FY 2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2008
Exhibit R-2

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: MINE AND EXPEDITIONARY WARFARE ADVANCED TECHNOLOGY

COST: (Dollars in Thousands)

| Project Number & Title | FY 2007 Actual | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | FY 2012 Estimate | FY 2013 Estimate |
|---|---|---|---|---|---|---|---|
| **Total PE** | 23,797 | 28,253 | 33,426 | 31,414 | 27,963 | 15,221 | 25,169 |
| 2917 MINE AND EXPEDITIONARY WARFARE ADVANCED TECHNOLOGY | 19,816 | 26,464 | 33,426 | 31,414 | 27,963 | 15,221 | 25,169 |
| 9999 CONGRESSIONAL PLUS-UPS | 3,981 | 1,789 | 0 | 0 | 0 | 0 | 0 |

**A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:** The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Jan 2007). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE primarily develops and demonstrates prototype Mine Countermeasures (MCM) and Expeditionary Warfare system components that support capabilities enabling Naval 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. Real world operations have demonstrated the requirement to quickly counter the mine threat. Advanced technologies must rapidly detect and neutralize all mine types, from deep water to the inland objective. This program supports the advanced development and integration of sensors, processing, warheads and delivery vehicles to demonstrate improved Naval Warfare capabilities. It supports the MCM-related Future Naval Capabilities (FNC) Enabling Capabilities (ECs). Within the Naval Transformation Roadmap, this investment will achieve one of

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three key transformational capabilities required by Sea Shield as well as technically enable the Ship To Objective Maneuver (STOM) key transformational capability within Sea Strike.

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

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**B. PROGRAM CHANGE SUMMARY:**

| | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|
| FY 2008/FY 2009 President's Budget Submission | 25,324 | 26,840 | 33,877 |
| Congressional Action | 0 | 1,800 | 0 |
| Congressional Undistributed Reductions/Rescissions | 0 | -182 | 0 |
| Execution Adjustments | -1,201 | 0 | 0 |
| Program Adjustments | 0 | 0 | -365 |
| Rate Adjustments | 0 | 0 | -86 |
| SBIR Assessment | -326 | -205 | 0 |
| FY 2009 President's Budget Submission | 23,797 | 28,253 | 33,426 |

**PROGRAM CHANGE SUMMARY EXPLANATION:**
Technical: Not applicable.

Schedule: Not applicable.

**C. OTHER PROGRAM FUNDING SUMMARY:**
Not applicable.

**D. ACQUISITION STRATEGY:**
Not applicable.

**E. PERFORMANCE METRICS:**
The overall metrics of this advanced technology program are the development of technologies supporting the Mine and Expeditionary Warfare challenges of reducing the MCM tactical timeline from months to days and eliminating the need for Navy divers and manned equipment to enter minefields. Another important metric is the scheduled transition of 6.3 advanced technology projects from the FNCs program into Navy and Marine Corps acquisition programs at agreed upon Technology Readiness Levels. Technology-specific metrics include: Mine warfare data fusion capabilities yielding a 10%-25% reduction in time and risk to mine hunting activities; Mine hunting sensors - Probability of Detection = 95%, Probability of Identification of Proud Mines = 90%,

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Probability of Classification of Buried Mines = 80%; Unmanned Systems for MCM sized for inclusion in the Littoral Combat Ship Mine Warfare Mission Package; MCM sensors sized, packaged and capable of 12 hour missions with a search rate greater than .05 square nautical mines per hour; Mine sweeping: Modular magnetic and acoustic influence sweeping systems packaged for deployment from Unmanned Surface Vehicles; Minesweeping single sortie coverage > 9.4 square nautical miles at 20 nautical miles per hour during a 4 hour mission up to Sea State 3; Surface-laid mine and obstacle breaching capability > 90% in the Beach Zone (BZ) using unitary warheads, and > 80% in the Surf Zone (SZ).

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COST: (Dollars in Thousands)

| Project Number & Title | FY 2007 Actual | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | FY 2012 Estimate | FY 2013 Estimate |
|---|---|---|---|---|---|---|---|
| 2917 MINE AND EXPEDITIONARY WARFARE ADVANCED TECHNOLOGY | 19,816 | 26,464 | 33,426 | 31,414 | 27,963 | 15,221 | 25,169 |

**A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:** This project primarily develops and demonstrates prototype MCM technologies that support a range of capabilities enabling Naval 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. Recent operations have demonstrated the requirement to counter the projected mine threat. Advanced technologies are required to rapidly detect and neutralize all mine types, from deep water to the inland objective. This project supports the advanced development and integration of sensors, processing, warheads and delivery vehicles. It supports the MCM-related FNC ECs.

**B. ACCOMPLISHMENTS/PLANNED PROGRAM:**

| | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|
| **MINE/OBSTACLE DETECTION** | 12,152 | 14,287 | 18,983 |

This activity focuses on developing and demonstrating technologies that support detection, classification, identification and multi-sensor data fusion of mine and obstacle data to speed tactical timelines and increase operator standoff. Efforts include: electro-optic sensors/systems to enable Unmanned Aerial Vehicle (UAV) rapid minefield reconnaissance and precise mineline location from Very Shallow Water (VSW) through the BZ; sensors/systems to enable cooperating Unmanned Underwater Vehicles (UUVs) to perform wide-area reconnaissance and assault lane reconnaissance/preparation from shallow water through the SZ; sensor development for detection and classification of buried mines; technologies for MCM Mission Modules for the new Littoral Combat Ships (LCS); and sensor data fusion to enable a theater mine warfare common operating picture and own ship protection. This activity supports the development and transition of technologies for the MCM-related FNCs.

The increase from FY 2008 to FY 2009 reflects the increased investment in the MCM critical S&T areas of Buried

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Mine Sensors and Processing; Undersea Cooperative Cueing (for UUVs); and MCM Sensors for the LCS. The FY 2009 budget reflects the transition of 6.2 applied research into advanced technology development (6.3). Acquisition Programs of Record at the Naval Seas Systems Command have program objectives memorandum funding for the transition of these S&T products from 6.3 to 6.4.

This S&T investment supports the Joint Requirements Oversight Council of the Joint Chiefs of Staff and Office of the Chief of Naval Operations (OPNAV) validated requirements for MCM. This S&T investment of mine and obstacle detection provides critical S&T transitions to the Mine Warfare Mission package of the Navy's new LCS. This investment in MCM S&T is reported as part of OPNAV's annual report to Congress in the MCM Certification Plan. This plan is reviewed and approved by the Office of the Secretary of Defense, and any deviations in ONR's reported S&T funding for MCM throughout the Future Years Defense Plan must be reported and justified through Navy and OSD. Further, the MCM S&T investment plan structure is reviewed and authorized by the Navy's Technology Oversight Group that approves ECs, their supporting products, and funding profiles.

**FY 2007 Accomplishments:**

-Continued demonstration of capability to enable diver teams with UUVs to efficiently and accurately reacquire previously targeted areas and individual targets.
-Continued demonstration of integrated UUV: search; marking; mapping of bathymetry, threat objects and gaps; and report back in test-bed minefields in VSW environments.
-Continued development of multi-platform fusion from high-resolution mine hunting systems (e.g. AN/AQS-20) for improved mine detection and avoidance.
-Continued development of Rapid Overt Airborne Reconnaissance (ROAR) multi-spectral laser, 3-D camera for airborne VSW/SZ/BZ day/night mine/minefield/ obstacle detection.
-Completed helo integration and first flight test of the ROAR sensor.
-Completed integration of Laser Scalar Gradiometer (LSG) into UUV and field evaluation of LSG performance against buried mines.
-Completed transition of the small object avoidance processing string in the SQS-53C Integrated Peer Review (IPS) adjunct processing system.
-Completed demonstration of buried minehunting systems on UUV platforms with a combined LSG and dual frequency Synthetic Aperture Sonar sensor suite in a UUV in a Fleet exercise.
-Completed flight testing of Tactical Multi-Spectral Imaging (TACMSI) passive multi-spectral sensor for detection of surface mines and obstacles in the BZ/SZ.
-Initiated multiple unmanned system MCM data fusion techniques for reduction in false alarms and reduction in

tactical timelines.
-Initiated technology development, integration and early demonstration planning for MCM Mission Module systems for Advanced Flight LCS.
-Initiated advanced processing development for Low Frequency Broad Band to enable rapid detection, classification and identification of buried sea mines.
-Initiated development of Tactical Unmanned Aerial Vehicle (TUAV)-based SZ/BZ buried minefield detection capability.

**FY 2008 Plans:**

-Continue all FY 2007 efforts less those noted as completed above.
-Complete demonstration of capability to enable diver teams with UUVs to efficiently and accurately reacquire previously targeted areas and individual targets.
-Complete demonstration of integrated UUV: search; marking; mapping of bathymetry, threat objects and gaps; and report back in test-bed minefields in VSW environments.
-Complete transition of ROAR sensor technology to PMS-495.
-Initiate buried mine sensing identification processing.
-Initiate technology development for multiple UUV Undersea Cooperative Cueing and Intervention in support of MCM operations.

**FY 2009 Plans:**

-Continue all FY 2008 efforts less those noted as completed above.
-Complete development of multi-platform fusion of high-resolution mine hunting systems (e.g. AN/AQS-20) for improved mine detection and avoidance.
-Complete multiple unmanned system MCM data fusion techniques for reduction in false alarms and reduction in tactical timelines.
-Complete buried mine sensing identification processing development.

| | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|
| **MINE/OBSTACLE NEUTRALIZATION** | 7,664 | 12,177 | 14,443 |

Mine and Obstacle Neutralization activity is focused on improving the capability to neutralize mines and obstacles from deep water through the beach exit zone. Efforts include the development of technologies for:

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stand-off breaching of mines and obstacles in the SZ/BZ; minesweeping and jamming of sea mines; and Autonomous Underwater Vehicle (AUV) neutralization of sea mines. Stand-off breaching efforts demonstrate a mine and obstacle breaching capability that is enabled by precision weapon guidance and Intelligence, Surveillance, and Reconnaissance (ISR), and delivered by Naval Tactical Aircraft (TACAIR) and USAF Bombers. Tactical performance of existing unitary bombs is being demonstrated. Other efforts will demonstrate a tactical countermine dart and dispenser concept. The minesweeping effort develops a mission package for deployment on Unmanned Surface Vehicles (USVs). Also, efforts will focus on improving an existing breaching weapon fuze and developing a precision assault lane marking navigation capability. This activity supports the development and transition of technologies for the MCM-related FNC ECs.

The funding profile from FY 2007 through FY 2009 reflects the increased emphasis on developing FNC products in AUV technology for neutralization of sea mines, assault lane navigation and improvements to breaching weapons.

**FY 2007 Accomplishments:**

-Continued development of low drag, low frequency sound source for mine influence sweeping.
-Completed development and demonstration of USV minesweeping module concept and began transition to PMS-495.
-Completed countermine dart lethality optimization.
-Completed Mine/Obstacle Defeat System (MODS) flight test with live darts and tactical mines.
-Completed transition of countermine dart technology to PMS-495.
-Completed countermine dart dispense flight tests with inert darts.
-Initiated development of an autonomous mine neutralization system for VSW MCM.
-Initiated development of advanced Mine Warfare Mission module capabilities in support of the LCS Mine Warfare mission.
-Initiated development effort to extend effectiveness of unitary warheads to greater depths and initiated planning of flight demo with Naval Special Clearance Team 1.
-Initiated technology development of precision navigation capability for targeting, safe navigation through assault lanes including lane marking.

**FY 2008 Plans:**

-Continue all FY 2007 efforts.
-Complete development of low drag, low frequency sound source for mine influence sweeping.
-Initiate development of an AUV system for neutralization of littoral mines.

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**FY 2009 Plans:**

-Continue all FY 2008 efforts.

**C. OTHER PROGRAM FUNDING SUMMARY - NAVY RELATED RDT&E:**
PE 0601153N Defense Research Sciences
PE 0602131M Marine Corps Landing Force Technology
PE 0602435N Ocean Warfighting Environment Applied Research
PE 0602747N Undersea Warfare Applied Research
PE 0602782N Mine and Expeditionary Warfare Applied Research
PE 0603502N Surface and Shallow Water Mine Countermeasures
PE 0603513N Shipboard System Component Development
PE 0603640M USMC Advanced Technology Demonstration (ATD)
PE 0604373N Airborne MCM
PE 0604784N Distributed Surveillance System

**OTHER PROGRAM FUNDING SUMMARY - NON-NAVY RELATED RDT&E:**
PE 0602712A Countermine Systems
PE 0603606A Landmine Warfare and Barrier Advanced Technology

**D. ACQUISITION STRATEGY:**
Not applicable.

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PROJECT NUMBER: 9999 PROJECT TITLE: CONGRESSIONAL PLUS-UPS

**CONGRESSIONAL PLUS-UPS:**

| | FY 2007 | FY 2008 |
|---|---|---|
| JEOD DIVER SITUATIONAL AWARENESS SYSTEM | 1,749 | 795 |

FY07: This project initiated the concept, design, and development of a self-contained device housed in a rugged, waterproof, portable container that is capable of gathering and providing critical intelligence and essential technical information for use by the Navy and other government organizations responsible for protecting the nation's seaports and maritime operations.

FY08: This project continues the development of a self-contained, rugged, waterproof, and portable device capable of providing critical intelligence and essential technical information for use by the Navy and other government organizations responsible for protecting the nation's seaports and maritime operations.

| | FY 2007 | FY 2008 |
|---|---|---|
| UPWARD LOOKING SONAR (ULS) | 1,019 | 994 |

FY07: This project initiated support for defining the concept of operating small, autonomous sonar units spaced randomly on the floor of the ocean in relatively shallow water of less than 1000 feet.

FY08: This project continues to define the concept of operating small, autonomous sonar units randomly spaced on the ocean floor in relatively shallow water of less than 1000 feet.

| | FY 2007 | FY 2008 |
|---|---|---|
| VISUAL INTEGRATED BRIDGE SYSTEM | 1,213 | 0 |

This effort supported the Expeditionary Fighting Vehicle operational requirements goal for Light Detection and Ranging data display and supported the Visual Integrated Bridge System Augmented Reality Program by superimposing visual information over the view from a ship’s bridge.