391		0.00018047		0.0000271		1.9080063
		Total	6.5736		0.0005215		0.0002776		0.0000417		2.6312656

Note: ac=acre; AMNS=Airborne Mine Neutralization System; GOMEX=Gulf of Mexico; JAX=Jacksonville; lb.=pounds; NSWC Panama City=Naval Surface Warfare Center Panama City; RC=Range Complex; VACAPES=Virginia Capes

Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

Table F-24: Potential Impact from Explosives On or Near the Bottom for Testing Activities Under Alternative 2 in a Single Year

Training Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (Acre)	Hard Substrate		Intermediate Substrate		Soft substrate		Unknown Substrate	
				Acre	% Impact	Acre	% Impact	Acre	% Impact	Acre	% Impact
Northeast U.S. Continental Shelf Large Marine Ecosystem											
VACAPES RC	650	7	1.1892	559,734	0.0002125	1,874,186	0.0001635	21,573,934	0.0000055	N/A	
	AMNS Neutralizer	255	1.2602		0.0002251		0.0000672		0.0000058		
		Total	2.4494		0.0004376		0.0001307		0.0000114		
Southeast U.S. Continental Shelf Large Marine Ecosystem											
JAX RC	AMNS Neutralizer	50	0.2471	9,306,697	0.0000027	6,530,477	0.0000038	26,485,602	0.0000009	0.08362373	295.4967
		Total	0.2471		0.0000027		0.0000038		0.0000009		295.4967
Gulf Of Mexico Large Marine Ecosystem											
GOEMX RC	AMNS Neutralizer	100	0.4942	2,955,100	0.0000167	3,418,643	0.0000145	56,370,160	0.0000009	971	0.0508971
		Total	0.4942		0.0001087		0.0000145		0.0000009		0.0508971
NSWC Panama City Testing Range	650	9	1.5290	1,260,458	0.0001213	2,368,180	0.0000646	15,776,970	0.0000097	224	0.6825732
	AMNS Neutralizer	333	1.6457		0.0001306		0.0000695		0.0000104		0.7346875
	Line Charge	4	4.2739		0.0003391		0.0001805		0.0000271		1.9079911
		Total	13.8733		0.0005909		0.0003145		0.0000472		3.3252518

Note: ac=acre; AMNS=Airborne Mine Neutralization System; GOMEX=Gulf of Mexico; JAX=Jacksonville; lb.=pounds; NSWC Panama City=Naval Surface Warfare
   Center Panama City; RC=Range Complex; VACAPES=Virginia Capes
   Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

Table F-25: Potential Impact from Explosives On or Near the Bottom for Training Activities under Alternatives 1 and 2 Over Five Years

Training Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (Acre)	Hard Substrate		Intermediate Substrate		Soft substrate		Unknown Substrate	
				Acre	% Impact	Acre	% Impact	Acre	% Impact	Acre	% Impact
Alternative 1											
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone											
VACAPES RC	5	40	0.2669	559,734	0.0000477	1,874,186	0.0000142	22,262,693	0.0000012	N/A	
	10	1,120	11.7622		0.0021014		0.0006276		0.0000528		
	20	1,440	24.0186		0.0042911		0.0012815		0.0001079		
	60	20	0.6944		0.0001241		0.0000371		0.0000031		
	AMNS Neutralizer	306	1.5123		0.0002702		0.0000807		0.0000068		
		Total	38.2544		0.0068344		0.0020411		0.0001718		
Northeast U.S. Continental Shelf Large Marine Ecosystem											
Lower Chesapeake Bay	5	60	0.4003	0	0	2,134	0.0187582	362,740	0.0001104	445	0.0899551
		Total	0.4003		0		0.0187582		0.0001104		0.0899551
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem											
Navy Cherry Point RC	5	20	0.1334	1,081,358	0.000012	214,657	0.0000621	14,611,417	0.0000009	N/A	
	20	60	1.0008		0.000093		0.0004662		0.0000068		
	AMNS Neutralizer	5	0.0247		0.000002		0.0000115		0.0000002		
		Total	1.235500		0.000107		0.0005399		0.0000079		
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone											
JAX RC	0.5	6	0.0089	9,306,697	0.0000001	6,530,477	0.0000001	26,485,602	0.0000000	0.0836237	10.6429120
	5	20	0.1334		0.0000014		0.0000020		0.0000005		159.5240968
	10	40	0.4201		0.0000045		0.0000064		0.0000016		502.3693633
	20	40	1.0008		0.0000072		0.0000102		0.0000025		797.8596506
	AMNS Neutralizer	6	0.0297		0.0000003		0.0000005		0.0000001		35.5162344
		Total	1.459500		0.0000135		0.0000193		0.0000048		1,505.9122

Table F-25: Potential Impact from Explosives On or Near the Bottom for Training Activities under Alternatives 1 and 2 Over Five Years (continued)

Training Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (Acre)	Hard Substrate		Intermediate Substrate		Soft substrate		Unknown Substrate	
				Acre	% Impact	Acre	% Impact	Acre	% Impact	Acre	% Impact
Caribbean and Gulf of Mexico Large Marine Ecosystem											
Key West RC	5	70	0.4671	4,493,152	0.0000104	1,472,965	0.0000317	14,163,039	0.0000033	1,324,082	0.0000353
	10	20	0.2100		0.0000047		0.0000143		0.0000015		0.0000159
	20	20	0.3360		0.0000075		0.0000228		0.0000024		0.0000254
	Total		*1.013100*		*0.0000225*		*0.0000688*		*0.0000072*		*0.0000765*
Gulf of Mexico Large Marine Ecosystem											
GOMEX RC	0.5	6	0.0089	2,955,100	0.0000003	3,418,643	0.0000003	56,370,160	0.0000000	971	*0.1595572*
	5	20	0.1334		0.0000045		0.0000039		0.0000002		*0.1595572*
	10	20	0.2100		0.0000071		0.0000061		0.0000004		*0.1595572*
	20	40	0.6672		0.0000226		0.0000195		0.0000012		*0.1595572*
	AMNS Neutralizer	106	0.5239		0.0000177		0.0000153		0.0000009		*0.1595572*
	Total		*1.543400*		*0.000052*		*0.0000451*		*0.0000027*		*0.1595572*
Alternative 2											
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone											
VACAPES RC	5	40	0.2669%	559,734	0.0000477	1,874,186	0.0000142	22,262,693	0.0000012	N/A	
	10	1,120	11.7622		0.0021014		0.0006276		0.0000528		
	20	1,440	24.0186		0.0042911		0.0012815		0.0001079		
	60	20	0.6944		0.0001241		0.0000371		0.0000031		
	AMNS Neutralizer	306	1.5123		0.0002702		0.0000807		0.0000068		
	Total		*38.2544*		*0.0068344*		*0.0020411*		*0.0001718*		
Northeast U.S. Continental Shelf Large Marine Ecosystem											
Lower Chesapeake Bay	5	60	0.4003	0	0	2,134	0.0187582	362,740	0.0001104	445	0.0899551
	Total		*0.4003*		*0*		*0.0187582*		*0.0001104*		*0.0899551*

Table F-25: Potential Impact from Explosives On or Near the Bottom for Training Activities under Alternatives 1 and 2 Over Five Years (continued)

Training Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (ac)	Hard Substrate		Intermediate Substrate		Soft substrate		Unknown Substrate	
				Acre	% Impact	Acre	% Impact	Acre	% Impact	Acre	% Impact
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem											
Navy Cherry Point RC	5	20	0.1334	1,081,358	0.000012	214,657	0.0000621	14,611,417	0.0000009	N/A	
	20	60	1.0008		0.000093		0.0004662		0.0000068		
	AMNS Neutralizer	5	0.0247		0.000002		0.0000115		0.0000002		
		Total	1.158900		0.00007		0.0005399		0.0000079		
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone											
JAX RC	0.5	10	0.0148	9,306,697	0.0000002	6,530,477	0.0000002	26,485,602	0.0000001	0.0836237	17.6983256
	5	20	0.1334		0.0000014		0.0000020		0.0000005		159.5240968
	10	40	0.4201		0.0000045		0.0000064		0.0000016		502.3693633
	20	40	0.6672		0.0000072		0.0000102		0.0000025		797.8596506
	AMNS Neutralizer	6	0.0297		0.0000003		0.0000005		0.0000001		35.5162344
		Total	1.265200		0.0000136		0.0000194		0.0000048		1,512.9676
Caribbean and Gulf of Mexico Large Marine Ecosystem											
Key West RC	5	70	0.4671	4,493,152	0.0000104	1,472,965	0.0000317	14,163,039	0.0000033	1,324,082	0.0000353
	10	20	0.2100		0.0000047		0.0000143		0.0000015		0.0000159
	20	20	0.3360		0.0000075		0.0000228		0.0000024		0.0000254
		Total	1.013100		0.0000225		0.0000688		0.0000072		0.0000765
Gulf of Mexico Large Marine Ecosystem											
GOMEX RC	0.5	10	0.0148	2,955,100	0.0000005	3,418,643	0.0000004	56,370,160	0.0000000	971	0.0015242
	5	20	0.1334		0.0000045		0.0000039		0.0000002		0.0137384
	10	20	0.2100		0.0000071		0.0000061		0.0000004		0.0216272
	20	40	0.6672		0.0000226		0.0000195		0.0000012		0.0687127
	AMNS Neutralizer	106	0.5239		0.0000177		0.0000153		0.0000009		0.0539547
		Total	1.549300		0.0000524		0.0000453		0.0000027		0.1595572

Note: ac=acre; AMNS=Airborne Mine Neutralization System; GOMEX=Gulf of Mexico; JAX=Jacksonville; lb.=pounds; RC=Range Complex; VACAPES=Virginia Capes

Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2.

Table F-26: Potential Impact from Explosives On or Near the Bottom for Testing Activities under Alternatives 1 and 2 Over Five Years

Testing Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (Acre)	Hard Substrate Acre	Hard Substrate % Impact	Intermediate Substrate Acre	Intermediate Substrate % Impact	Soft substrate Acre	Soft substrate % Impact	Unknown Substrate Acre	Unknown Substrate % Impact
Alternative 1											
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone											
VACAPES RC	650	10	1.6988	559,734	0.0003035	1,874,186	0.0000906	22,262,693	0.0000076	N/A	
	AMNS Neutralizer	1,090	5.3869		0.0009624		0.0002874		0.0000242		
	Total		*7.0857*		*0.0012659*		*0.0003781*		*0.0000318*		
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone											
JAX RC	AMNS Neutralizer	250	1.2355	9,306,697	0.0000133	6,530,477	0.0000189	28,485,62	0.0000047	0.0836237	1,477.451
	Total		*1.2355*		*0.0000133*		*0.0000189*		*0.0000047*		*1,477.451*
Gulf Of Mexico Large Marine Ecosystem											
GOMEX RC	AMNS Neutralizer	500	2.4711	2,955,100	0.0000836	3,418,643	0.0000723	56,370,160	0.0000044	971	0.2544851
	Total		*2.4711*		*0.0000836*		*0.0000723*		*0.0000044*		*0.2544851*
NSWC Panama City Testing Range	650	20	3.3977	1,260,458	0.0002696	2,368,180	0.0001435	15,776,970	0.0000215	224	1.5168304
	AMNS Neutralizer	1,584	7.8283		0.0006211		0.0003306		0.0000496		3.4947768
	Line Charge	20	21.3697		0.0016954		0.0009024		0.0001354		9.5400446
	Total		*32.5957*		*0.0025860*		*0.0013764*		*0.0002066*		*14.551652*
Alternative 2											
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone											
VACAPES RC	650	35	5.9456	559,734	0.0010622	1,874,186	0.0003172	22,262,693	0.0000267	N/A	
	AMNS Neutralizer	1275	6.3012		0.0011257		0.0003362		0.0000283		
	Total		*19.0426*		*0.0034021*		*0.0010160*		*0.0000855*		
Southeast U.S. Continental Shelf Large Marine Ecosystem											
JAX RC	AMNS Neutralizer	250	1.2355	9,306,697	0.0000133	6,530,477	0.0000189	28,485,62	0.0000047	0.0836237	1,477.451
	Total		*1.2355*		*0.0000133*		*0.0000189*		*0.0000047*		*1,477.451*

Table F-26: Potential Impact from Explosives On or Near the Bottom for Testing Activities under Alternatives 1 and 2 Over Five Years (continued)

Testing Areas	Net Explosive Weight (lb.)	Number of Charges	Total Impact Footprint (Acre)	Hard Substrate		Intermediate Substrate		Soft substrate		Unknown Substrate	
				Acre	% Impact	Acre	% Impact	Acre	% Impact	Acre	% Impact
Gulf Of Mexico Large Marine Ecosystem											
GOMEX RC	AMNS Neutralizer	500	2.4711	2,955,100	0.0000836	3,418,643	0.0000723	56,370,160	0.0000044	971	0.2544851
	Total		2.4711		*0.0000836*		*0.0000723*		*0.0000044*		*0.2544851*
NSWC Panama City Testing Range	650	45	7.6448	1,260,458	0.0006065	2,368,180	0.0003228	15,776,970	0.0000485	224	3.4128571
	AMNS Neutralizer	1,665	8.2286		0.0006528		0.0003475		0.0000522		3.6734821
	Line Charge	20	21.3697		0.0016954		0.0009024		0.0001354		9.5400446
	Total		*37.2431*		*0.0029547*		*0.0015726*		*0.0002361*		*16.62638*

Note: ac=acre; AMNS=Airborne Mine Neutralization System; GOMEX=Gulf of Mexico; JAX=Jacksonville; lb.=pounds; NSWC Panama City=Naval Surface Warfare Center Panama City; RC=Range Complex; VACAPES=Virginia Capes

Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

Table F-27: Potential Impact of Military Expended Materials from Training Activities on Each Substrate Type in a Single Year

Training Areas	Percent Impact to Hard Bottom		Percent Impact to Intermediate Bottom		Percent Impact to Soft Bottom	
	Alternative 1	Alternative 2	Alternative 1	Alternative 2	Alternative 1	Alternative 2
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone						
Northeast RC	0.00006493	0.00006494	0.000025762	0.000025765	0.000005122	
VACAPES RC	0.0075159	0.0075172	0.0022446	0.0022451	0.00012257	
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem						
James River and Tributaries, VA	0		0.01434		0.0027481	
Lower Chesapeake Bay	0		0.002863		0.00001685	
York River, VA	0		0.00019588		0.000012257	
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem						
Navy Cherry Point RC	0.0013585	0.00103587	0.006843	0.006844	0.00010050	0.00010060
Cooper River, SC	0		0		0.00011270	
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone						
JAX RC	0.0004252	0.0004254	0.000606	0.000606	0.00014900	0.00014900
Port Canaveral, FL	0		0		0.00380165	
Caribbean and Gulf of Mexico Large Marine Ecosystems						
Key West RC	0.00008736		0.0002555		0.00002657	
Gulf of Mexico Large Marine Ecosystem						
GOMEX RC	0.000103	0.000112	0.0000867	0.0000965	0.00000526	0.00000580
Abyssal Zone						
Other AFTT Area	0.00009653		0.00006201		0.00000433	
SINKEX Area	0		0		0.00000011	

Note: GOMEX=Gulf of Mexico; JAX=Jacksonville; RC=Range Complex; SINKEX = Sinking Exercise; VACAPES=Virginia Capes
Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

Table F-28: Potential Impact of Military Expended Materials from Testing Activities on Each Substrate Type in a Single Year

Testing Areas	Percent Impact to Hard Bottom		Percent Impact to Intermediate Bottom		Percent Impact to Soft Bottom	
	Alternative 1	Alternative 2	Alternative 1	Alternative 2	Alternative 1	Alternative 2
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone						
Northeast RC	0.00022622	0.00022855	0.00008975	0.00009068	0.00001785	0.00001803
VACAPES RC	0.00343850	0.00344346	0.00102692	0.00102841	0.00008645	0.00008658
Northeast U.S. Continental Shelf Large Marine Ecosystem						
NUWC Newport Testing Range	0.00145520		0.00017250		0.00003892	
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem						
Navy Cherry Point RC	0.00034316	0.00034509	0.00172870	0.00173840	0.00002540	0.00002554
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone						
JAX RC	0.00011128	0.00011239	0.00015859	0.00016017	0.00003910	0.00003949
Southeast U.S. Continental Shelf Large Marine Ecosystem						
SFOMF	0.00014342		0.01507990		0.00050836	
Caribbean and Gulf of Mexico Large Marine Ecosystems						
Key West RC	0.00009702		0.00029596		0.00003078	
Gulf of Mexico Large Marine Ecosystem						
GOMEX RC	0.00017477		0.00015107		0.00000916	
NSWC Panama City Testing Range	0.00005165	0.00005220	0.00002749	0.00002779	0.00000413	0.00000417

Note: GOMEX=Gulf of Mexico; JAX=Jacksonville; NSWC=Naval Surface Warfare Center; NUWC=Naval Undersea Warfare Center; ; RC=Range Complex; SFOMF = South Florida Ocean Measurement Facility
Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

Table F-29: Potential Impact of Military Expended Materials from Training Activities on Each Substrate Type over Five Years

Training Areas	Percent Impact to Hard Bottom		Percent Impact to Intermediate Bottom		Percent Impact to Soft Bottom	
	Alternative 1	Alternative 2	Alternative 1	Alternative 2	Alternative 1	Alternative 2
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone						
Northeast RC	0.00032466	0.00032469	0.00012881	0.00012882	0.00002561	
VACAPES RC	0.03756110	0.03758600	0.01121780	0.01122520	0.0009444	0.9449970
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem						
James River and Tributaries, VA	0		0.0717019		0.0137407	
Lower Chesapeake Bay	0		0.0143167		0.00008484	
York River, VA	0		0.00097943		0.000061287	
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem						
Navy Cherry Point RC	0.0067761	0.0067936	0.03413351	0.00342234	0.00501482	0.00050278
Cooper River, SC	0		0		0.00056343	
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone						
JAX RC	0.00211835	0.00212709	0.00301889	0.00303135	0.00074436	0.00074743
Port Canaveral, FL	0		0		0.01900820	
Caribbean and Gulf of Mexico Large Marine Ecosystems						
Key West RC	0.000418816		0.00127756		0.00013287	
Gulf of Mexico Large Marine Ecosystem						
GOMEX RC	0.00050173	0.00055826	0.00043370	0.00048256	0.00002630	0.00002927
Abyssal Zone						
Other AFTT Area	0.000047457		0.00003048		0.00000213	
SINKEX Area	0		0		0.00000053	

Note: GOMEX=Gulf of Mexico; JAX=Jacksonville; NSWC=Naval Surface Warfare Center; NUWC=Naval Undersea Warfare Center; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; RC=Range Complex; SINKEX = Sinking Exercise
Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

Table F-30: Potential Impact of Military Expended Materials from Testing Activities on Each Substrate Type over Five Years

Testing Areas	Percent Impact to Hard Bottom		Percent Impact to Intermediate Bottom		Percent Impact to Soft Bottom	
	Alternative 1	Alternative 2	Alternative 1	Alternative 2	Alternative 1	Alternative 2
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone						
Northeast RC	0.001083	0.001135	0.000430	0.000450	0.000085	0.000089
VACAPES RC	0.016657	0.017190	0.004975	0.005134	0.000419	0.000432
Northeast U.S. Continental Shelf Large Marine Ecosystem						
NUWC Newport Testing Range	0.007229		0.000857		0.000193	
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem						
Navy Cherry Point RC	0.001702	0.001716	0.008572	0.008646	0.000126	0.000127
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone						
JAX RC	0.000537	0.000559	0.000765	0.000796	0.000189	0.000196
Southeast U.S. Continental Shelf Large Marine Ecosystem						
SFOMF	0.000687		0.072179		0.002433	
Caribbean and Gulf of Mexico Large Marine Ecosystems						
Key West RC	0.000480	0.000483	0.001463	0.001473	0.000152	0.000153
Gulf of Mexico Large Marine Ecosystem						
GOMEX RC	0.000854	0.000871	0.000738	0.000752	0.000045	0.000046
NSWC Panama City Testing Range	0.000247	0.000253	0.000131	0.000135	0.000197	0.000020

Note GOMEX=Gulf of Mexico; JAX=Jacksonville; NSWC=Naval Surface Warfare Center; NUWC=Naval Undersea Warfare Center; RC=Range Complex; SFOMF = South Florida Ocean Measurement Facility;
Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

Table F-31: Proportional Impact to Bottom Habitat from Training Activities Under Alternatives 1 and 2 in a Single Year

Training Areas		Impact to Hard Bottom		Impact to Intermediate Bottom		Impact to Soft Bottom		Impact to Unknown Bottom	
		MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone									
Northeast RC	Alternative 1	0.098433	0	0.248094	0	1.247814	0	0.00012372	0
	Alternative 2	0.098442		0.248112		1.247923		0.00012373	
VACAPES RC	Alternative 1	0.952110	0.173244	3.187990	0.580081	37.868830	6.890549	0	0
	Alternative 2	0.952280		3.188550		37.875480		0	
Northeast U.S. Continental Shelf Large Marine Ecosystem									
Lower Chesapeake Bay	Alternative 1	0	0	0.000337	0.000442	0.057306	0.075073	0.000070	0.000092
	Alternative 2								
James River and Tributaries	Alternative 1	0	0	0.354140	0	1.847980	0	0.048350	0
	Alternative 2								
York River, VA	Alternative 1	0	0	0.000095	0	0.001519	0	0.000013	0
	Alternative 2								
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem									
Navy Cherry Point	Alternative 1	0.997284	0.015735	0.197968	0.003124	13.475478	0.212612	0	0
	Alternative 2	0.997424		0.197996		13.477290			
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone									
JAX RC	Alternative 1	8.693468	0.056455	6.100176	0.039614	24.740434	0.160663	0	0
	Alternative 2	8.697558		6.103046		24.752074			
Cooper River, SC	Alternative 1	0	0	0	0	0.000805	0	0.002288	0
	Alternative 2								
Port Canaveral, FL	Alternative 1	0	0	0	0	0.008452	0	0.005535	
	Alternative 2								
Caribbean and Gulf of Mexico Large Marine Ecosystems									
Key West	Alternative 1	0.787791	0.042310	0.258257	0.013870	2.483225	0.133367	0.232153	0.012468
	Alternative 2								
Gulf of Mexico Large Marine Ecosystem									
GOMEX	Alternative 1	0.139264	0.014738	0.161109	0.017050	2.656541	**0.281137**	0.000046	0.000005
	Alternative 2	0.154953		0.179259		2.955825		0.000051	
Abyssal Zone									
Other AFTT	Alternative 1	0.007712	0	0.012006	0	0.1719333	0	1.177579	0
	Alternative 2								
SINKEX Area	Alternative 1	0	0	0	0	0.034267	0	0.014862	0
	Alternative 2								

Note: ac=acre; GOMEX=Gulf of Mexico; JAX=Jacksonville; MEM = Military Expended Materials; NSWC=Naval Surface Warfare Center; NUWC=Naval Undersea Warfare Center; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; RC=Range Complex; SINKEX = Sinking Exercise
Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

Table F-32: Proportional Impact to Bottom Habitat from Testing Activities Under Alternatives 1 and 2 in a Single Year

Training Areas		Impact to Hard Bottom		Impact to Intermediate Bottom		Impact to Soft Bottom		Impact to Unknown Bottom	
		MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone									
Northeast RC	Alternative 1	0.342933	0	0.864339	0	4.347285	0	0.000431	0
	Alternative 2	0.346475		0.873266		4.392187		0.000436	
VACAPES RC	Alternative 1	0.435586	0.035652	1.458493	0.119376	17.324844	1.418014	0	0
	Alternative 2	0.436214	0.055436	1.460598	0.185617	17.349847	2.204873		
Northeast U.S. Continental Shelf Large Marine Ecosystem									
NUWC Newport Testing Range	Alternative 1	0.063395	0	0.534798	0	2.370474	0	0.017550	0
	Alternative 2								
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem									
Navy Cherry Point RC	Alternative 1	0.251914	0	0.050007	0	3.403885	0	0	0
	Alternative 2	0.253324		0.050286		3.422932			
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone									
JAX RC	Alternative 1	2.275096	0.054284	1.596426	0.038091	6.474615	0.154484	0.000000	0.000000
	Alternative 2	2.297848		1.612392		6.539364		0.000000	
Southeast U.S. Continental Shelf Large Marine Ecosystem									
SFOMF	Alternative 1	0.350173	0	0.003331	0	0.098796	0	0.000012	0
	Alternative 2								
Caribbean and Gulf of Mexico Large Marine Ecosystems									
Key West RC	Alternative 1	0.912499	0	0.299139	0	2.876322	0	0.268903	0
	Alternative 2								
Gulf of Mexico Large Marine Ecosystem									
GOMEX RC	Alternative 1	0.242548	0.023210	0.280594	0.026850	4.626728	0.442735	0.000080	0.000008
	Alternative 2								
NSWC Panama City Testing Range	Alternative 1	0.042075	0.424939	0.079052	0.798385	0.526652	5.318893	0.000007	0.000075
	Alternative 2	0.042529	0.481438	0.079904	0.904537	0.532325	6.026086		0.000085

Note: ac=acre; GOMEX=Gulf of Mexico; JAX=Jacksonville; MEM = Military Expended Materials; NSWC=Naval Surface Warfare Center; NUWC=Naval Undersea Warfare Center; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; RC=Range Complex; SINKEX = Sinking Exercise

Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

Table F-33: Proportional Impact to Bottom Habitat from Training Activities Under Alternatives 1 and 2 over Five Years

Training Areas		Impact to Hard Bottom		Impact to Intermediate Bottom		Impact to Soft Bottom		Impact to Unknown Bottom	
		MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone									
Northeast RC	Alternative 1	0.492165	0	1.240468	0	6.239068	0	0.000619	0
	Alternative 2	0.492208		1.240577		6.239616		0.000619	
VACAPES RC	Alternative 1	4.758210	0.865773	15.932138	2.898909	189.251318	34.434949	0	0
	Alternative 2	4.761361		15.942689		189.376659		0	
Northeast U.S. Continental Shelf Large Marine Ecosystem									
Lower Chesapeake Bay	Alternative 1	0	0	0.001686	0.002209	0.286530	0.375367	0.0003517	0.00046071
	Alternative 2								
James River and Tributaries	Alternative 1	0	0	1.770699	0	9.239897	0	0.2417497	0
	Alternative 2								
York River, VA	Alternative 1	0	0	0.000475	0	0.007594	0	0.000067	0
	Alternative 2								
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem									
Navy Cherry Point RC	Alternative 1	4.974258	0.078675	0.987427	0.015618	67.212644	1.063061	0	0
	Alternative 2	4.987121		0.989981		67.386452			
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone									
JAX RC	Alternative 1	43.309050	0.276629	30.389809	0.194110	123.251700	0.787249	0	0
	Alternative 2	43.487725	0.277932	30.515184	0.195024	123.760184	0.790956		
Cooper River, SC	Alternative 1	0	0	0	0	0.004027	0	0.0114378	0
	Alternative 2								
Port Canaveral, FL	Alternative 1	0	0	0	0	0.042262	0	0.027674	0
	Alternative 2								
Caribbean and Gulf of Mexico Large Marine Ecosystems									
Key West RC	Alternative 1	3.938953	0.211549	1.291285	0.069351	12.416125	0.666833	1.160766	0.062341
	Alternative 2								
Gulf of Mexico Large Marine Ecosystem									
GOMEX RC	Alternative 1	0.696307	0.072484	0.805531	0.083853	13.282436	1.382663	0.000229	0.000024
	Alternative 2	0.774754	0.072762	0.896284	0.084176	14.778861	1.387976	0.000255	
Abyssal Zone									
Other AFTT	Alternative 1	0.037914772	0	0.059026955	0	0.845273	0	5.789313	0
	Alternative 2								
SINKEX Area	Alternative 1	0	0	0	0	0.171338	0	0.074308	0
	Alternative 2								

Note: ac=acre; GOMEX=Gulf of Mexico; JAX=Jacksonville; MEM = Military Expended Materials; NSWC=Naval Surface Warfare Center; NUWC=Naval Undersea Warfare Center; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; RC=Range Complex; SINKEX = Sinking Exercise

Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

Table F-34: Proportional Impact to Bottom Habitat from Testing Activities Under Alternatives 1 and 2 over Five Years

Training Areas		Impact to Hard Bottom		Impact to Intermediate Bottom		Impact to Soft Bottom		Impact to Unknown Bottom	
		MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)	MEM Footprint (ac)	Explosive Footprint (ac)
Northeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone									
Northeast RC	Alternative 1	1.641822	0	4.138102	0	20.813033	0	0.002064	0
	Alternative 2	1.719770		4.334567		21.801174		0.002162	
VACAPES RC	Alternative 1	2.110074	0.160365	7.065258	0.536956	83.925297	6.378284	0	0
	Alternative 2	2.177571	0.277178	7.291262	0.928087	86.609904	11.024366		
Northeast U.S. Continental Shelf Large Marine Ecosystem									
NUWC Newport Testing Range	Alternative 1	0.314904	0	2.656512	0	11.774893	0	0.087174	0
	Alternative 2								
Northeast and Southeast U.S. Continental Shelf Large Marine Ecosystem									
Navy Cherry Point RC	Alternative 1	1.249154	0	0.247966	0	16.878691	0	0	0
	Alternative 2	1.259951		0.250110		17.024582			
Southeast U.S. Continental Shelf Large Marine Ecosystem and Abyssal Zone									
JAX RC	Alternative 1	10.975187	0.271418	7.701250	0.190453	31.233899	0.772418	0	0
	Alternative 2	11.420121		8.013459		32.500120			
Southeast U.S. Continental Shelf Large Marine Ecosystem									
SFOMF	Alternative 1	1.676089	0	0.015941	0	0.472885	0	0.000058	0
	Alternative 2								
Caribbean and Gulf of Mexico Large Marine Ecosystems									
Key West RC	Alternative 1	4.512035	0	1.479155	0	14.222560	0	1.329647	0
	Alternative 2	4.540391		1.488451		14.311941		1.338003	
Gulf of Mexico Large Marine Ecosystem									
GOMEX RC	Alternative 1	1.185216	0.116048	1.371131	0.13425141	22.608639	2.21367739	0.000390	0.000038
	Alternative 2	1.208126		1.397635		23.045671		0.000397	
NSWC Panama City Testing Range	Alternative 1	0.201081	2.106805	0.377795	3.958317	2.516897	26.370563	0.000036	0.000374
	Alternative 2	0.206296	2.407190	0.387595	4.522687	2.582181	30.130432	0.000037	0.000427

Note: ac=acre; GOMEX=Gulf of Mexico; JAX=Jacksonville; MEM = Military Expended Materials; NSWC=Naval Surface Warfare Center; NUWC=Naval Undersea Warfare Center; Other AFTT Area = Location outside east coast Range Complexes and other defined areas; RC=Range Complex; SINKEX = Sinking Exercise

Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

F.3 STATISTICAL AND PROBABILITY ANALYSIS FOR ESTIMATING DIRECT STRIKE IMPACT AND NUMBER OF POTENTIAL EXPOSURES FROM MILITARY EXPENDED MATERIALS

This section discusses the methods and results for calculating the probability of a direct strike of an animal from any military items from the proposed training and testing activities falling toward (or directed at) the sea surface. For the purposes of this section, military items include non-explosive practice munitions, sonobuoys, acoustic countermeasures, targets, and high-energy lasers. Only marine mammals and sea turtles will be analyzed using these methods because animal densities are necessary to complete the calculations, and density estimates are currently only available for marine mammals and sea turtles within the Study Area. The analysis conducted here does not account for explosive munitions because impacts from explosives are analyzed within the Navy Acoustic Effects Model as described in the Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing (U.S. Department of the Navy, 2018b).

F.3.1 DIRECT IMPACT ANALYSIS

A probability was calculated to estimate the impact probability (P) and number of exposures (T) associated with direct impact of military items on marine animals on the sea surface within the specified training or testing area (R) in which the activities are occurring. The statistical probability analysis is based on probability theory and modified Venn diagrams with rectangular "footprint" areas for the individual animal (A) and total impact (I) inscribed inside the training or testing area (R). The analysis is over-predictive and conservative, in that it assumes: (1) that all animals would be at or near the surface 100 percent of the time, when in fact, marine mammals spend the majority of their time underwater, and (2) that the animals are stationary, which does not account for any movement or any potential avoidance of the training or testing activity.

1. A = length*width, where the individual animal's width (breadth) is assumed to be 20 percent of its length for marine mammals and 112 percent of its length for sea turtles. This product for A is multiplied by the number of animals Na in the specified training or testing area (i.e., product of the highest average month animal density [D] and training or testing area [R]: Na = D*R) to obtain the total animal footprint area (A*Na = A*D*R) in the training or testing area. As a conservative scenario, the total animal footprint area is calculated for the species with the highest average month density in the training or testing area with the highest use of military items within the entire Study Area.

2. I = Nmun*length*diameter, where Nmun = total annual number of military items for each type, and "length" and "diameter" refer to the individual military equipment dimensions. For each type, the individual impact footprint area is multiplied by the total annual number of military items to obtain the type-specific impact footprint area (I = Nmun*length*diameter). Each training or testing activity uses one or more different types of military items, each with a specific number and dimensions, and several training and testing activities occur in a given year. When integrating over the number of military items types for the given activity, and then over the number of activities in a year, these calculations are repeated (accounting for differences in dimensions and numbers) for all military items types used, to obtain the type-specific impact footprint area (I). These impact footprint areas are summed over all military items types for the given activity, and then summed (integrated) over all activities to obtain the total impact footprint area resulting from all activities occurring in the training or testing area in a given year.

As a conservative scenario, the total impact footprint area is calculated for the training or testing area with the highest use of military items within the entire Study Area.

Though marine mammals and sea turtles may not be randomly distributed in the environment, a random point calculation was chosen due to the intensive data needs that would be required for a calculation that incorporated more detailed information on an animal's or military item's spatial occurrence.

The analysis is expected to provide an overestimation of the probability of a strike for the following reasons: (1) it calculates the probability of a single military item (of all the items expended over the course of the year) hitting a single animal at its species' highest seasonal density, (2) it does not take into account the possibility that an animal may avoid military activities, (3) it does not take into account the possibility that an animal may not be at the water surface, (4) it does not take into account that most projectiles fired during training and testing activities are fired at targets, and so only a very small portion of those projectiles that miss the target would hit the water with their maximum velocity and force, and (5) it does not quantitatively take into account the Navy avoiding animals that are sighted through the implementation of mitigation measures (for consideration of mitigation during analysis see Section 3.7.3.4, Marine Mammals, and Section 3.8.3.4, Reptiles).

The likelihood of an impact is calculated as the probability (P) that the animal footprint (A) and the impact footprint (I) will intersect within the training or testing area (R). This is calculated as the area ratio A/R or I/R, respectively. Note that A (referring to an **individual** animal footprint) and I (referring to the impact footprint resulting from the **total** number of military items N_{mun}) are the relevant quantities used in the following calculations of single-animal impact probability [P], which is then multiplied by the number of animals to obtain the number of exposures (T). The probability that the random point in the training or testing area is within both types of footprints (i.e., A and I) depends on the degree of overlap of A and I. The probability that I overlaps A is calculated by adding a buffer distance around A based on one-half of the impact area (i.e., 0.5*I), such that an impact (center) occurring anywhere within the combined (overlapping) area would impact the animal. Thus, if L_i and W_i are the length and width of the impact footprint such that $L_i*W_i = 0.5*I$ and $W_i/L_i = L_a/W_a$ (i.e., similar geometry between the animal footprint and impact footprint), and if L_a and W_a are the length and width (breadth) of the individual animal such that $L_a*W_a = A$ (= individual animal footprint area), then, assuming a purely static, rectangular scenario (Scenario 1), the total area $A_{tot} = (L_a + 2*L_i)*(W_a + 2*W_i)$, and the buffer area $A_{buffer} = A_{tot} - L_a*W_a$.

Four scenarios were examined with respect to defining and setting up the overlapping combined areas of A and I:

1. Scenario 1: Purely static, rectangular scenario. Impact is assumed to be static (i.e., direct impact effects only; non-dynamic; no explosions or scattering of military items after the initial impact). Hence the impact footprint area (I) is assumed to be rectangular and given by the product of military items length and width (multiplied by the number of military items). $A_{tot} = (L_a + 2*L_i)*(W_a + 2*W_i)$ and $A_{buffer} = A_{tot} - L_a*W_a$.
2. Scenario 2: Dynamic scenario with end-on collision, in which the length of the impact footprint (L_i) is enhanced by $R_n = 5$ military items lengths to reflect forward momentum. $A_{tot} = (L_a + (1 + R_n)*L_i)*(W_a + 2*W_i)$ and $A_{buffer} = A_{tot} - L_a*W_a$.
3. Scenario 3: Dynamic scenario with broadside collision, in which the width of the impact footprint (W_i) is enhanced by $R_n = 5$ military items lengths to reflect forward momentum. $A_{tot} = (L_a + 2*W_i)*(W_a + (1 + R_n)*L_i)$ and $A_{buffer} = A_{tot} - L_a*W_a$.

4. Scenario 4: Purely static, radial scenario, in which the rectangular animal and impact footprints are replaced with circular footprints while conserving area. Define the radius (R_a) of the circular individual animal footprint such that $\pi*R_a^2 = L_a*W_a$, and define the radius (R_i) of the circular impact footprint such that $\pi*R_i^2 = 0.5*L_i*W_i = 0.5*I$. Then $A_{tot} = \pi*(R_a + R_i)^2$ and $A_{buffer} = A_{tot} - \pi*R_a^2$ (where $\pi = 3.1415927$).

Static impacts (Scenarios 1 and 4) assume no additional aerial coverage effects of scattered military items beyond the initial impact. For dynamic impacts (Scenarios 2 and 3), the distance of any scattered military items must be considered by increasing the length (Scenario 2) or width (Scenario 3), depending on orientation (broadside versus end-on collision), of the impact footprint to account for the forward horizontal momentum of the falling object. Forward momentum typically accounts for five object lengths, resulting in a corresponding increase in impact area. Significantly different values may result from the static and dynamic orientation. Both of these types of collision conditions can be calculated each with 50 percent likelihood (i.e., equal weighting between Scenarios 2 and 3, to average these potentially different values).

Impact probability P is the probability of impacting one animal with the given number, type, and dimensions of all military items used in training or testing activities occurring in the area per year, and is given by the ratio of total area (A_{tot}) to training or testing area (R): $P = A_{tot}/R$. Number of exposures is $T = N*P = N*A_{tot}/R$, where N = number of animals in the training or testing area per year (given as the product of the animal density [D] and range size [R]). Thus, $N = D*R$ and hence $T = N*P = N*A_{tot}/R = D*A_{tot}$. Using this procedure, P and T were calculated for each of the four scenarios, for Endangered Species Act (ESA)-listed marine mammals and the marine mammal and sea turtle species with the highest average month density (used as the annual density value) and for each military item type. The scenario-specific P and T values were averaged over the four scenarios (using equal weighting) to obtain a single scenario -averaged annual estimate of P and T. The potential numbers of exposures (T) are reported in Table F-36 through Table F-39.

F.3.2 PARAMETERS FOR ANALYSIS

Impact probabilities (P) and number of exposures (T) were estimated by the analysis for the following parameters:

1. Two action alternatives: Alternative 1 and Alternative 2. Animal densities, animal dimensions, and military item dimensions are the same for the two action alternatives.
2. Two training or testing areas: Virginia Capes (VACAPES) and Jacksonville (JAX) Range Complexes. Areas are approximately 28,000 square nautical miles (NM^2) and 50,000 NM^2, respectively. These two training and testing areas were chosen because they constitute the areas with the highest estimated numbers and concentrations of military expended materials for both alternatives, and would, thus, provide a reasonable comparison for all other areas with fewer expended materials.
3. The following types of non-explosive munitions or other items:

   - **Small-caliber projectiles**: up to and including .50 caliber rounds

   - **Medium-caliber projectiles:** larger than .50 caliber rounds but smaller than 57 millimeters (mm) projectiles

   - **Large-caliber projectiles:** includes projectiles greater than or equal to a 57 mm projectile

   - **Missiles:** includes rockets and jet-propelled munitions

- **Bombs:** Non-explosive practice bombs and mine shapes, ranging from 10 to 2,000 lbs
- **Torpedoes:** includes all lightweight torpedoes
- **Sonobuoys:** includes all sonobuoys
- **Targets:** includes expended airborne and surface, as well as mine shapes
- **Lightweight torpedo accessories:** includes all accessories that are dropped along with the torpedo (nose cap, air stabilizer, etc.)
- **Anchors:** includes blocks used to anchor mine shapes to the seafloor
- **Acoustic countermeasures:** includes aircraft deployed acoustic countermeasures
- **High Energy Lasers**: includes high energy laser weapons that are directed at a surface target
- **Expended Bathythermographs**: small sensor deployed from ships

4. Animal species of interest: The six species of ESA-listed marine mammals and the non-ESA listed marine mammal species with the highest average month density in the training and testing areas of interest. The sea turtle species with the highest average month density in the training and testing areas of interest.

F.3.3 INPUT DATA

Input data for the direct strike analysis include animal species likely to be in the area and military items proposed for use under each of the two action alternatives. Animal species data include: (1) species identification and status (i.e., threatened, endangered, or neither), (2) highest average month density estimate each species of interest, and (3) adult animal dimensions (length and width) for the species with the highest density. The animal's dimensions are used to calculate individual animal footprint areas (A = length*width), and animal densities are used to calculate the number of exposures (T) from the impact probability (P): T = N*P. Military items data include: (1) military items category (e.g., projectile, bomb, rocket, target), (2) military items dimensions (length and width), and (3) total number of military items used annually.

Military items input data, specifically the quantity (e.g., numbers of bombs, and rockets), are different in magnitude between the two action alternatives. All animal species input data, the military items identification and category, and military items dimensions are the same for the two alternatives, only the quantities (i.e., total number of military items) are different.

F.3.4 OUTPUT DATA

Estimates of impact probability (P) and number of exposures (T) for a given species of interest were made for the specified training or testing area with the highest annual number of military items used for each of the two action alternatives. The calculations derived P and T from the highest annual number of military items used in the Study Area for the given alternative. Differences in P and T between the alternatives arise from different numbers of events (and therefore military items) for the two alternatives.

Results for marine mammals and sea turtles are presented in Table F-36 through Table F-39.

Table F-35: Estimated Representative Marine Mammal Exposures from Direct Strike of a High Energy Laser by Area and Alternative in a Single Year

Northeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area				
VACAPES Range Complex				
	Training		*Testing*	
Species	*Alternative 1*	*Alternative 2*	*Alternative 1*	*Alternative 2*
North Atlantic Right Whale	0.000000	0.000000	0.000000	0.000000
Sei Whale	0.000000	0.000000	0.000001	0.000001
Fin Whale	0.000001	0.000001	0.000005	0.000005
Blue Whale	0.000000	0.000000	0.000000	0.000000
Sperm Whale	0.000002	0.000002	0.000010	0.000010
Short Beaked Common	0.000007	0.000007	0.000140	0.000140

Note: VACAPES=Virginia Capes

Table F-36: Estimated Representative Sea Turtle Exposures from Direct Strike of a High Energy Laser by Area and Alternative in a Single Year

Northeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area				
VACAPES Range Complex				
	Training		*Testing*	
Species	*Alternative 1*	*Alternative 2*	*Alternative 1*	*Alternative 2*
Loggerhead Sea Turtle	0.000008	0.000008	0.000136	0.000136

Note: VACAPES=Virginia Capes

Table F-37: Estimated Representative Marine Mammal Exposures from Direct Strike of Military Expended Materials by Area and Alternative in a Single Year

Northeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area				
VACAPES Range Complex				
Species	*Training*		*Testing*	
	Alternative 1	*Alternative 2*	*Alternative 1*	*Alternative 2*
North Atlantic Right Whale	0.000061	0.000061	0.000024	0.000024
Sei Whale	0.000256	0.000256	0.000098	0.000098
Fin Whale	0.001259	0.001259	0.000486	0.000487
Blue Whale	0.000003	0.000003	0.000001	0.000001
Sperm Whale	0.003051	0.003052	0.001171	0.001171
Short Beaked Common Dolphin	0.068821	0.068835	0.025966	0.025974
Southeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area				
JAX Range Complex				
Species	*Training*		*Testing*	
	Alternative 1	*Alternative 2*	*Alternative 1*	*Alternative 2*
North Atlantic Right Whale	0.000329	0.000340	0.000568	0.000568
Sei Whale	0.000023	0.000024	0.000040	0.000040
Fin Whale	0.000025	0.000025	0.000042	0.000042
Blue Whale	0.000002	0.000002	0.000003	0.000003
Sperm Whale	0.000077	0.000079	0.000132	0.000132
Atlantic Spotted Dolphin	0.011027	0.011409	0.019204	0.019210

Note: JAX=Jacksonville; VACAPES=Virginia Capes

Table F-38: Estimated Representative Sea Turtle Exposures from Direct Strike of Military Expended Materials by Area and Alternative in a Single Year

Northeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area				
VACAPES Range Complex				
Species	*Training*		*Testing*	
	Alternative 1	*Alternative 2*	*Alternative 1*	*Alternative 2*
Loggerhead Sea Turtle	0.065726	0.065740	0.032481	0.024822
Southeast United States Continental Shelf Large Marine Ecosystem and Gulf Stream Open Ocean Area				
JAX Range Complex				
Species	*Training*		*Testing*	
	Alternative 1	*Alternative 2*	*Alternative 1*	*Alternative 2*
Loggerhead Sea Turtle	0.038939	0.040289	0.067786	0.067810

Note: JAX=Jacksonville; VACAPES=Virginia Capes

F.4 POISSON PROBABILITY OF DIRECT VESSEL STRIKE WITH MARINE MAMMALS

In order to assess the probability of a Navy vessel striking a marine mammal during future training and testing activities, the Navy considered data on vessel usage within the Study Area (steaming days) and past ship strike records from the time period beginning in 2009. The Navy determined that data beginning in 2009 would be the most representative for predicting the potential for future vessel strikes, because this year coincided with when the Navy's mitigation, monitoring, and reporting requirements became standardized across the Fleets with the issuance of Marine Mammal Protection Act (MMPA) permits for sonar and explosive usage in at-sea Navy ranges.

Between 2007 and 2009, the Navy developed and distributed additional training, mitigation, and reporting tools to Navy operators to improve marine mammal protection and to ensure compliance with upcoming permit requirements. In 2007, the Navy implemented the Marine Species Awareness Training, which is designed to improve the effectiveness of visual observations for marine resources, including marine mammals and sea turtles. In subsequent years, the Navy issued refined policy guidance regarding marine mammal incidents (e.g., ship strikes) in order to collect the most accurate and detailed data possible in response to a possible incident. For over a decade, the Navy has implemented the Protective Measures Assessment Protocol software tool, which provides operators with notification of the required mitigation and a visual display of the planned training or testing activity location overlaid with relevant environmental data (see Section 5.1, Introduction).

Similar mitigation, reporting and monitoring requirements have been in place since 2009 and are expected to continue into the future. Therefore, the conditions affecting the potential for ship strikes are the most consistent across this time frame. As a result, data from the past eight years (i.e., 2009 to 2016) are used to calculate the probability of a Navy vessel striking a whale during proposed training and testing activities in the Study Area. The year 2009 was selected because it is the beginning of programmatic permitting within the Atlantic and Pacific oceans; acknowledges advances in Navy marine species awareness training and overall enhanced sensitivity to marine resource issues in general; and is the first year of the codification of multiple marine species mitigation measures including specific measures to avoid large whales by 500 yards so long as it is safe for navigation. Additionally, due to better data and knowledge of species presence, the period beginning in 2009 is more representative of current and reasonably foreseeable marine mammal occurrence in AFTT. The level of vessel use and the manner in which the Navy trains and tests in the future is expected to be consistent with this time period.

In the AFTT Study Area, there were a total of three reported Navy vessel whale strikes from 2009-2016. During this same time period there were a total of 39,040 steaming days of vessel use within the Study Area. Therefore, there was an average strike rate of 0.00008 strikes per steaming day. Based on the annual average from 2009-2016, the Navy estimates that 24,400 steaming days will occur over any five-year period associated with an MMPA authorization. These values were used to determine the rate parameters to calculate a series of Poisson probabilities (a Poisson distribution is often used to describe random occurrences when the probability of an occurrence is small, e.g., count data such as cetacean sighting data, or in this case strike data, are often described as a Poisson or over-dispersed Poisson distribution).

In modeling strikes as a Poisson process, we assume this strike rate for the future and we use the Poisson distribution to estimate the number of strikes over a defined time period in the future:

$$P \left\langle n \middle| \mu \right\rangle = \frac{e^{-\mu} \bullet \mu^{n}}{n!}$$

P(*n*|*μ*) is the probability of observing *n* events in some time interval, when the expected number of events in that time interval is *u*. As stated previously, the Navy estimates that 24,400 steaming days could occur; and given a strike rate of 0.00008 strikes per steaming day the expected number of strikes (μ) over a five-year period is 1.875. To estimate zero occurrences (in this case, no whales being struck), the formula P(0)=e$^{-\mu}$ would apply. Assuming the estimated number of strikes over a five-year period, the equation yields a value of P(0) = 0.153. The resulting probabilities of one through five strikes over a five-year period are:

1. P(1) = (0.153 * 1.875^1)/1 = 0.288
    - *29 percent probability of striking one whale in a 5-year period*
2. P(2) = (0.288 * 1.875^ 2)/2 = 0.270
    - *27 percent probability of striking two whales in a 5-year period*
3. P(3) = (0.270 * 1.875^ 3)/6 = 0.168
    - *17 percent probability of striking three whales in a 5-year period*
4. P(4) = (0.168 * 1.875^ 4)/24 = 0.079
    - *8 percent probability of striking four whales in a 5-year period*
5. P(5) = (0.079* 1.875^ 5)/120 = 0.030
    - *3 percent probability of striking five whales in a 5-year period*

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