FY 2004/2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2003
Exhibit R-2

BUDGET ACTIVITY: 3

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

COST: (Dollars in Thousands)

PROJECT NUMBER/ TITLE	FY 2002 ACTUAL	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	FY 2008 ESTIMATE	FY 2009 ESTIMATE
R2917 Mine and Expeditionary Warfare Advanced Technology	44,950	42,761	31,719	30,081	39,282	38,083	38,784	39,537
R2720 Ocean Modeling for Mine & Expeditionary Warfare	1,455	977						
R9166 Modeling the Warrior as a Cognitive System		1247						
Total	46,405	44,985	31,719	30,081	39,282	38,083	38,784	39,537

A. 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 particularly the Organic Mine Countermeasures Future Naval Capability (OMCM FNC) whose purpose is to provide the systems which can easily be deployed to any available afloat asset to clear and/or avoid an adversary minefield, enabling Naval Expeditionary Forces to influence operations ashore.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. PROGRAM CHANGE SUMMARY:

	FY 2002	FY 2003	FY 2004	FY 2005
FY 2003 President's Budget Submission:	49,339	43,725	44,324	43,105
Congressional Plus-Ups	0	+2,275	0	0
Congressional Rescissions/Adjustments/Undist Reductions	-239	-526	0	0
SBIR Adjustment	-859			
Execution Adjustments	-1,836	0	0	0
NWCF Rate Adjustments			-557	-554
Pay Raise/Inflation Adjustments	0	-489	-670	-649
S&T Program Adjustments			-11,378	-11,821
FY 2004/2005 President's Budget Submission:	46,405	44,985	31,719	30,081

FY 2004/2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2003
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BUDGET ACTIVITY: 3

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

PROGRAM CHANGE SUMMARY EXPLANATION:

Schedule: Not applicable
Technical: Not applicable

FY 2004/2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2003
Exhibit R-2a

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

Project Number: R2917
Project Title: Mine and Expeditionary Warfare Advanced Technology

COST: (Dollars in Thousands)

PROJECT NUMBER/ TITLE	FY 2002 ACTUAL	FY2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	FY 2008 ESTIMATE	FY 2009 ESTIMATE
R2917 Mine and Expeditionary Warfare Advanced Technology	44,950	42,761	31,719	30,081	39,282	38,083	38,784	39,537

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project develops and demonstrates prototype Mine Warfare (MIW) system components that support a range of capabilities enabling Naval Expeditionary Forces to influence operations ashore. Third-world nations have the capability to procure, stockpile and rapidly deploy all types of naval mines, including new generation mines having sophisticated performance characteristics, throughout the littoral battlespace. "Operation Desert Storm" demonstrated the requirement to counter the projected third world mine threat. Advanced technologies are required to rapidly detect and neutralize all mine types, from deep water through the beach. This project supports the advanced development and integration of sensors, processing, warheads and delivery vehicles to demonstrate improved MIW capabilities. The activities in this project are: (1) Surveillance and Reconnaissance; and (2) Breaching and Neutralization. These activities support the Organic Mine Countermeasures (OMCM) Future Naval Capability. Within the Naval Transformation Roadmap, this investment will achieve one of three key transformational capabilities required by Sea Shield as well technically enable the Ship to Objective Maneuver (STOM) key transformational capability within Sea Strike.

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 02	FY 03	FY 04	FY 05
Surveillance and Reconnaissance	26,018	21,962	17,553	20,182

The Surveillance and Reconnaissance activity focuses on developing and demonstrating technologies to detect, classify, and identify mines and obstacles throughout the Littoral Penetration Area. Efforts within this activity include: remote sensing techniques to survey threat mining activities and mine/obstacle field locations; advanced acoustic/non-acoustic sensors and processing technologies for rapid minefield reconnaissance and determination of the location of individual mines and obstacles. A major current focus is the development of technologies that provide rapid surveillance and reconnaissance, specifically in the very shallow water, surf zone, and beach zone (VSW,SZ,BZ), that support Ship to Objective Maneuver.

FY 2002 ACCOMPLISHMENTS:

- ADVANCED SURVEILLANCE/RECONNAISSANCE: Continued algorithm refinement efforts on critical environmental parameters, including offshore bathymetry, surface currents, and other essential elements of information for amphibious operations. Updated surveillance exploitation guide. Completed transition of Tier I algorithms for critical battlespace products to the Naval Oceanographic Office.

- MODELING AND SIMULATION: Continued simulation/visualization concept-based assessment of technologies for Future Naval Capabilities in organic Mine Countermeasures (MCM). Completed technology guideline study for mine countermeasures in support of ship to objective maneuver. Initiated system integration of technologies/concepts for mine countermeasures in support of ship to objective maneuver. Continued participation in Fleet Battle Laboratory experiments and expeditionary warfare wargaming. Developed initial prototype planning tool for expeditionary maneuver in a mined environment and provided it to amphibious squadrons for evaluation and feedback. Initiated development of visualization tool for amphibious assault craft to aid in staying in cleared lanes.

- VSW/SZ MINEHUNTING (formerly VSW/EOD Reconnaissance): Continued development of unmanned underwater vehicle (UUV) based optimized search strategies for very shallow water (VSW) reconnaissance. Continued development and demonstration of asset redirection and command redirection by radio frequency and underwater acoustic communication remote control. Continued demonstration of integrated search, marking, bathymetry-mapping threat objects and gaps and reports back in test-bed minefields in VSW environments. Continued demonstration of capability to enable diver teams to efficiently and accurately reacquire previously targeted areas and individual targets. Demonstrated VSW reconnaissance from a high-speed vessel during Fleet Battle Experiment Juliet. Transitioned autonomous underwater vehicle (AUV) technologies and Hydrographic Reconnaissance Littoral Mapping Device to Naval Sea Systems Command.

- ADVANCED AIRBORNE MINE DETECTION: Continued development of advanced electro-optic technologies for detection of near surface mines from a maritime unmanned airborne vehicle (UAV). Initiated development of automated mine/minefield detection and classification algorithms for active/passive electro-optic sensors. Continued development of multi-spectral laser for detection and targeting of minefields from a maritime UAV. Continued development of three-dimensional camera for detection and targeting of minefields.

- DATA FUSION: Initiated multi-platform, multi-sensor fusion of mine countermeasure sensor data. Initiated development and demonstration of a Common Tactical Picture to support expeditionary maneuver planning in a mined environment.

- FLEET DEMONSTRATIONS: Initiated planning for demonstration of mine countermeasures autonomous underwater vehicle (AUV) technologies during Fleet Battle Experiment Juliet (FBE (J)). Conducted Gulf of Mexico Limited Objective Experiment in preparation for FBE (J). Demonstrated deployment and operation of mine countermeasures AUV technologies from a high-speed vessel during FBE (J). Initiated planning for Transparent Hunter 2003 demonstration of mine countermeasure technologies in support of Ship To Objective Maneuver (STOM).

- VECTORED THRUST DUCTED PROPELLER (VTDP) COMPOUND HELICOPTER: Completed modifications to H-60 helicopter for flight testing of the VTDP. Completed pilot-in-the-loop verification of the VTDP flight control system. Continued flight test planning.

FY 2003 PLANS:

- ADVANCED SURVEILLANCE/RECONNAISSANCE: Continue Tier II algorithm refinement efforts on critical environmental parameters, including offshore bathymetry, surface currents, and other essential elements of information for amphibious operations. Optimize processing and data reduction tools for wide area detection of beach mined areas and obstacle belts. Initiate development of Tier III algorithms for critical environmental parameters. Demonstrate wide area detection of beach mined areas during Transparent Hunter 2003.

- MODELING AND SIMULATION: Complete development of visualization tool for amphibious assault craft to aid in staying in cleared lanes. Demonstrate visualization/navigation tool for amphibious assault craft lane keeping during Kernal Blitz 03 (Third Fleet Training Exercise). Continue simulation/visualization concept-based assessment of technologies for Future Naval Capabilities in organic MCM. Continue system integration of technologies/concepts for mine countermeasures in support of ship to objective maneuver. Continue participation in Fleet Battle Laboratory experiments and expeditionary warfare wargaming.

- VSW/SZ MINEHUNTING: Complete development of UUV based optimized search strategies for VSW reconnaissance. Continue demonstration of integrated search, marking, bathymetry mapping, threat objects and gaps and report back in test-bed minefields in VSW environments. Continue demonstration of capability to enable diver teams to efficiently and accurately reacquire previously targeted areas and individual targets. Demonstrate magneto-inductive firing device for remote triggering of neutralization charges. Demonstrate multi platform, coordinated VSW reconnaissance during FY03 Fleet Exercises.

- ADVANCED AIRBORNE MINE DETECTION: Continue development of advanced Electro-optic technologies for detection of near surface mines from a maritime unmanned airborne vehicle (UAV). Continue development of automated mine/minefield detection and classification algorithms for active/passive electro-optic sensors.

Complete development of multi-spectral laser for detection and targeting of minefields from a maritime UAV. Complete development of three-dimensional camera for detection and targeting of minefields. Initiate integration of multi—spectral laser and three-dimensional camera on a UAV testbed. Demonstrate night illumination techniques by using an Airborne Laser Diode Array Illuminator (ALDAI) in a COBRA-type mission, i.e. detection of land minefields from an airborne (Tactical UAV) platform.

- DATA FUSION: Continue multi-platform, multi-sensor fusion of mine countermeasures focusing on fusion of AV 15 kingfisher mode data for improved mine detection and avoidance. Continue improvements to AV 15 processing string. Initiate fusion of Nuclear Quadrapole Resonance (NQR) sensor with primary detection sensors to reduce false alarms.

- FLEET DEMONSTRATIONS: Complete documentation of FBE (J) exercise results. Complete the planning, then demonstrate mine countermeasures technologies in support of ship to objective maneuver during Transparent Hunter 03 (3^{rd} Fleet Exercise). Initiate analysis of Transparent Hunter exercise. Demonstrate integrated AUV minehunting operations from a Surface Mine Countermeasures Vehicle (SMCMV).

- VECTORED THRUST DUCTED PROPELLER (VTDP) COMPOUND HELICOPTER: Complete flight test planning.

FY 2004 PLANS:

- ADVANCED SURVEILLANCE/RECONNAISSANCE: Continue Tier III algorithm refinement efforts on critical environmental parameters, including offshore bathymetry, surface currents and other essential elements of information for amphibious operations. Complete transition of Tier II algorithms for critical battlespace products to the Naval Oceanographic Office and demonstrate operational integration.

- MODELING AND SIMULATION: Improve functionality of expeditionary warfare decision support software to include domain interpretation rules, active templates, and intelligent agents. Continue system integration of technologies/concepts for mine countermeasures in support of ship to objective maneuver. Continue participation in Fleet Battle Laboratory experiments and expeditionary warfare wargaming.

- VSW/SZ MINEHUNTING: Continue demonstration of integrated search, marking, bathymetry mapping, threat objects and gaps and report back in test-bed minefields in VSW environments. Continue demonstration of capability to enable diver teams to efficiently and accurately reacquire previously targeted areas and individual targets. Transition Diver Visual Interface System to Program Management Office, Explosive Ordnance Disposal (PMS-EOD). Integrate synthetic aperture sonar on VSW UUV system. Transition Search-Classify-Map UUV system to PMS-EOD. Transition acoustic micro-modem to NAVAL SEA SYSTEMS COMMAND product improvement program. Transition Computer Aided Detection, Computer Aided Classification System to NAVAL

SEA SYSTEMS COMMAND product improvement program. Transition Diver Charting and Graphical Display System to PMS-EOD. Develop demonstration of UUV target reacquisition with simulated neutralization. Demonstrate multi platform, coordinated VSW reconnaissance and reacquisition/identification during Fleet Exercises in FY04.

- ADVANCED AIRBORNE MINE DETECTION: Finalize development and testing of Rapid Overt Airborne Reconnaissance (ROAR) system for automated mine/minefield/obstacle detection in the VSW, SZ and BZ - using a scanning laser with a 3-D receiver for VSW and SZ capability and the multi-spectral capability for land-based detection in the BZ. Initiate a Broad Agency Announcement for advanced development for airborne buried minefield detection for over the beach, inward to the Beach Exit Zone.

- DATA FUSION: Continue multi-platform, multi-sensor fusion of mine countermeasure sensor data. Continue development of multi-platform fusion of AV 15 Kingfisher mode data for improved mine detection and avoidance. Continue improvements to AV 15 processing string for mine detection and avoidance. Initiate development of fusion between AV 15 detections and those from high-resolution mine hunting systems (e.g. AN/AQS-20).

- FLEET DEMONSTRATIONS: Complete documentation of FY03 technology demonstrations' results. Initiate planning for demonstration of mine countermeasures technologies during FY04 fleet training exercises and experiments of opportunity.

FY 2005 PLANS:

- ADVANCED SURVEILLANCE/RECONNAISSANCE: Complete development and transition of Tier III algorithms for critical battlespace products to the Naval Oceanographic Office and demonstrate operational integration.

- MODELING AND SIMULATION: Continue system integration of technologies/concepts for mine countermeasures in support of ship to objective maneuver. Continue participation in Fleet Battle Laboratory experiments and expeditionary warfare wargaming.

- VSW/SZ MINEHUNTING: Continue demonstration of integrated search, marking, bathymetry mapping, threat objects and gaps and report back in test-bed minefields in VSW environments. Continue demonstration of capability to enable diver teams to efficiently and accurately reacquire previously targeted areas and individual targets. Perform field evaluation of synthetic aperture sonar on UUV. Demonstrate UUV target reacquisition with simulated neutralization in Fleet Exercise.

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Exhibit R-2a

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

Project Number: R2917
Project Title: Mine and Expeditionary Warfare Advanced Technology

- ADVANCED AIRBORNE MINE DETECTION: Demonstrate full capability to detect mines, mine lines, and minefields during a fleet exercise with the Rapid Overt Airborne Reconnaissance (ROAR) system.

- DATA FUSION: Continue multi-platform, multi-sensor fusion of mine countermeasure sensor data. Continue development of multi-platform fusion of AV 15 Kingfisher mode data for improved mine detection and avoidance. Continue improvements to AV 15 processing string for mine detection and avoidance. Continue development of fusion between AV 15 detections and those from high-resolution mine hunting systems (e.g. AN/AQS-20). Initiate development of multi-sensor fusion of Long-Term Mine Reconnaissance System (LMRS) sensors with other high-resolution mine hunting sensors and AV 15 data. Continue development and demonstration of a Common Tactical Picture to support expeditionary maneuver planning in a mined environment.

- FLEET DEMONSTRATIONS: Complete documentation of FY04 exercise results. Continue planning for near term demonstrations of mine countermeasure technologies in support of ship to objective maneuver. Demonstrate mine countermeasure technologies in support of ship to objective maneuver during fleet training and readiness exercises and experiments.

	FY 02	FY 03	FY 04	FY 05
Breaching and Neutralization	18,932	20,799	14,166	9,899

The Breaching and Neutralization activity focuses on developing and demonstrating technologies for stand-off breaching of mines and obstacles in the surf and beach zones and precision neutralization of individual sea mines. Research areas within this activity include: influence sweeping technologies for influence minefield clearance, explosive and non-explosive technologies for mine/obstacle field breaching, and advanced technologies to rapidly neutralize near-surface sea mines. A major current focus is the development of technologies that provide rapid detection and standoff breaching of mines and obstacles, specifically in the very shallow water/surf zone/beach zone (VSW/SZ/BZ) that enable Ship to Objective Maneuver.

FY 2002 ACCOMPLISHMENTS:

- SZ NEUTRALIZATION OF MINES AND OBSTACLES: Continued development of chemical and reactive darts for neutralization of beach and surf zone mines. Continued development of dispensing technologies for distributing reactive and chemical darts. Continued testing of chemical dart lethality against representative beach zone mines. Initiated demonstration of dart lethality against representative surf zone mines. Initiated integration of chemical and reactive dart warhead payload and delivery platform for

system levels demonstration.

- BZ NEUTRALIZATION OF OBSTACLES: Continued development of air delivered, continuous rod warhead for neutralization of beach obstacles.

- ORGANIC MINEHUNTING AND NEUTRALIZATION OF MINES: Initiated a broad area announcement (BAA) for the development and demonstration of mine countermeasures mission packages from an unmanned surface vehicle (USV). Initiated unmanned surface vehicle tow body motion measurements and analysis.

FY 2003 PLANS:

- SZ NEUTRALIZATION OF MINES AND OBSTACLES: Continue development of chemical and reactive darts for neutralization of beach and surf zone mines. Continue development of dispensing technologies for distributing reactive and chemical darts. Complete demonstration of chemical and reactive dart lethality against representative surf zone mines. Begin integration of chemical dart warhead payload and delivery platforms for system level demonstration. Initiate development of a system concept employing guided bombs for SZ neutralization. Begin advanced development of assault lane navigation system.

- BZ NEUTRALIZATION OF OBSTACLES: Continue development of air delivered, continuous rod warhead for neutralization of beach obstacles. Initiate development of a system concept for BZ neutralization.

- ORGANIC MINEHUNTING AND NEUTRALIZATION OF MINES: Initiate development of minesweeping mission package technologies and begin integration onto an Unmanned Surface Vehicle. Complete Unmanned Surface Vehicle tow body motion measurement and analysis.

FY 2004 PLANS:

- SZ NEUTRALIZATION OF MINES AND OBSTACLES: Complete development of chemical and reactive darts for neutralization of beach and surf zone mines. Continue development of dispensing technologies and integration of chemical and reactive dart warhead payload and delivery platforms for system level demonstrations. Continue development of a system concept employing guided bombs for SZ neutralization of mines and obstacles.

- BZ NEUTRALIZATION OF OBSTACLES: Continue development of air delivered, continuous rod warhead and integration onto delivery platforms for system level demonstrations. Continue development of system concept employing guided bombs for BZ neutralization.

- ORGANIC MINEHUNTING AND NEUTRALIZATION OF MINES: Complete development and integration of mine sweeping mission package on an Unmanned Surface Vehicle. Begin experimentation of autonomous mine sweeping operations from a High Speed Vessel (HSV) during a fleet training exercise or fleet battle experiment.

FY 2005 PLANS:

- SZ NEUTRALIZATION OF MINES AND OBSTACLES: Complete development of dispensing technologies and integration of chemical and reactive dart warhead payload and delivery platforms for system level demonstrations. Demonstrate a system concept employing guided bombs for SZ neutralization of mines and obstacles.

- BZ NEUTRALIZATION OF OBSTACLES: Complete development of air delivered, continuous rod warhead for neutralization of beach obstacles. Continue integration of the continuous rod warhead and delivery platforms for system level demonstrations. Demonstrate a system concept employing guided bombs for BZ neutralization of mines and obstacles.

- ORGANIC MINEHUNTING AND NEUTRALIZATION OF MINES: Initiate development of minehunting mission package on an Unmanned Surface Vehicle. Continue experimentation of autonomous mine sweeping operations from a High Speed Vessel (HSV) during a fleet training exercise or fleet battle experiment focusing on multiple Unmanned Surface Vehicle operations (with supervision).

C. OTHER PROGRAM FUNDING SUMMARY:

NAVY RELATED RDT&E:
PE 0601153N (Defense Research Sciences)
PE 0602131M (Marine Corps Landing Force Technology)
PE 0602747N (Undersea Warfare Applied Research)
PE 0602782N (Mine and Expeditionary Warfare Applied Research)
PE 0602435N (Ocean Warfighting Environment Applied Research)
PE 0603502N (Surface and Shallow Water Mine Countermeasures)
PE 0603513N (Shipboard System Component Development)
PE 0603640M (Marine Corps Advanced Technology Demo)
PE 0604373N (Airborne Mine Countermeasures)
PE 0604784N (Distributed Surveillance System)

NON-NAVY RELATED RDT&E:
PE 0602712A (Countermine Systems)
PE 0603606A (Landmine Warfare and Barrier Advanced Technology)

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

Project Number: R2917
Project Title: Mine and Expeditionary Warfare Advanced Technology

D. ACQUISITION STRATEGY: Not applicable.

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BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603782N Project Number: Various
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology Project Title: Congressional Plus-ups

Congressional Plus-Ups:

R2720	FY 02	FY 03
Ocean Modeling for Mine & Expeditionary Warfare	1,455	977

The objective of this effort is to continue maintenance of an ocean observational and data management system for the Gulf of Maine and to demonstrate the exploitation of a common environment for enhancing expeditionary operations in a mined environment.

R9166	FY 02	FY 03
Modeling the Warrior as a Cognitive System	0	1,247

The objective of this effort is to design and implement new methodologies for modeling warrior competencies and capabilities across operations, support and training. As new missions develop, there is a need to better understand the warrior’s human factors and develop situation-specific models.