

# UNCLASSIFIED

FY 2001 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 2000

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603782N  
PROGRAM ELEMENT TITLE: Mine and Expeditionary  
Warfare Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2226 Mine and Expeditionary Warfare Advanced Technology									
	41,546	48,442	45,618	46,417	47,139	45,574	46,683	CONT.	CONT.
R2499 ALISS	978	0	0	0	0	0	0	0	978
R2720 Ocean Modeling for Mine & Sub Warfare		8,951	0	0	0	0	0	0	8,951
	42,524	57,393	45,618	46,417	47,139	45,574	46,683	CONT.	CONT.
TOTAL									

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program supports demonstrations of technologies for Naval Expeditionary Forces performing the missions of Mine and Expeditionary Warfare. The technologies support a range of capabilities enabling Naval Expeditionary Forces to influence operations ashore.

(U) This Program Element (PE) transitions technologies responding to high-priority Naval Expeditionary Warfare mission requirements. The emphasis is on simulating and testing prototypes of technologies with the potential for providing Naval capabilities in six major areas:

- Organic Mine Countermeasure (MCM) technologies for organic minehunting and clearance; and organic ship protection.
  - Mine Countermeasures technologies for Ship to Objective Maneuver
  - Offensive Sea Mining
  - Battlefield surveillance, reconnaissance, and targeting.
  - Naval fire support.
  - Command, control, communications, information processing, and mission planning supporting land battles.
  - Force mobility and survivability.

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(U) Due to the sheer volume of efforts included in this PE, the programs described in the Accomplishments and Plans section are representative selections of the work included in this PE.

(U) The Navy Science and & Technology program includes projects that focus on or have attributes that enhance the affordability of warfighting systems.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or prototype hardware to validate technological feasibility and concept of operations and reduce technical risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

B. (U) PROGRAM CHANGE SUMMARY:

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
(U) FY 2000 President's Budget	44,220	48,711	45,869
(U) Appropriated Value:		57,711	
(U) Adjustments from PRESBUDG:			
(U) SBIR/STTR Transfer	- 512		
(U) Various Rate Adjustments			- 240
(U) Congressional Plus up		9,000	
(U) SPP Adjustment			- 11
(U) Execution Adjustment	- 990		
(U) Inflation Adjustment	- 194		
(U) Congressional Rescission		- 318	
(U) FY 2001 PRESBUDG Submission	42,524	57,393	45,618

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

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(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2226 Mine and Expeditionary Warfare Advanced Technology	41,546	48,442	45,618	46,417	47,139	45,574	46,683	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program supports demonstrations of technologies for Naval Expeditionary Forces performing the missions of Mine and Expeditionary Warfare. The technologies support a range of capabilities enabling Naval Expeditionary Forces to influence operations ashore.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1.(U) FY 1999 ACCOMPLISHMENTS:

- (U) ADVANCED DEGAUSSING: Completed all efforts in advanced deperming, closed loop degaussing, and algorithm development. Completed documentation of algorithms and demonstration results. Transitioned degaussing technologies to PE 0603513N, PE 0603502N, and the LPD-17 construction program.
- (U) ADVANCED SURVEILLANCE/RECONNAISSANCE: Continued focused efforts on environmental parameters, including offshore bathymetry, optical clarity, and other essential elements of information appropriate to amphibious assaults. Continued transitioning critical battle space products to the Naval Oceanographic Office. Demonstrated littoral remote sensing products during Fleet Battle Experiment (FBE) Echo (Kernal Blitz).

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- (U) MODELING AND SIMULATION: Continued simulation based concept, based assessment focusing on assessment of technologies for naval surface fire support and Future Naval Capabilities in Organic Mine Countermeasures. The effort continues to emphasize warfighter-technologist interaction and warfighter driven simulation based technology assessment to explore in detail current and advanced technologies in tandem with relevant concepts of operations. Initiated concept visualization of future naval surface fire support and organic mine warfare technologies.
- (U) Joint Countermine Advanced Concept and Technology Demonstration (JCM ACTD): Completed post exercise analysis of JCM ACTD Demonstration II and documentation of demonstration results (incorporating "user" comments). Continued logistics support for ACTD "residual" equipment left with operational forces. Completed documentation of Joint Countermine Operational Simulation (JCOS) and Command, Control, Communication and Computer Intelligence (C4I). Demonstrated C4I and JCOS during FBE-Echo (Kernal Blitz) as part of the residual phase, collecting additional data on military utility.
- (U) ADVANCED AIRBORNE TARGET DESIGNATOR: Completed field tests and demonstrations with live fires to determine accuracy of targeting to resulting fire locations. Continue documentation of field test results and quantification of localization accuracy for transition of airborne target designator technology to Marine Corps Systems Command Ground Weapons for integration in UH-1N helicopter and Unmanned Aerial Vehicles (UAVs).
- (U) EXPEDITIONARY WARFARE COMMUNICATIONS NETWORKING: Continued demonstration of advanced high capacity radio frequency links between ships at sea, focusing on beyond line of sight communications between ships and objectives ashore. Completed assessment of high capacity radio technologies between ships at sea.
- (U) SURFACE SURVEILLANCE, TARGET ACQUISITION, FIRE CONTROL, AND ORDNANCE: Initiated development of component technologies for demonstration of a low cost, high speed guided projectile for Naval guns. Began development of actuated aerodynamic control surfaces for control of high velocity projectiles. Initiated warhead lethality study against hard and soft targets.
- (U) MINE IDENTIFICATION: Began integration of component technologies together in the laboratory. Began fabrication of final design suitable for tow-body configuration. Conducted laboratory and field tests of integrated system components.

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- (U) LITTORAL SEA MINE: Initiated design of littoral sea mine technology demonstration model. Initiated fabrication/testing of individual components. Began development of data fusion algorithms and assured communication algorithms.
- (U) VERY SHALLOW WATER/EXPLOSIVE ORDNANCE DISPOSAL (VSW/EOD) RECONNAISSANCE: Initiated development of diver-portable detection, classification, and identification technologies and autonomous underwater vehicles for VSW reconnaissance. Initiated development of a simulation which provides for the evaluation of the approach and effectiveness of Unmanned Underwater Vehicles (UUVs) under varying environmental conditions to perform critical Mine Countermeasure VSW missions including search and inspection. Initiated trade-off studies of technical and operational concepts to include directed versus autonomous operation, deployment, recovery, command, control and communication. Began development of prototype low-cost acoustic and magnetic induction navigation transponders and receivers to enable localization in VSW. Began demonstration of VSW technologies during training exercises to assess operational effectiveness.
- (U) ORGANIC MINEHUNTING AND NEUTRALIZATION OF MINES: Began demonstration of advanced technologies for organic mine countermeasures during Fleet training exercises to assess operational effectiveness and develop concept of operations. Demonstrated rapid, organic mine identification using electro-optic sensor (laser line scan technology) and synthetic aperture sonar during FBE Echo (Kernal Blitz). Demonstrated high speed influence minesweeping using ALISS technologies during FBE Echo (Kernal Blitz). Demonstrated control of a high speed, unmanned surface vehicle using an interoperable tactical control system during FBE Echo (Kernal Blitz).
- (U) SURF ZONE (SZ) NEUTRALIZATION OF MINES AND OBSTACLES: Initiated development a system of small, autonomous minehunting vehicles capable of detection, classification of mines and obstacles in the SZ environments. Begin development of air delivered, reactive, intermetallic darts for neutralization of mines on the beach. Developed baseline dart design and began testing of dart lethality against key mine types. Initiated development of Inverse Guidance Law concept which allows guidance of air dropped ordnance with Global Positioning System (GPS) position and velocity state data only.

2. (U) FY 2000 PLAN

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- (U) ADVANCED SURVEILLANCE/RECONNAISSANCE: Continue focused algorithm refinement efforts on critical environmental parameters, including offshore bathymetry, optical clarity, and other essential elements of information appropriate to amphibious operations. Continue transition of critical battle space products to the naval oceanographic office.
- (U) MODELING AND SIMULATION: Continue simulation based concept based assessment of technologies for naval surface fire support and Future Naval Capabilities in Organic Mine Countermeasures. Continue concept visualization of naval surface fire support technologies focusing on air space deconfliction. Continue concept visualization and assessment of organic mine countermeasures technologies focusing on the future Marine Corps warfighting concept of Ship to Objective Maneuver. Participate in Fleet Battle Laboratory experiments and expeditionary warfare wargaming.
- (U) JCM ACTD: Continue logistics support for select ACTD "residual" equipment left with operational forces for further evaluation.
- (U) ADVANCED AIRBORNE TARGET DESIGNATOR: Complete documentation of field test results and quantification of localization errors. Complete transition of airborne target designator technology to Marine Corps Systems Command Ground Weapons for integration in UH-1N and UAVs.
- (U) EXPEDITIONARY WARFARE COMMUNICATIONS NETWORKING: Continue evaluation of advanced high capacity communications links between ships at sea and ship to objectives ashore through assessment during Amphibious Ready Group deployments. Complete analysis and assessment of high capacity radio linkages between ships at sea and ships to objective ashore.
- (U) SURFACE SURVEILLANCE, TARGET ACQUISITION, FIRE CONTROL, AND ORDNANCE: Complete development of actuated control surface for high speed projectile. Conduct wind tunnel tests. Complete development of ultracompact, high G GPS/Inertial Measuring Unit guidance package for high speed projectile. Integrate components and demonstrate guidance and control of an inert, high velocity 5 inch projectile. Begin development of composite metal fleschette and packaging and distribution warhead.
- (U) MINE IDENTIFICATION: Complete integration of component Streak Tube Imaging Laser (STIL) technologies in airborne minehunting sonar (AQS-20) towbody. Initiate development of automated mine identification algorithms.

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Demonstrate mine identification at operational speeds from a surface ship tow. Quantify performance as a function of operational parameters. Demonstrate mine identification from a helicopter tow. Begin transition of STIL mine identification technology to PE 0603502N and PE 0604373N (Airborne Mine Countermeasures).

- (U) LITTORAL SEA MINE: Demonstrate and evaluate assured communications between an underwater testbed and an external surface and subsurface control authority. Demonstrate and evaluate long baseline target detection and tracking sensor hardware and algorithms against quiet underwater targets.
- (U) VSW/EOD RECONNAISSANCE: Develop search strategies which are optimized based on information provided by environmental survey data acquired by search and reconnaissance UUVs. Develop sensing technologies and capability to conjunctively employ sensed information between communicating platforms employing independently acquired sensed data. Demonstrate coordinated navigation and positioning in very shallow water through actual deployments of a search vehicle and inspection vehicle.
- (U) ORGANIC MINEHUNTING AND NEUTRALIZATION OF MINES: Complete analysis of Fleet Battle Experiment demonstration of advanced technologies for organic minehunting. Demonstrate and evaluate the use of a scaleable, interoperable tactical control system common to both UAVs and remote minehunting vehicles. Initiate development of a prototype H-60 compatible, conductively cooled, low temperature superconducting magnetic solenoid for organic sweeping of influence mines.
- (U) SZ NEUTRALIZATION OF MINES AND OBSTACLES: Demonstrate coordinated navigation and positioning in the SZ through actual deployments of an unmanned bottom crawling vehicle. Demonstrate autonomous detection and classification of threat-like bottom objects in the presence of natural and man-made clutter in the SZ. Demonstrate group search (up to 5 vehicles), report back of target information, and marking of targets.
- (U) BEACH ZONE (BZ) NEUTRALIZATION OF OBSTACLES: Complete development of Inverse Guidance Law concept which allows guidance of air dropped ordnance with GPS position and velocity state data only. Assess performance of conventional GPS updated inertial navigation concepts. Continue development and lethality testing of intermetallic darts for neutralization of beach and surf zone mines.

3. (U) FY 2001 PLAN

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- (U) ADVANCED SURVEILLANCE/RECONNAISSANCE: Complete algorithm development efforts on critical environmental parameters, including offshore bathymetry, optical clarity, and other essential elements of information for amphibious operations. Assess performance of algorithms against ground truth data. Transition results to the Naval Oceanographic Office.
- (U) MODELING AND SIMULATION: Continue simulation/visualization based concept based assessment of technologies for naval surface fire support and Future Naval Capabilities in organic MCM. Continue participation in Fleet Battle Laboratory experiments and expeditionary warfare wargaming.
- (U) EXPEDITIONARY WARFARE COMMUNICATIONS NETWORKING: Complete evaluation/assessment of high capacity communications links between ships and objectives ashore. Complete documentation of all deployment assessments.
- (U) SURFACE SURVEILLANCE, TARGET ACQUISITION, FIRE CONTROL, AND ORDNANCE: Complete development of composite metal flechettes and delivery system. Begin integration of guidance, control and warhead technologies into 5 inch projectile.
- (U) MINE IDENTIFICATION: Complete analysis of helicopter towed STIL mine identification technology demonstration. Complete development of automated mine identification algorithms and assess performance utilizing data obtained during ship/helicopter towed technology demonstration. Transition STIL mine identification technology to PE 0603502N and PE 0604373N (Airborne Mine Countermeasures).
- (U) LITTORAL SEA MINE: Integrate target detection/tracking long baseline sensors, detection/tracking algorithms, underwater communications, and test bed weapons system (hybrid lightweight torpedo). Demonstrate target detection, tracking and fire control.
- (U) VSW/EOD RECONNAISSANCE: Demonstrate and evaluate capability to communicate VSW target information to a control authority by one or more methods including surface piercing Radio Frequency technology. Demonstrate asset redirection and command detonation by a remote control. Demonstrate integrated search, marking, bathymetry mapping, threat objects and gaps and report back in test-bed minefields in VSW environments. Demonstrate capability to enable diver teams to efficiently and accurately reacquire previously targeted areas and individual targets. Evaluate covertness of operation and capability to provide complete coverage.

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- (U) ORGANIC MINEHUNTING AND NEUTRALIZATION OF MINES: Develop and demonstrate adaptive, shallow water reconnaissance and minehunting sampling strategies which are optimized based on information provided by environmental survey data and through in-situ environmental measurements. Complete development of conductively cooled, low temperature superconducting magnetic solenoid for organic mine sweeping. Demonstrate magnet functionality and transition to Airborne Mine Countermeasures acquisition program.
- (U) SZ NEUTRALIZATION OF MINES AND OBSTACLES: Demonstrate and evaluate capability to communicate SZ target information to a control authority by one or more methods to include surface piercing RF technology. Demonstrate asset redirection by a remote control authority. Assess neutralization capability for small targets which are predominant in the SZ.
- (U) BZ NEUTRALIZATION OF OBSTACLES: Complete development of GPS only guidance component. Demonstrate accuracy of warhead deployment utilizing GPS only inverse guidance technology. Complete development of intermetallic darts for neutralization of beach and surf zone mines. Initiate development of air delivered, explosively formed impactor for neutralization of beach obstacles. Begin integration of guidance and warhead technologies for demonstration.
- (U) ADVANCED AIRBORNE MINE DETECTION: Initiate development of advanced electro-optic technologies for detection of near surface mines from a maritime UAV. Technologies include Laser Imaging Detection and Ranging, STIL, and hyperspectral imaging. Actual system concept and design will be determined based upon technical maturity, operational viability, and anticipated total ownership cost.

(U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602131M (Marine Corps Landing Force Technology)
- (U) PE 0602314N (Undersea Warfare Surveillance Technology)
- (U) PE 0602315N (MCM, Mining and Special Warfare Technology)
- (U) PE 0602435N (Oceanographic and Atmospheric Technology)

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- (U) PE 0603502N (Surface and Shallow Water MCM)
- (U) PE 0603513N (Shipboard System Component Dev)
- (U) PE 0603528N (Non-Acoustic ASW)
- (U) PE 0603640M (Marine Corpse Advanced Technology)
- (U) PE 0604373N (Airborne Mine Countermeasures)
- (U) PE 0604784N (Distributed Surveillance System)
- (U) PE 0602712A (Countermine Systems)
- (U) PE 0603606A (Landmine WF and Barrier Advanced Technology)

D. (U) SCHEDULE PROFILE: Not Applicable.

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