FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Applied Research

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
	**	**	57,668

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & FY 2001 was funded in PE 0602315N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Navy program element (PE) provides technologies for naval Mine Countermeasures (MCM), U.S. Naval sea mines, Naval Special Warfare, and Department of Defense (DOD) Explosive Ordnance Disposal (EOD). It is strongly aligned with the Joint Chiefs of Staff Joint Warfighting Capabilities through the development of technologies to achieve military objectives (Power Projection from the Sea) with minimal casualties and collateral damage. The PE supports the Joint Littoral Warfare Mission Area by focusing on technologies that will provide the Naval Force with the capability to dominate the battlespace, project power from the sea, and support forces ashore with particular emphasis on rapid MCM operations. The MCM thrusts concentrate on the development and transition of technologies for organic mine countermeasures and Future Naval Capabilities supporting Ship to Objective Maneuver. These include technologies for clandestine minefield surveillance and reconnaissance, organic self-protection, organic minehunting, neutralization/breaching and clearance. The sea mining thrust emphasizes offensive sea mining capabilities. The Naval Special Warfare and EOD technology thrust concentrates on the development of technologies for near-shore mine/obstacle detection and clearance, mobility and survivability, as well as explosive ordnance disposal.

(U)MCM Technology: 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. “Desert Storm” demonstrated the U.S. Navy’s needs to counter the projected third-world mine threat. Advanced technologies are required to rapidly detect and neutralize all mine types, from deep water to the beach. This task has two major thrusts: (1) Mine/obstacle detection and (2) mine/obstacle neutralization. The detection thrust includes: remote sensing techniques to survey threat mining activities and mine/obstacle field locations; advanced acoustic/non-acoustic sensors and processing technologies (e.g. biomimetic, broadband, synthetic aperture) for rapid minefield reconnaissance and determination of the location of individual mines and obstacles. The neutralization thrust includes influence sweeping technologies for influence minefield clearance, explosive and non-explosive technologies for mine/obstacle field breaching, and advanced technologies to rapidly neutralize shallow water (SW) sea mines. The overall goal of the MCM technology thrust is the reduction of MCM tactical timelines and increased stand-off.

(U)Mine Technology: The requirements for improved sea mine technologies has changed due to the reduced threat of the traditional modern submarines and surface ships. The elevated threats today are the third-world submarines and surface

ships, which may be encountered in the littoral waters of regional conflicts. Despite the diminished sophisticated threat, it is imperative that the US Navy maintains a broad-based and robust sea mining capability through advanced mine sensors, environmental characterization, and systems performance analysis technologies. Emphasis is placed on potentially high payoff advanced sensors for target detection and discrimination and on low cost, wide area sea mine system concepts, including positive command/control mechanisms and expanded weapon effectiveness for regional warfare.

(U) Special Warfare Technology: Naval Special Warfare (NSW) missions primarily support covert naval operations. The goal is to develop technology required to increase the combat range and effectiveness of Special Warfare units. A major current focus is to develop technologies to enhance the Sea-Air-Land mission of pre-invasion detection for clearance/avoidance of mines and obstacles in the very shallow water (VSW) and surf zone (SZ) approaches to the amphibious landing areas. Improvements to mission support equipment are needed to increase the probability of mission success, endurance and SEAL swimmer survivability.

(U) EOD Technology: Technology development for EOD needs addresses the DOD Joint Service and interagency responsibilities in EOD, including that required to counter and neutralize Weapons of Mass Destruction (WMD). The technologies developed are required for locating, rendering safe and disposing of Unexploded Explosive Ordnance (UXO). These operations typically occur in deep, poor-visibility water, in areas of high background noise, and in strategic operating areas contaminated by a variety of UXO. Advanced technologies are needed for gaining access to areas contaminated by sophisticated area-denial sensors and/or booby traps and for contending with WMD. These technologies are expected to transition to the Joint Service EOD Program, the Naval EOD Program or the DOD Technical Response Group.

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

(U) Due to the sheer number of efforts in this PE, the programs described are representative of the work included in this PE.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within APPLIED RESEARCH, Budget Activity, because it investigates technical advances with possible applications toward solution of specific Naval problems, short of a major development effort.

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

Mine and Obstacle Detection	**FY00**	**FY01**	**FY02 (36,168)**
Initiate	• Field testing of thin film,	• Transition of CAD/CAC	• Real-time processing for airborne

	high temperature supercoducting gradiometer • Multi-platform, multi-sensor data fusion for organic mine countermeasures • Development of advanced electro-optic mine identification sensor • Development of automated mine identification algorithms • Mine burial prediction model development	algorithms to AQS-20 airborne mine countermeasures program • Environmentally adaptive processing	lidar/multispectral minefield detection • Development of long range SAS motion compensation and beamforming • Development of environmental tactical decision aids • Modeling and simulation for adaptive planning of amphibious operations • Development of Autonomous Underwater Vehicle (AUV) compatible low frequency, buried minehunting sonar • Transition of automated mine identification algorithms to AQS-20/X airborne mine countermeasures program
Continue	• Development of scene classification algorithms based on target optical properties • Development of broadband acoustic processing techniques/algorithms • Development of computer aided detection/classification (CAD/CAC) algorithms for side scan imagery • Development of thin film, high temperature superconducting gradiometer	• Multi-platform, multi-sensor data fusion • Development of advanced electro-optic mine identification sensor • Development of broadband acoustic processing techniques/algorithms • Environmentally adaptive processing • Automated mine identification algorithms • Mine burial prediction algorithm development	• Development of advanced electro-optic mine identification sensor • Development of broadband acoustic processing techniques/algorithms • Mine burial prediction • Development of automated mine identification algorithms

Complete	• Development of broadband sonar projector for synthetic aperture sonar (SAS) • Demonstrated CAD/CAC algorithms in very shallow water during Fleet Battle Experiment Hotel.	• Field test and assessment of thin film, high temperature superconducting gradiometer • Field testing of broadband SAS technology • Collection of electrooptic mine identification sensor data for assessment of automated mine identification algorithms • Mine burial prediction field experiment focusing on impact burial • Demonstration of minehunting technologies during 3rd Fleet training exercise (Kernal Blitz 2001)	• Transition of CAD/CAC algorithms to AQS-20 airborne mine countermeasures program

Mine and Obstacle Neutralization	**FY00**	**FY01**	**FY02 (9,900)**
Initiate	• Development of linear shaped charge array anti-obstacle technology	• Lethality studies for chemical penetrator warhead concept • Development of continuous rod warhead technology for obstacle clearance	• Development of advanced supercavitating anti-mine projectile
Continue	• Nondeterministic modeling of mine vulnerability • Development and evaluation of small unmanned bottom robotic platforms for Surf Zone (SZ) reconnaissance and targeting • Development of database for	• Nondeterministic modeling of mine vulnerability • Model development of shock interaction with and propagation through the sea bed	• Nondeterministic modeling of mine vulnerability • Model development of shock interaction and propagation through the sea bed

	damage characteristics of obstacles		
Complete	• Testing of High Energy Low Pressure (HELP) explosive technology to promote pressure impulse characterization • Transitioned mine kill criteria for new threat mines to PMS-407	• Assessment of sequential and simultaneous detonationing bombs for obstacle clearance	• Demonstration of chemical and pyrotechnic dart lethality against common SZ and beach zone mines (BZ) • Demonstrate effectiveness of continuous rod warhead against light and medium beach obstacles

Sea Mining	**FY00**	**FY01**	**FY02 (1,200)**
Initiate	• Demonstration of mine network concept • Field tests of guidance sensors and signal processing for Distributed Autonomous Detection System (DADS) weapon • Development of command and control hardware/software for minefield control	• Field test of command and control of DADS weapon	
Continue	• Development of guidance sensors	• Demonstration of mine network concept • Development of command and control hardware/software for minefield control	• Development of command and control hardware/software for minefield control • Field test of command and control of DADS weapon
Complete	• Development of hardware/software to demonstrate feasibility of DADS weapon concept	• Field tests of guidance sensors and signal processing for DADS weapon	• Analysis/documentation of guidance sensors and signal processing field tests
Special Warfare/ EOD	**FY00**	**FY01**	**FY02 (10,400)**

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Applied Research

Initiate	• Development of deployable virtual environment based training aid and tactical decision aid • Design of Shallow Water Imaging Polarimeter (SHRIMP) EOD • Development of robotic actuators and manipulators based on artificial muscle materials • Development of SAS for small autonomous search vehicles	• Investigate technology options for heating system for Swimmer Deliver Vehicle (SDV) EOD • Development of technologies to remotely jam or disable electronic safed armed fused devices.	• Development of hyperspectral polarometer prototype
Continue	• Development of life support technologies • Development of Buried minehunting dual frequency sonar • Development of Unmanned underwater vehicle (UUV) technologies to support VSW reconnaissance missions EOD • Development of diver portable high frequency acoustic imaging sonar	• Development of life support equipment technologies • UUV technologies to support VSW reconnaissance missions • Development of virtual environment based training aid and tactical decision aids for Navy Special Warfare missions • Development of SAS for small autonomous search vehicles EOD • Development of robotic manipulators and actuators based on artificial muscle materials • Development of coordinated behavior and mission execution by UUVs	• Development of life support equipment technologies • UUV technologies to support VSW reconnaissance missions • Development of virtual environment based training aid and tactical decision aids for NSW missions
Complete			

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Applied Research

	• Feasibility assessment of hyperspectral imaging polorimeter technology • Fabricated test bed for catalyst free CO2 scrubber EOD • Transitioned diode pumped laser to Environmental Security Technology Certification Program (ESTCP)	• Field tests and evaluation of buried minehunting sonar • Transition underwater photo curable adhesive technology to PMS-EOD	• Field tests of synthetic aperture sonar integrated on a UUV • Field tests of SHRIMP sensor EOD • Field tests of diver portable high frequency imaging sonar

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	**	**	
Adjustments from FY 2001 President's Budget:			
PE Restructure			57,675
NWCF Rates Adjustment			-4
Non Pay Inflation Adjustment			68
Program Adjustment			-71
FY 2002 PRESBUDG Submission	**	**	57,668

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & FY 2001 was funded in PE 0602315N.

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.
(U) Schedule: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy's 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602131M (Marine Corps Applied Research)
(U) PE 0602236N (Warfighter Sustainment Applied Research)
(U) PE 0602747N (Undersea Warfare Applied Research)
(U) PE 0602435N (Ocean Warfighting Environment Applied Research)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Applied Research

(U) PE 0603502N (Surface and Shallow Water Mine Countermeasures)
(U) PE 0603654N (Joint Service EOD Development)
(U) PE 0603782N (Mine and Expeditionary Warfare Advanced Research)
(U) PE 0604654N (Joint Service EOD Development)
(U) PE 0603640M (Marine Corps Advanced Technology Demo)

(U) NON NAVY RELATED RDT&E:
(U) PE 0602712A (Countermine Systems)
(U) PE 0603606A (Landmine WF and Barrier Advanced Technology)
(U) PE 1160401BB (Special Operation Technology Development)
(U) PE 1160402BB (Special Operation Advanced Technology Development)

(U) SCHEDULE PROFILE: Not applicable.