BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602782N
PROGRAM ELEMENT TITLE: MINE AND EXPEDITIONARY WARFARE APPLIED RESEARCH

COST: (Dollars in Thousands)

Project Number & Title	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
MINE AND EXPEDITIONARY WARFARE APPLIED RESEARCH	43,637	47,544	49,520	54,839	50,321	51,640	51,166	51,843

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Provides technologies for Naval Mine Countermeasures (MCM), U.S. Naval sea mines, Naval Special Warfare (NSW), and Department of Defense (DOD) Explosive Ordnance Disposal (EOD). It is strongly aligned with the Joint Chiefs of Staff Joint Warfighting Capability Objectives through the development of technologies to achieve military objectives with minimal casualties and collateral damage. Within the Naval Transformation Roadmap, this investment will achieve one of 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” 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. These efforts concentrate on the development and transition of technologies for the Organic Mine Countermeasures (OMCM) and Littoral Combat/Power Projection (LC/PP) Future Naval Capabilities (FNCs). The Mine and Obstacle Detection/Neutralization efforts include technologies for clandestine minefield surveillance and reconnaissance, organic ship self-protection, organic minehunting and neutralization/breaching. Littoral Combat Warfare effort includes critical warfighting functions such as Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnsissance (C4ISR), fires, maneuver, sustainment, etc. The NSW and EOD technology efforts concentrate on the development of technologies for near-shore mine/obstacle detection and clearance, mobility and survivability, as well as EOD.

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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PROGRAM CHANGE SUMMARY:

	FY 2004	FY 2005	FY 2006	FY 2007
FY 2005 President's Budget Submission	47,929	48,016	47,176	49,777
Cong Rescissions/Adjustments/Undist. Reductions	0	-462	0	0
Execution Adjustments	-3,070	0	0	0
FNC Realignment	0	0	1,736	3,098
Non-Pay Inflation Adjustments	-44	0	0	0
Program Adjustments	0	-10	633	1,778
Rate Adjustments	0	0	-25	186
SBIR Assessment	-1,178	0	0	0
FY 2006/2007 President's Budget Submission	43,637	47,544	49,520	54,839

PROGRAM CHANGE SUMMARY EXPLANATION:
Technical: Not applicable.

Schedule: Not applicable.

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COST: (Dollars in Thousands)

Project Number & Title	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
MINE AND EXPEDITIONARY WARFARE APPLIED RESEARCH	43,637	47,544	49,520	54,839	50,321	51,640	51,166	51,843

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project focuses on reducing the time involved in conducting Mine Countermeasures (MCM) operations and removing personnel from minefields. The MCM project develops and transitions technologies for Organic Mine Countermeasures and Littoral Combat/Power Projection Future Naval Capabilities (OMCM and LC/PP FNCs). These include technologies for clandestine minefield surveillance and reconnaissance, organic ship self-protection, organic minehunting, neutralization/breaching and clearance. The Littoral Warfare effort includes critical warfighting functions such as Command, Control, Communication, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), fires, maneuver, sustainment, etc. The sea mining effort emphasizes technologies for future sea mines. The Naval Special Warfare and Explosive Ordnance technology efforts concentrate on the development of technologies for near-shore mine/obstacle detection and clearance, mobility and survivability, as well as Explosive Ordnance Disposal (EOD).

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2004	FY 2005	FY 2006	FY 2007
LITTORAL COMBAT	112	2,162	485	1,853

Within the Naval Transformation Roadmap, this investment supports achievement of transformational capabilities of Ship to Objective Maneuver, a key transformational capability within Sea Strike. Activity develops and demonstrates prototype capability to enable Naval Expeditionary Forces to influence operations ashore. The goal of Littoral Combat is the application of technologies to enhance the ability of the Navy/Marine Corps team to execute the naval portion of a joint campaign in the littorals. This activity considers all the critical functions of warfighting: Command, Control, Communication, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), fires, maneuver, sustainment, force protection, and training.

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This activity, which reflects LC/PP FNC investments formerly included in Mine/Obstacle Detection, was split out to provide improved detail of the underlying investment.

FY 2004 Accomplishments:

-Continued integration, development and demonstration of secure mobile networks/secure wireless local area network (LAN) and Beyond Line of Sight (BLOS) communication technologies. (FY 05 effort funded by PE 0602131M).

FY 2005 Plans:

-Continue development of advanced sensing algorithms to derive maps using digital imagery from airborne ISR assets to support expeditionary maneuver. (Previous efforts funded by PE 0602131M; FY 06 effort funded by PE 0602131M)
-Continue development of advanced weapon materials technologies. (Previous efforts funded by PE 0602131M and PE 0602236N; FY 06 effort funded by PE 0602131M)
-Continue development of expeditionary warfare decision support tools for Marine ground forces to support of ship to objective maneuver (STOM). (FY 06 effort funded by PE 0602131M)
-Initiate development of an advanced sensor miniature digital data link. (Concurrent effort PE 0603782N)
-Initiate development of organic light emitting diode (OLED) display technology for shipboard use.

FY 2006 Plans:

-Continue design and development of rocket propelled grenade (RPG) defensive systems. (Previous efforts funded by PE 0602131M)
-Complete development of organic light emitting diode (OLED) display technology for shipboard use.

FY 2007 Plans:

-Continue design and development of rocket propelled grenade (RPG) defensive systems.
-Continue integration, development and demonstration of secure mobile networks/secure wireless LAN and Position Location Indication communication technologies. (Previous efforts funded by PE 0602236)
-Initiate development of improvised explosive device (IED) detection and neutralization technologies.

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	FY 2004	FY 2005	FY 2006	FY 2007
MINE/OBSTACLE DETECTION	23,153	27,300	30,786	34,916

This activity focuses on applied research to enable longer detection ranges and precise mine location with fewer false alarms in a variety of challenging environments. This activity supports the OMCM FNC. For acoustic sensors, efforts in Synthetic Aperture Sonar (SAS) technologies, sensor integration onto Autonomous Underwater Vehicles (AUVs) and buried mine classification are being addressed. Electro-optic (E-O) sensor research develops algorithms to enable image processing for rapid overt reconnaissance from an Unmanned Aerial Vehicle (UAV). Other processing, classification and data fusion techniques to reduce operator workload, and a mine burial prediction “expert system” are also being developed.

FY 2004 Accomplishments:

-Completed development of Bottom Object Search Sonar (BOSS) disc prototype sensor for 3-D classification of buried mines.
-Completed development of BOSS Synthetic Aperture Sonar(SAS)wing prototype for Unmanned Underwater Vehicle (UUV) applications and conducted at-sea measurements of prototype sensor.
-Completed documentation of Remote Sensing Tier III algorithm development efforts.
-Continued development of prototype broadband acoustic scattering sonar and Post Mission Analysis (PMA) tools.
-Continued development of automated broadband physics-based target recognition algorithms.
-Continued development of motion compensation and beam-forming techniques for long range SAS imaging, focusing on multi-path, shallow water environments.
-Continued development of the Laser Scalar Gradiometer (LSG) for buried mine detection.
-Continued development of the Real-time Tracking Gradiometer (RTG) for Unmanned Underwater Vehicle (UUV) applications.
-Continued development of sensor systems for crawling vehicles, focusing on Surf Zone (SZ) mine detection and identification.
–Continued development of 12.75” UUV technology and the development of common control language for AUVs.
-Continued development Rapid Overt Airborne Reconnaissance (ROAR) active/passive electro-optic image processing for detection of mines/minefields in Very Shallow Water (VSW),
surf Zone (SZ), and the Beach Zone (BZ).
-Continued development of a Surf Zone Index (SZI) to predict sensor performance for both active and passive airborne E-O systems.
-Demonstrated, at-sea, AUV based data collection of broadband acoustic scattering from mines, focusing on

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multi-aspect data collection.
-Initiated development of active electromagnetic sensing for the short-range mine classification.
-Initiated the development of a directional transponder and the development of an acoustic smart marker/pinger for reacquisition of vsw mines.
-Initiated buried and proud mine target scattering measurements in the presence of bottom ripples using parametric and conventional sonar.
-Initiated development of multi-static techniques for multiple, cooperating AUVs.
-Initiated optimization of the data input-output capabilities of the mine burial expert system and began assessment of operational utility during fleet exercises.
–Initiated development of multi-platform fusion of AV-15 Kingfisher contact data via registration with those from the Mine warfare Environmental and Decisions Aids Library (MEDAL) for improved mine detection and avoidance.

Following are D&I efforts:
-Completed development of a comprehensive database of acoustic scattering from mines and false targets. (NRL)
-Completed an at-sea demonstration of the use of time reversal acoustics to scan along the sea bottom using broadband signals for objects. (NRL)
-Completed at-sea demonstration of AUV based SAS for shallow water mine hunting during Combined Joint Task Force Exercise (CFTFEX 04-02).
-Completed development of optical performance models for EO mine identification sensors.
-Continued the development of mine burial sub-models to provide predictions in an acceptable operational format.
-Continued the development of underwater sensor prediction tools to support development, system design, and Tactical Digital Aids efforts.
-Continued development of blazed array obstacle avoidance sonar for AUV applications.
-Initiated development of advanced, prototype Remote Sensing EO sensors for Tactical UAV(TUAV) applications.
-Initiated development of multi-static acoustic sensing and processing for cooperating, unmanned vehicles.

FY 2005 Plans:

-Complete development of prototype broadband acoustic scattering sonar and integration onto a 21 inch AUV.
-Complete development of sas motion compensation and beamforming algorithm for long-range, multi-path environment.
-Complete development of the RTG for classification of buried mines.

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-Complete integration of RTG and BOSS prototype wing onto a 12.75" UUV and executed initial at-sea testing of combined sensors.
-Complete development of the LSG.
-Complete development of blazed array obstacle avoidance sonar and integrate onto a UUV for testing.
-Complete development of a SZI to predict sensor performance for both active and passive airborne EO systems.
-Complete development of multi-platform fusion of AV-15 Kingfisher contact data via registration with those from the Mine Warfare Environmental Decision Aids Library (MEDAL) for improved mine detection and avoidance.
-Continue development of automated broadband physics-based target recognition algorithms.
-Continue the development of active electromagnetic sensing for short-range mine classification.
-Continue buried and proud mine target acoustic scattering measurements in the presence of bottom roughness using parametric and conventional sonars.
-Continue development of sensor systems for crawling vehicles, focusing on SZ mine detection and identification.
-Continue development of multi-static AUV-based minehunting integrating navigation, communication and sensor elements.
–Continue development of 12.75" UUV technology conducting field testing.
-Continue development of a directional transponder and the development of an acoustic smart marker/pinger for reacquisition of VSW mines.
-Continue development ROAR active/passive EO image processing for detection of mines/minefields in VSW, SZ, and the BZ.
-Continue to optimize the data input-output capabilities of the mine burial expert system and participate in a fleet exercise to demonstrate operational utility.
-Initiate at-sea testing of prototype broadband acoustic scattering sonar focusing on multi-aspect mine classification/identification and characterization of clutter in various environments.
-Initiate the development of a low-cost, 12.75" UUV-based EO sensor for mine identification.
-Initiate development of long range, forward-looking sonar for small (12.75") UUVs.
-Initiate data fusion from underwater magnetic and acoustic sensors to enhance Probability of classification (Pc) and reduce false alarm rate for buried mine hunting.
-Initiate testing and evaluation of a common control language for AUVs.
-Initiate development of Over the Horizon (OTH) deployment concepts for UUVs.
-Initiate development of multi-platform fusion of data from high-resolution mine hunting systems (e.g. AN/AQS-20 and submarine-launched Mine warfare (MIW) UUVs via registration with those from the MEDAL for improved mine detection and avoidance.

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Following are D&I efforts:
-Complete analysis and reporting of scanning focused acoustic fields using time-reversal acoustics. (NRL)
-Complete an at-sea demonstration of Broadband SAS detection/classification of buried and proud mines at Sediment Acoustics Experiment 2004 (SAX04).
-Complete the development of underwater sensor prediction tools to support development, system design, and Tactical Decision Aids (TDA) efforts.
-Continue prototype Remote Sensing EO sensors for TUAV applications.
-Continue the development of multi-static acoustic sensing and processing for cooperating, unmanned vehicles.
-Initiate development of a concept of operations for generating geotechnical data inputs to the impact mine burial prediction model. (NRL)
-Initiate evaluation of algorithm development requirements and capitalize on data streams available from national and organic sensors.
-Initiate the primary sub-system design efforts to extend mine identification using acoustic color concept to longer ranges. (NRL)
-Initiate design and development of broadband interferometric SAS.
-Initiate investigations to expand the knowledge of elevated Synthetic Aperture Radar (SAR) imaging algorithms for detecting buried mines. (NRL)

FY 2006 Plans:

-Complete, at-sea, UUV based testing of blazed array obstacle sonar.
-Complete at-sea testing of the RTG and BOSS wing prototype on a 12.75” UUV.
-Complete buried and proud mine acoustic scattering measurements in the presence of bottom roughness using conventional and parametric sonars.
-Complete development of sensor systems for crawling vehicles, focusing on SZ mine detection and identification.
–Complete development and field testing of 12.75” UUV technology.
-Complete testing and evaluation of a common control language for AUVs.
-Complete development of a directional transponder and the development of an acoustic smart marker/pinger for reacquisition of VSW mines.
-Complete development ROAR active/passive electro-optic image processing for detection of mines/minefields in VSW, SZ, and the BZ.
-Continue at-sea testing of prototype broadband acoustic scattering sonar focusing on multi-aspect mine classification/identification and characterization of clutter in various environments.

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-Continue development of automated broadband, physics-based target recognition algorithms utilizing data collected by prototype sonar.
-Continue development of long range, forward-looking sonar for small (12.75”) UUVs.
-Continue the development of a low cost, UUV based electro-optic sensor for mine identification.
-Continue the development of active electromagnetic sensing for short-range mine classification.
-Continue the development of algorithms for the fusion of acoustic, passive electromagnetic, active electromagnetic, and electro-optic classification/identification data.
-Continue development of OTH deployment concepts for UUVs.
-Continue development of multi-static AUV-based minehunting integrating navigation, communication and sensor elements.
-Continue development of tactics for autonomous reconnaissance and mine hunting by multiple cooperating UUVs.
-Continue to optimize the data input-output capabilities of the mine burial expert system and participate in a fleet exercise to demonstrate the utility of the mine burial expert system.
–Continue development of multi-platform fusion of data from high-resolution mine hunting systems (e.g. AN/AQS-20 and sub-launched MIW UUVs via registration with those from MEDAL for improved mine detection and avoidance.
-Initiate development of automatic mine detection and classification algorithms for integrated forward-looking and side-looking sonars.

Following are D&I efforts:
-Complete development and testing of the Integrated Mine Burial Model and transition to the Naval Oceanographic Office (NAVOCEANO). (NRL)
-Complete development of prototype Remote Sensing EO sensors for TUAV applications.
-Continue evaluation of remote sensing algorithm development requirements and capitalize on data streams available from national and organic sensors.
-Continue development of a long-range mine identification system using acoustic color concept. (NRL)
-Continue development of a broadband interferometric SAS.
-Continue to develop mine burial prediction sub-models to support development of the mine burial expert system.
-Continue the development of multi-static acoustic sensing and processing, conducting at-sea exercise involving multiple UUVs.
-Continue design, development and fabrication of elevated SAR breadboard experimental system for mine detection and suitable for eventual UAV applications. (NRL)
-Initiate analysis of at-sea experimental results and sediment poro-elastic and elastic propagation models to investigate the high frequency acoustic bottom interaction for various seafloor sediment properties. (NRL)

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FY 2007 Plans:

-Complete development of automated broadband, physics-based target recognition algorithms utilizing data collected by prototype sonar; and begin transition to PMS-403 and PMS-495.
-Complete development of long-range, forward-looking sonar for small (12.75”) UUVs and begin at-sea testing.
-Complete the development of active electromagnetic sensor for short range mine classification.
-Complete the development of algorithms for the fusion of acoustic, passive electromagnetic, active electromagnetic, and electro-optic classification/identification data.
-Complete the development of a low cost, UUV based electro-optic sensor for mine identification, integrate onto a UUV, and conduct initial at-sea tests of sensor performance.
-Complete mine burial expert system and transition to the NAVOCEANO.
-Continue at-sea testing of prototype broadband acoustic scattering sonar focusing on multi-aspect mine classification/identification and characterization of clutter in various environments.
-Continue development of OTH deployment concepts for UUVs.
-Continue development of multi-static AUV-based minehunting integrating navigation, communication and sensor elements.
-Continue development of tactics for autonomous reconnaissance and mine hunting by multiple cooperating UUVs.
-Continue development of automatic mine detection and classification algorithms for integrated forward-looking and side-looking sonars.
–Continue development of multi-platform fusion of data from high-resolution mine hunting systems (e.g. AN/AQS-20 and sub-launched MIW UUVs via registration with those from MEDAL for improved mine detection and avoidance.
-Initiate large area search and survey based upon multiple, cooperating UUVs.

Following are D&I efforts:
-Complete development of broadband interferometric SAS and begin at-sea testing.
-Complete evaluation of sediment poro-elastic and elastic propagation models to understand high-frequency acoustic-bottom interactions. (NRL)
-Complete evaluation of remote sensing algorithm development requirements and capitalize on data streams available from national and organic sensors.
-Continue the development of multi-static acoustic sensing and processing, conducting at-sea exercise involving multiple, uuv's.
-Continue conducting tests of elevated SAR breadboard experimental system (NRL).

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-Continue development of a long-range mine identification system using the acoustic color concept and provide an initial at-sea demonstration. (NRL)

	FY 2004	FY 2005	FY 2006	FY 2007
SPECIAL WARFARE/EOD	9,015	12,140	12,058	12,455

Increase in funding from FY 2004 to FY 2005 is due to NRL efforts in this activity starting in FY 2005. Naval Special Warfare (NSW) missions primarily support covert near-shore naval operations. The goal is to develop technology to increase the combat range and effectiveness of Special Warfare units. A major 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 VSW and SZ amphibious landing areas. EOD operations typically occur in shallow, poor-visibility water, with high background noise, and in areas contaminated by a variety of unexploded ordnance (UXO). Advanced technologies are needed to gain access to areas contaminated by area-denial sensors and/or booby traps. These technologies will transition to the Joint Service EOD Program, the Naval EOD Program, or the DOD Technical Response Group. This activity includes applied research in sensor technology for NSW and EOD autonomous and handheld sonar systems to increase detection range and accuracy in harsh environments. Other efforts include mission support technology improvements for AUVs and human divers – such as communications, navigation and life support.

FY 2004 Accomplishments:

-Completed development of digital beamformer architecture for high frequency imaging sonar.
-Completed the characterization of acousto-optic effect in liquid-crystal cells as a function of the key parameters affecting the performance of an underwater imaging device. (NRL)
-Completed development of hyperspectral polarimeter prototype.
-Completed development of scannerless range imaging sensor.
-Completed extended lifetime underwater adhesive development.
-Completed development of passively controlled rebreather.
-Completed study of design alternatives for next generation Swimmer Delivery Vehicle (SDV).
-Continued development of Low Probability of Intercept (LPI)/Low Probability of Detection (LPD) underwater communications.
-Continued development of AUV technologies for autonomous inspection of ship hulls.
-Continued development of standoff detection and classification sensor for surface and buried UXO using multi-dimensional Electro-Magnetic(EM) methods.

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-Continued development of technology to detect, monitor, and disrupt operation of Explosive Safe and Arming (ESA) devices.
-Continued efforts to support the design of a deformable fin for AUV propulsion with 3-D unsteady flow computations of fin flapping. (NRL)
-Continued development of a miniature CO2 sensor.
-Continued development of robotic manipulators, actuators and control algorithms based on artificial muscle materials.
-Initiated development of dual-mode visible sensor for clandestine tracking of near-shore craft and other objects.
-Initiated development of a diver heating system for SDV.
-Initiated development of a composite garment to provide diver thermal insulation.
-Initiated development of man-portable impulse radar system for sense-thru-the-wall applications.

FY 2005 Plans:

-Continue development of dual-mode visible sensor for clandestine tracking of near-shore craft and other objects.
-Continue development of standoff detection and classification sensors for surface and buried UXO using multi-dimensional EM methods.
-Continue development of technology to detect, monitor, and disrupt operation of ESA devices.
-Continue development of LPI/LPD underwater communications.
-Continue development of AUV technologies for autonomous inspection of ship hulls.
-Continue efforts in the design of a prototype deformable fin for AUVs. (NRL)
-Continue development of robotic manipulators, actuators and control algorithms based on artificial muscle materials.
-Continue development of a diver heating system for SDV.
-Complete development of CO2 sensor.
-Complete development of a composite garment to provide diver insulation.
-Complete development of man-portable impulse radar system for sense-thru-the-wall applications.
-Initiate assembly of a prototype portable liquid crystal underwater imager by integrating the liquid-crystal cells with an acoustic lens. (NRL)
-Initiate analysis of NSW equipment signatures.
-Initiate development of an SDV low-observable periscope.

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FY 2006 Plans:

-Complete prototype device of a portable liquid crystal underwater imager and perform a prototype demonstration. (NRL)
-Complete analysis of NSW equipment signatures.
-Complete development of standoff detection and classification sensors for surface and buried UXO using multi-dimensional EM methods.
-Continue development of dual-mode sensor for clandestine tracking of near-shore craft and other objects.
-Continue development of LPI/LPD underwater communications.
-Continue development of AUV technologies for autonomous inspection of ship hulls.
-Continue efforts in the design and optimization of a prototype deformable fin for AUVs. (NRL)
-Continue development of technology to detect, monitor, and disrupt operation of ESA devices.
-Continue development of robotic manipulators, actuators and control algorithms based on artificial muscle materials.
-Continue development of a diver heating system for SDV.
-Continue development of an SDV low-observable periscope.
-Initiate development of buried ordnance identification sensor.

FY 2007 Plans:

-Complete prototype of an AUV using a deformable fin by performing self-propulsion tests on a working vehicle and provide a demonstration. (NRL)
-Complete development of a diver heating system for SDV.
-Continue development of dual-mode visible sensor for clandestine tracking of near-shore craft and other objects.
-Continue development of buried ordnance identification sensor.
-Continue development of LPI/LPD underwater communications.
-Continue development of AUV technologies for autonomous inspection of ship hulls.
-Continue development of SDV low-observable periscope.
-Continue development of technology to detect, monitor, and disrupt operation of ESA devices.
-Continue development of robotic manipulators, actuators and control algorithms based on artificial muscle materials.

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	FY 2004	FY 2005	FY 2006	FY 2007
MINE/OBSTACLE NEUTRALIZATION	4,609	5,744	5,991	5,414

Activity includes applied research to support to the OMCM FNC Enabling Capabilities for rapid mine and obstacle neutralization and sea mine jamming techniques to increase surface ship safe standoff from threat mines. It includes various lethality, vulnerability and dispensing computational tools, as well as models and assessments to support the various far-term Surf Zone (SZ) and beach zone (BZ) mine and obstacle breaching concepts in PE 0603782N.

FY 2004 Accomplishments:

-Continued development of the mine vulnerability database for kinetic damage, shock, blast and thermal effects.
-Continued development of computational tools and engineering level models to assess dart dispenser concepts.
-Continued development of mine vulnerability database for SZ mines neutralized by pressure and impulse.
-Continued development of advanced computational model to simulate guided bombs in the BZ and SZ against mines and obstacles.
-Initiated assessment of mine jamming utilizing the advanced degaussing system of the San Antonio Class Amphibious Transport Dock Ship(LPD-17).
-Initiated investigation of mine jamming effect on dumb mines.
-Initiated development of platform concepts for autonomous mine neutralization by AUVs.

FY 2005 Plans:

-Complete development of mine vulnerability database for SZ mines neutralized by pressure and impulse.
-Complete development of an advanced computational model to simulate guided bombs against SZ and BZ mines.
-Complete investigation of mine jamming effect on dumb mines.
-Continue development of the mine vulnerability database for kinetic damage, shock, blast and thermal effects.
-Continue assessment of mine jamming using the advanced degaussing system of the LPD-17.
-Continue development of platform concepts for autonomous mine neutralization by AUVs.
-Continue assessment of dart dispenser concepts using advanced computational tools and engineering level models.
-Initiate development of models to assess performance of bombs against mines in Very Shallow Water (VSW).
-Initiate development of advanced computational models for high speed water entry and penetration.

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-Initiate development of advanced computational tools for predicting soil penetration by countermine darts.
-Initiate assessment of mine jamming using Impressed Current Cathodic Protection (ICCP) system.

FY 2006 Plans:

-Continue development of platform concepts for autonomous mine neutralization by AUVs.
-Continue assessment of dart dispenser concepts using advanced computational tools and engineering level models.
-Continue development of mine vulnerability database for kinetic damage, shock, blast and thermal effects.
-Continue development of models to assess performance of bombs against mines in VSW.
-Continue development of advanced computational models for high speed water entry and penetration.
-Continue development of advanced computational tools for predicting soil penetration by countermine darts.
-Continue assessment of mine jamming using ICCP system.
-Initiate development of tool to assess mine jamming effectiveness on future ship designs.

FY 2007 Plans:

-Complete development of platform concepts for autonomous mine neutralization by AUVs.
-Complete assessment of dart dispenser concepts using computational tools and engineering level models.
-Complete development of mine vulnerability database for kinetic damage, shock, blast and thermal effects.
-Complete development of models to assess performance of bombs against mines in VSW.
-Complete development of mine jamming effectiveness tool.
-Complete assessment of mine jamming using ICCP; and complete mine jamming effort with exit demonstration on representative mine field using USS Higgins Guided Missile Destroyer(DDG-76) or LPD-17.
-Continue development of advanced computational models for high speed water entry and penetration.
-Continue development of advanced computational tools for predicting soil penetration by countermine darts.

	FY 2004	FY 2005	FY 2006	FY 2007
MINE TECHNOLOGY	187	198	200	201

This activity assesses advanced sea mine technologies to maintain expertise in this Naval Warfare area.

FY 2004 Accomplishments:

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602782N PROGRAM ELEMENT TITLE: MINE AND EXPEDITIONARY WARFARE APPLIED RESEARCH
PROJECT TITLE: MINE AND EXPEDITIONARY WARFARE APPLIED RESEARCH

-Continued assessment of advanced sea mine technologies.

FY 2005 Plans:

-Continue assessment of advanced sea mine technologies, focusing on remote control and warhead concepts for increased effectiveness.

FY 2006 Plans:

-Continue assessment of advanced sea mine technologies, focusing on remote control and warhead concepts for increased effectiveness.

FY 2007 Plans:

-Continue assessment of advanced sea mine technologies, focusing on remote control and warhead concepts for increased effectiveness.

	FY 2004	FY 2005	FY 2006	FY 2007
ASSAULT BREACHING SYSTEM	5,597	0	0	0

Assault Breaching System concepts will lead to a future mine and obstacle breaching capability. The employment of air and surface strike weapon systems will minimize exposure to service personnel, enable amphibious landing forces to maintain an unencumbered operational tempo from the sea to the objectives ashore, and reduce total ownership costs and logistics requirements. It supports the future naval warfare directions of power projection, operational maneuver from the sea, Ship-to-Objective Maneuver, and sea-based logistics. Funding for this effort for FY 2005 and out is budgeted and executed by NAVSEA Mine Undersea Warfare.

FY 2004 Accomplishments:

-Accelerated the development and demonstration of a reconnaissance system for detecting minefields on the beach.
-Developed a systems level model to support the planned tradeoff analysis of Assault Breaching Systems. The 6-Degrees of Freedom (DoF) model will integrate system/platform level guidance algorithms, accurate aerodynamics, and dispenser concepts to assess the performance of countermine dart delivery concepts.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602782N PROGRAM ELEMENT TITLE: MINE AND EXPEDITIONARY WARFARE APPLIED RESEARCH
PROJECT TITLE: MINE AND EXPEDITIONARY WARFARE APPLIED RESEARCH

CONGRESSIONAL PLUS-UPS:

	FY 2004	FY 2005
MOBILE UNDERWATER COASTAL SURVEILLANCE SYSTEM	964	0

This effort developed control algorithms to effect cooperative behavior among multiple autonomous underwater vehicles in specific, extended duration mission scenarios. Duration was achieved through the use of vehicles capable of harvesting solar energy from the environment.

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 0603502N (Surface and Shallow Water Mine Countermeasures)
PE 0603640M (USMC Advanced Technology Demonstration (ATD))
PE 0603654N (Joint Service Explosive Ordnance Development)
PE 0603782N (Mine and Expeditionary Warfare Advanced Technology)
PE 0604654N (Joint Service Explosive Ordnance Development)

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

D. ACQUISITION STRATEGY:
Not applicable