FY 2007 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: Feb 2006
Exhibit R-2

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

COST: (Dollars in Thousands)

Project Number & Title	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
UNDERSEA WARFARE APPLIED RESEARCH	79,380	84,482	83,435	70,646	69,167	68,359	68,165

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: All Navy applied research in undersea target detection, classification, localization, tracking, and neutralization is funded through this Program Element (PE). Technologies being developed within this PE are aimed at enabling Sea Shield, one of the core operational concepts detailed in the Naval Transformational Roadmap. Associated efforts focus on new anti-submarine warfare (ASW) operational concepts that promise to improve wide-area surveillance, detection, localization, tracking, and attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments. Related efforts are aimed at leveraging technologies that will protect the country’s current capital investment in surveillance, submarine, surface ship, and air ASW assets.

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

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

B. PROGRAM CHANGE SUMMARY:

	FY 2005	FY 2006	FY 2007
FY 2006 President's Budget Submission	84,325	71,362	85,857
Congressional Action	0	14,200	0
Congressional Undistributed Reductions/Rescissions	-65	-1,080	0
Execution Adjustments	-3,499	0	0
FY 2005 SBIR	-1,381	0	0
Program Adjustments	0	0	-2,042
Program Realignment	0	0	-590
Rate Adjustments	0	0	210
FY 2007 President's Budget Submission	79,380	84,482	83,435

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 applied research in undersea warfare are to develop technologies aimed at improving target detection, classification, localization, tracking, increasing attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments, countering enemy torpedoes, providing the ability to conduct long-range engagements, increasing weapons load-out, providing multi-platform connectivity, increasing endurance/survivability, and reducing size and power requirements.

FY 2007 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: Feb 2006
Exhibit R-2a

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

COST: (Dollars in Thousands)

Project Number & Title	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
UNDERSEA WARFARE APPLIED RESEARCH	58,919	70,282	83,435	70,646	69,167	68,359	68,165

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: All Navy applied research in undersea target detection, classification, localization, tracking, and neutralization is funded through this project. Technologies being developed within this project are aimed at enabling Sea Shield, one of the core operational concepts detailed in the Naval Transformational Roadmap. Associated efforts focus on new ASW operational concepts that promise to improve wide-area surveillance, detection, localization, tracking, and attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments. Related efforts are aimed at leveraging technologies that will protect the country's current capital investment in surveillance, submarine, surface ship, and air ASW assets.

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2005	FY 2006	FY 2007
WIDE AREA ANTI-SUBMARINE WARFARE (ASW) SURVEILLANCE	19,134	27,523	42,877

Wide Area ASW Surveillance is focused on dramatically improving the capability to sanitize large areas relative to the capabilities of legacy ASW sensors. Efforts include the development of affordable off-board systems with associated processing and robust, high bandwidth communications links. The cornerstone of Wide Area Surveillance is the ability to rapidly distribute acoustic and non-acoustic sensors from air, surface, and sub-surface platforms as well as to develop long-endurance sensors and unmanned ASW vehicles. This activity represents a shift from traditional fixed surveillance systems to autonomous, networked-components, multi-static operation, and supported by passive/active signal processing all with the objective of increased detection capabilities.

The increases from FY 2005 to FY 2006 and FY 2006 to FY 2007 reflect the following: realignments of Future Naval Capabilities (FNC) program investments associated with the Sea Shield Enabling Capability (EC) into this

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

activity; and a realignment of funds associated with the Innovative Naval Prototype (INP)- Persistent Littoral Undersea Surveillance (PLUS).

FY 2005 Accomplishments:

- Continued development of Telesonar technologies to enable deployable system acoustic communications.
- Continued development of signal processing algorithms aimed at reducing clutter-generated false alerts.
- Continued development/improvement of multi-static signal processing techniques for systems employing coherent sound sources.
- Continued development of “intelligent” algorithms aimed at optimizing distributed multistatic sources/receivers.
- Continued development of an advanced node design for survivable sensors.
- Continued development of a non-traditional tracking system for deployment on undersea vehicles.
- Continued development of multistatic signal processing algorithms with controllable transmit waveform type and ping schedule to enable improved detection and tracking of threat submarines.
- Completed analysis of at-sea data to validate signal-processing techniques derived from acoustic time reversal concepts. (NRL)
- Completed development of high data rate multi-access communications technique in Underwater Acoustic Communications (ACOMMS) and provide a demonstration of its capability. (NRL)
- Initiated integration of a prototype system for undersea persistent surveillance.
- Initiated investigation of undersea persistent surveillance system performance through simulation and subsystem tests.
- Initiated development and testing of components of a prototype system for undersea persistent surveillance.
- Initiated testing of a non-traditional tracking system.
- Initiated analysis and modeling of high frequency underwater acoustic communications techniques between Unmanned Undersea Vehicles (UUVs) and demonstrate its capability. (NRL)
- Initiated efforts to develop an underwater intruder defense system, including comprehensive active and passive signatures from swimmers, harbor environment noise characteristics, and fiber optic array technology.(NRL)

The following efforts contribute to the Littoral Anti-Submarine Warfare Future Naval Capability:
- Continued at-sea testing of the multistatic system components.
- Completed development and testing of a software baseline for in-buoy signal processing.
- Completed development of smaller, cheaper low-frequency active transducers for multistatic sonar systems.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

- Completed development of “field-level” processing for large numbers of Compact Deployable Multistatic Receivers.
- Completed Palantir Project Plan.
- Initiated concept feasibility study and initial design concepts for a non-acoustic surveillance system (Palantir).

FY 2006 Plans:

- Continue all FY 2005 efforts, less those noted as completed.
- Complete efforts to measure, quantify, and model reverberation and clutter from biologics and the seafloor and provide a prediction tool for multistatic active sonars. (NRL)
- Initiate planning for testing of advanced node designs and associated technologies.
- Initiate development of alternative active optical sources and sensor devices for Non-Acoustic ASW systems.
- Initiate development of tracking and classification algorithms for broadband Doppler sensitive waveforms for wide area surveillance.
- Initiate development of a prototype system for Persistent Littoral Undersea Surveillance (PLUS).

The following efforts contribute to the Littoral Anti-Submarine Warfare Future Naval Capability:
- Continue all FY 2005 efforts, less those noted as completed.
- Complete at-sea testing of the multistatic system components. This effort transitions to PE 0603747N.
- Complete concept feasibility study and initial design concepts for a non-acoustic surveillance system (Palantir).
- Initiate design and development of Palantir sensor and data collection system and conduct a FY 2006 data collection exercise.
- Initiate experimental test planning for Palantir sensor.
- Initiate Deployable Autonomous Distributed System study of component feasibility to enable effective deployment, survival, and cost options. This effort transitions to PE 0603747N in FY 2007.

FY 2007 Plans:

- Continue all FY 2006 efforts, less those noted as completed or transitioned.
- Complete development of Telesonar technologies to enable deployable system acoustic communications.
- Complete testing of advanced node design and associated technologies.
- Complete development of multistatic signal processing algorithms with controllable transmit waveform type

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

and ping schedule to enable improved detection and tracking of threat submarines.
- Complete integration of a prototype system for undersea persistent surveillance.
- Complete investigation of undersea persistent surveillance system performance through simulation and subsystem tests.
- Complete development and testing of components of a prototype system for undersea persistent surveillance.
- Complete evaluation of undersea persistent surveillance system performance and trade-offs.
- Complete demonstration of a prototype system for undersea persistent surveillance.
- Complete development of a prototype system for PLUS. PLUS transitions to PE 0603782N (Mine and Expeditionary Warfare Advanced Technology) for advanced technology development beginning in FY 2008.
- Complete initial development of an underwater intruder defense system and provide a demonstration of a viable overall system concept. (NRL)
- Complete analysis and modeling of high frequency underwater acoustic communications techniques between UUVs and demonstrate its capability. (NRL)

The following efforts contribute to the Littoral Anti-Submarine Warfare Future Naval Capability:
- Continue all FY 2006 efforts less those noted as completed.
- Continue Submarine Track and Trail applied research efforts for UUV technology in the areas of advanced undersea sensors, communications, and autonomy. This effort transferred from PE 0602114N due to EC realignments.
- Initiate an applied research effort to improve distributed system processing techniques and capabilities.
- Initiate the On-Demand Detection Classification and Localization effort focusing on the development of sensor and platform designs compatible with notional Concept of Operations.
- Initiate an effort to develop automation techniques for transition to various Littoral ASW distributed sensor systems.
- Initiate development of active sonar sensors and processing for wide area surveillance of deep ocean operating areas.
- Initiate development of signal processing and data fusion algorithms for deployed, bottom-mounted, distributed acoustic sensor fields.

	FY 2005	FY 2006	FY 2007
BATTLEGROUP ANTI-SUBMARINE WARFARE (ASW) DEFENSE	28,297	23,540	15,944

Battlegroup ASW Defense technology focuses on the development of platform-based sources and receivers aimed at denying submarines the ability to target grey ships. This technology area is primarily concerned with

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

detections inside 10 nm. Battlegroup ASW Defense integrates next-generation technologies, automatic target recognition, sensors that adjust to complex acoustic environments, and environmentally adaptive processing techniques. Battlegroup ASW Defense will enable smaller, lighter, and cheaper acoustic/non-acoustic arrays, large multi-line arrays, and submarine flank arrays (all with environmental adaptation capabilities).

The decreases from FY 2005 to FY 2006 and FY 2006 to FY 2007 reflect the completion and transition of efforts to budget activity 3 PEs as well as the realignment of FNC program investments into ECs. As a result of FNC reorganization, funding for each EC has been aligned to a budget activity 2 and budget activity 3 PE as appropriate. The FY 2007 funding level reflects the alignment of investments for the Sea Shield EC.

FY 2005 Accomplishments:

- Continued development of signal processing improvements for coherent tactical active sonar systems aimed at improving Detection, Classification, and Localization of small, slow moving submarines in shallow water.
- Continued investigation of synthetic aperture sonar techniques for improving target versus clutter classification performance.
- Continued development of Acoustic Flux Sensor for affordable improvement of sonar signal-to-noise.
- Continued development and complete testing of line arrays with piezocrystal vector sensors for improved signal-to-noise and bandwidth.
- Continued design and development of underwater projectors using structural magnetostrictive materials.
- Continued development of baffled ring transducer technology.
- Continued development of improved techniques to distinguish submarine echoes from those produced by ocean bottom features.
- Continued development of an acoustic/magnetic hybrid sensor.
- Completed evaluation of Reduced Diameter fiber-optic sensor to improve towed array reliability and transition to the NAVSEA Advanced Systems Technology Office, PE 0603561N.
- Completed development of sensors and algorithms to compensate for towed array performance degradation during maneuvers/turns and transition to the NAVSEA Advanced Systems Technology Office, PE 0603561N.
- Completed development of structural magnetostrictive materials to enable more rugged transducer designs.
- Completed investigations into time-reversal techniques to improve the performance of active sonar systems.
- Completed the development of a concept that automatically guides sonar operators through the complicated threat submarine detection, classification, and tracking process.
- Completed investigations of the feasibility of geo-acoustic parameter inversion and demonstrate using an operational Navy asset. (NRL)

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

- Initiated development of low cost, compact, combined acoustic sensor.
- Initiated development of advanced sonar signal processing algorithms that integrate target classification and tracking into a combined system for autonomous deployable sensor processing. The following efforts contribute to the Littoral Anti-Submarine Warfare Future Naval Capability:
- Continued development of signal processing and system control algorithms for the AN/WSQ-11 “Tripwire” torpedo protection system.
- Continued development of an AN/WSQ-11 “Tripwire” testbed for the testing of algorithms.
- Continued hardware component integration, testing; initiated further development to improve array functionality of the acoustic test bed in support of future passive sonar system designs.
- Completed preliminary Multi-Mode Magnetic Detection System (MMMDS) design and component-level development of air deployed magnetometer sensor technologies.
- Completed MMMDS development and installation of real-time noise reduction, detection, and tracking algorithms to enable data collection and performance evaluation.
- Initiated Adaptive Beamforming processing development.
- Initiated collection and analysis of MMMDS performance data. This effort transitions to PE 0603747N in FY 2006.
- Initiated evaluation of proposed MMMDS processing approaches and down-select to one approach. This effort transitions to PE 0603747N in FY 2006.
- Initiated collection of data at sea from torpedoes fired in salvoes of two and four for purposes of developing advanced automatic detectors and false alarm reduction techniques.

FY 2006 Plans:

- Continue all FY 2005 efforts, less those noted as completed.
- Continue collection of data at sea from torpedoes fired in salvoes of two and four for purposes of developing advanced automatic detectors and false alarm reduction techniques. Counter Torpedo Detection, Classification, and Localization (CTDCL) transitions to PE 0603123N (Force Protection Advanced Technology) in FY07.
- Complete development of baffled ring transducer technology. The following efforts contribute to the Littoral Anti-Submarine Warfare Future Naval Capability:
- Continue all FY 2005 efforts, less those noted as completed or transitioned.
– Continue hardware component integration, testing, and installation of acoustic array components in support of future array deployment.
- Complete Adaptive Beamforming processing development.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

FY 2007 Plans:

- Continue all FY 2006 efforts, less those noted as completed.
- Complete investigation of synthetic aperture sonar techniques for improving target versus clutter classification performance.
- Complete development of Acoustic Flux Sensor for affordable improvement of sonar signal-to-noise.
- Complete development of line arrays with piezocrystal vector sensors for improved signal-to-noise and bandwidth.

The following efforts contribute to the Littoral Anti-Submarine Warfare Future Naval Capability:
- Continue all FY 2006 efforts, less those noted as completed.
- Initiate a focused research study to evaluate sonar performance using the acoustic array testbed.

	FY 2005	FY 2006	FY 2007
COOPERATIVE ASW	1,171	738	766

Cooperative ASW technology developments enable ASW platforms to work together effectively to detect, classify, and localize very quiet undersea targets. Many of the tools required to achieve this objective were being developed as components of the Littoral Anti-Submarine Warfare Future Naval Capability under the heading of Integrated Anti-Submarine Warfare (IASW) in PEs 0602235N and 0603235N. The focus of this effort is to leverage those concepts and technologies previously investigated under IASW in order to develop technologies that enable the exchange and fusion of ASW sensor data among the technologies developed under Battlegroup ASW Defense, Wide Area ASW Surveillance, and Neutralization program areas.

The funding profile from FY06 to FY07 reflects the completion of the real-time data fusion effort.

FY 2005 Accomplishments:

- Continued development of technologies to automatically fuse tactical ASW sensor information to enhance the ASW portion of the Common Tactical Undersea Picture.
- Completed investigation into a flexible information/knowledge management architecture that can support several sonar systems and include land/air-based sensors.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

- Initiated the incorporation of estimates of environmental uncertainty into the fusion of sensor information.

FY 2006 Plans:

- Continue all FY 2005 efforts, less those noted as completed.
- Complete development of technologies to automatically fuse tactical ASW sensor information to enhance the ASW portion of the Common Tactical Undersea Picture.
- Initiate planning for an at-sea demonstration of real-time data fusion technologies.

FY 2007 Plans:

- Continue all FY 2006 efforts, less those noted as completed.
- Complete planning for and conduct at-sea technology demonstration of real-time data fusion technologies and analyze results.

	FY 2005	FY 2006	FY 2007
NEUTRALIZATION	10,317	18,481	23,848

Neutralization focuses on the development of enabling technologies for undersea weapons to counter threat submarines and surface vessels by increasing Probability of Kill and platform survivability. Weapon technology focus areas include: Explosives and Warheads, Guidance and Control (G&C), Multidisciplinary Systems Design & Optimization (MSDO) (comprising Simulation Based Design, Silencing, and Propulsion), Power Sources, Supercavitation, and Torpedo Defense (TD).

Demonstration Future Naval Capabilities projects included in the Neutralization effort (between FY05 and FY07) include: 1). Heavyweight Torpedo Technologies project (completed in FY05; subset of Torpedo Bridging Technology (TBT)), 2). the initiation of the Lightweight Torpedo Technology (LTT) project (initiated in FY05; subset of TBT), and 3). the initiation of the Compact Rapid Attack Weapon (CRAW) project (initiates in FY07).

The ultimate goal of the Neutralization effort is to develop modular and reduced sized undersea weapons based on common technology enablers (where possible), to provide revolutionary capabilities needed to fill Sea Shield Warfighter Capability Gaps, and enable new undersea weapon concepts of operations to rapidly transition to submarine neutralization/engagement in deep and shallow water under unique payload limitations posed by unmanned platforms, external stowage, and future Naval platforms.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

The funding profile from FY05 to FY06 reflects an increased naval emphasis on applied research and development of Lightweight Torpedo Technology (LTT) for the operational fleet. Additionally the development of LTT will sequentially feed into the Compact Rapid Attack Weapon (CRAW) initiating in FY07.

The increase from FY 2006 to FY 2007 reflects the reorganization of FNC program investments into ECs. As a result of this reorganization, the funding for each EC has been aligned to a budget activity 2 and budget activity 3 PE as appropriate. This activity reflects the alignment of investments for the Sea Shield EC.

FY 2005 Accomplishments:

- Continued development of improved threat models and torpedo system simulation capabilities under the Torpedo Enterprise Advanced Modeling and Simulation initiative.
- Continued development of technologies for terminal defense against close-in waterborne/underwater threats and high-speed weapons (examine experimentally, in water, the physics of interactions among multiple supercavitating projectiles in a projectile burst).
- Continued optimization of undersea weapons system design using MSDO with respect to constraints in cost and performance.
- Continued development of enhanced performance directed energy torpedo warhead technologies for Light Weight Torpedo Improvement and Compact Rapid Attack Weapon (CRAW) applications.
- Continued validation of computational models for torpedo lethality.
- Continued effort to conduct full ship validation effort for Explosion Response simulation code, using Dynamic System Mechanics Advanced Simulation (DYSMAS) Hydrocode (test plan developed, finite element ship model was completed, pretest simulations were conducted).
- Continued implementation of MSDO tools in hybrid propulsion and Weapons Silencing systems development.
– Continued development of high-speed supercavitating torpedo vehicle control and homing sensor. Continued to conduct experiments and tests on vehicle control concepts and homing sensors.
- Continued fourth quarter (of the fiscal year) explosive testing for warhead projects.
- Completed development of algorithms for coordinated behavior of groups of torpedo defense vehicles. Transition software algorithms to Next Generation Counter Measure (NGCM) in PE 0602123N.
- Completed technology development and in-water testing of the Weapon Silencing integrated motor/propulsor - Low Acoustic Motor Propulsor (LAMPrEy).
- Initiated development of a supercavitating 6.75-inch (or full-scale) vehicle with vehicle control devices and homing sensors.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

- Initiated feasibility investigations (including acoustic element construction) to test the ability of single crystal to operate at high field, high drive, and high duty cycle for both torpedo Tonpiltz transducer and broadband cylindrical projector applications.
- Initiated transition of undersea weapons system design tools techniques to Lightweight Torpedo (LWT), Anti-Torpedo Torpedo (ATT), and Next Generation Countermeasure. PEs 0602747N (FNC) and 0602123N (FNC).

The following efforts support the Sea Shield Future Naval Capability in the Littoral Anti-Submarine Warfare Mission Area:
- Continued application of MSDO tools probabilistic methods and uncertainty analysis for LWT design.
- Continued planning of a joint project agreement between the US and UK titled “Torpedo Guidance and Control (G&C): False Targets" and delivered a summary statement of intent to the Navy International Project Office.
- Completed development of TBT for weapons and combat systems to capitalize on connectivity between a HWT and submarine platform combat control including sensors.
- Completed development of TBT Weapons G&C innovative adaptive broadband signal processing algorithms that will improve a torpedo’s single-ping detection, classification, and localization.
- Completed transition of broadband signal processing and intelligent control technologies to PE 0603747N (R2 Activity: Neutralization) for integration and in-water demonstration during FY 2005.
- Initiated and completed development of a high fidelity Simulation Based Design model evaluation of weapon signal processing, Heavyweight Torpedo (HWT) tactical control technologies, and false alarm bottoms. Transition to PE 0603747N.
- Initiated feasibility investigations under LTT to quantify adjunct sensor configurations and signal processing approaches to enable positive discrimination of artificial targets at standoff ranges. This feasibility investigation is expected to result in five (5) new patent applications.
- Initiated (within the LTT project) sub-scale testing and scaling law determination of the directed blast warhead.
- Initiated LTT feasibility investigations to select the stealth and propulsion technologies for future integration as a low cost propulsion replacement for the Mk 54 lightweight torpedo.
- Initiated LTT feasibility investigations and selected geo-coordinate based navigation system technologies and connectivity methods (i.e. acoustic communications, fiber link) for future development of technologies for lightweight torpedo demonstration).
- Initiated data collection for lightweight torpedo broadband and counter-countermeasures in the harsh shallow water environment of the Shore Bombardment Area site off the Southern California Off-Shore Range using an experimental test vehicle fitted with a broadband Mk 54 array.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

FY 2006 Plans:

- Continue all efforts of FY 2005, less those noted as completed.
- Complete transition of undersea weapons system design tools techniques to LWT, Anti-Torpedo Torpedo (ATT), and Next Generation Countermeasure. PEs 0602747N (FNC) and 0602123N (FNC).
- Initiate fin and cavitator control, and integrate with controller for the supercavitating 6.75-inch vehicle.
- Initiate transition of LAMPrEy technology to DARPA Tango Bravo Program.
- Initiate torpedo design and optimization to support the external weapon stowage effort in DARPA Tango Bravo Program.
- Initiate data collection on a technology test-bed for surface ship close in torpedo defensive system using supercavitating projectiles

The following efforts support the Sea Shield Future Naval Capability in the Littoral Anti-Submarine Warfare Mission Area:
- Continue all efforts of FY 2005, less those noted as completed.
- Initiate LTT sensor package development to achieve integrated coherent broadband sonar and novel adjunct sensors homing and classification capabilities for LWT.
- Initiate LTT development of an advanced LWT directed charge warhead, multi-mode fusing, and sub-scale detonation testing.
- Initiate LTT advanced counter-countermeasure algorithm and tactics development for LWT.
- Initiate feasibility assessment of LTT to best utilize precision targeting and distributed sensors for weapon employment from high altitude and standoff range.
- Initiate development and integration of adjunct sensors into a lightweight torpedo sensor and design signal processing and data fusion techniques to improve target classification in areas of high contact density.
- Initiate a high fidelity weapon frequency model development effort to parallel adjunct sensor developments and provide accurate synthetic data for algorithm design and measurement. Transition to PE 0603747N.

FY 2007 Plans:

- Continue all efforts of FY 2006, less those noted as completed.
- Complete LAMPrEy technology transition to DARPA Tango Bravo Program. PE 0603766E, Project NET-02.
- Complete development of improved threat models and torpedo system simulation capabilities under the Torpedo Enterprise Advanced Modeling and Simulation initiative.
- Complete transition of appropriate supercavitating vehicle control technology and control devices to DARPA

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

Underwater Express program.
- Initiate efforts that enhance undersea weapons G&C capabilities in autonomy, sensors, sensor processing, communication and networking by leveraging current, or contribute to developing, technologies for unmanned undersea vehicles (UUVs).

The following efforts support the Sea Shield Future Naval Capability in the Littoral Anti-Submarine Warfare Mission Area:
- Continue all efforts of FY 2006, less those noted as completed.
- Complete the joint project agreement between the US and UK titled “Torpedo Guidance & Control (G&C): False Targets" and investigate options for continued collaboration.
- Initiate development of a reduced size/weight CRAW for air deployment. This effort will include sensor, guidance and control, warhead, propulsion, and air frame integration tasks.
- Initiate use of design techniques for LWT using undersea weapons system design tools transitioned from PE 0602747N D&I in FY 2006.

CONGRESSIONAL PLUS-UPS:

	FY 2005	FY 2006
ACOUSTIC LITTORAL GLIDER SYSTEM	4,148	3,900

FY 2005 - Designed, built, and tested a prototype acoustic glider capable of operation in harsh littoral environments.

FY 2006 - This effort supports acoustic littoral glider system research.

	FY 2005	FY 2006
ATT (6.75-INCH DIAMETER) MULTI-MISSION WEAPON	4,919	1,700

FY 2005 - Continued optimization of signal processing and 6.75” weapon tactics used in ATT for offensive applications; updated the multi-mission ATT performance assessment software tools to address air dropped compact rapid attack weapon concept; and collected in-water data to evaluate proposed multi-mission guidance and control technologies.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

FY 2006 - This effort supports the ATT multi-mission weapon research.

	FY 2005	FY 2006
GALFENOL ALLOYS	1,156	0

Initiated development of metallurgical techniques to inexpensively manufacture Galfenol and other compositions of that general class of magnetostrictive materials. Galfenol is ductile (i.e., not brittle) and as such can be utilized in numerous applications that normal magnetostrictive and piezoelectric materials cannot be used.

	FY 2005	FY 2006
HIGH POWER, HIGH DUTY TRANSDUCERS	0	2,300

This effort supports high power, high duty transducer research.

	FY 2005	FY 2006
HIGH POWERED ULTRASONICS/SHIP WASTE TREATMENT	977	0

Continued most promising efforts of FY04. Initiated development of a small-scale prototype system for treating shipboard waste using high-powered ultrasonic technology.

	FY 2005	FY 2006
MAGNETORESTRICTIVE TRANSDUCTION RESEARCH	3,859	0

Continued the development and transition of Terfenol-D as an active magnetostrictive material for use in advanced underwater sonar transducer arrays. Expanded effort to include improvements to the corrosion resistance of the material.

	FY 2005	FY 2006
MEMS-IMU FOR AN ADVANCED UNDERWATER SENSOR	2,701	2,800

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

FY 2005 - Continued development of advanced manufacturing processes for MEMS and demonstrated their reliability and application in system prototyping and low volume output for various applications.

FY 2006 - This effort supports MEMS-IMU for an advanced underwater sensor research.

	FY 2005	FY 2006
MICRO-DETONICS FOR MINIATURE WEAPONS	2,701	0

Initiated development of the technology to enable fabrication of integrated Microelectromechanical Systems (MEMS) fuzing and micro-explosive initiators. Base materials and processes for in-situ fabrication of the micro-explosive material were investigated and developed. Micro-explosive materials resulting from candidate processing methods were analyzed and tested. The best processes was adopted and integrated into the MEMS fabrication sequence. The fabrication process, including the incorporation of micro-explosive material into a MEMS Fuzing/Safe & Arming chip, was demonstrated.

	FY 2005	FY 2006
PROTOTYPE DEMONSTRATION OF POINT DEFENSE UNDERSEA WEAPON	0	2,500

This effort supports prototype demonstration of point defense undersea weapon research.

	FY 2005	FY 2006
TOW CABLE SHAPE ESTIMATION	0	1,000

This effort supports tow cable shape estimation research.

C. OTHER PROGRAM FUNDING SUMMARY:
NAVY RELATED RDT&E:
PE 0601153N (Defense Research Sciences)
PE 0602114N (Power Projection Applied Research)
PE 0602123N (Force Protection Applied Research)

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE APPLIED RESEARCH
PROJECT TITLE: UNDERSEA WARFARE APPLIED RESEARCH

PE 0602435N (Ocean Warfighting Environment Applied Research)
PE 0602782N (Mine and Expeditionary Warfare Applied Research)
PE 0603114N (Power Projection Advanced Technology)
PE 0603123N (Force Protection Advanced Technology)
PE 0603506N (Surface Ship Torpedo Defense)
PE 0603553N (Surface ASW)
PE 0603561N (Advanced Submarine System Development)
PE 0603747N (Undersea Warfare Advanced Technology)
PE 0603758N (Navy Warfighting Experiments and Demonstrations)
PE 0604221N (P-3 Modernization Program)
PE 0604261N (Acoustic Search Sensors)
PE 0604784N (Distributed Surveillance Systems)

NON-NAVY RELATED RDT&E:
PE 0603763E (Marine Technology)
PE 0603739E (Advanced Electronics Technologies)
PE 0602702E (Tactical Technology)

D. ACQUISITION STRATEGY:
Not applicable.