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

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

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
Total PE	36,949	35,110	35,055	54,160	54,773	54,968	54,954
2916 UNDERSEA WARFARE ADVANCED TECHNOLOGY	30,296	27,160	35,055	54,160	54,773	54,968	54,954
9999 CONGRESSIONAL PLUS-UPS	6,653	7,950	0	0	0	0	0

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: All Navy advanced technology development in undersea target detection, classification, localization, tracking and neutralization is funded through this Program Element (PE). The related technologies being developed are aimed at enabling Sea Shield, one of the three 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. The focus is on 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.

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B. PROGRAM CHANGE SUMMARY:

	FY 2005	FY 2006	FY 2007
FY 2006 President's Budget Submission	33,087	27,603	35,520
Congressional Action	0	7,950	0
Congressional Undistributed Reductions/Rescissions	-26	-443	0
Execution Adjustments	4,391	0	0
FY 2005 SBIR	-509	0	0
Program Adjustments	6	0	0
Program Realignment	0	0	-404
Rate Adjustments	0	0	-61
FY 2007 President's Budget Submission	36,949	35,110	35,055

PROGRAM CHANGE SUMMARY EXPLANATION:
Technical: Not applicable.

Schedule: Project Morgan funding for FY 2005-07 was transferred from PE 0603747N (BA 3) to 0603734N (BA 4). This funding transfer creates a downward funding profile in PE 0603747N.

C. OTHER PROGRAM FUNDING SUMMARY:
Not applicable.

D. ACQUISITION STRATEGY:
Not applicable.

E. PERFORMANCE METRICS:
The overall metrics of advanced 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.

BUDGET ACTIVITY: 03
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PROJECT NUMBER: 2916 PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

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
2916 UNDERSEA WARFARE ADVANCED TECHNOLOGY	30,296	27,160	35,055	54,160	54,773	54,968	54,954

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: All Navy advanced technology development 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 three 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	7,710	12,564	22,909

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 ASW Surveillance is the ability to rapidly distribute 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, multi-static operation, supported by passive/active signal processing with the objective of increased detection capabilities. This activity includes support to Project Morgan the details of which are classified. Project Morgan funding transferred to PE 0603734N, Project 1804 in FY 2005 through FY 2007.

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
PROJECT NUMBER: 2916 PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

As described under the Cooperative ASW Activity, beginning in FY 2005 testing and demonstrations associated with LWAD will be reported as part of the overall technologies being tested/demonstrated in this PE. As a result, funding no longer is reported under Cooperative ASW, rather it is included in the other activities. This change causes an additional shift among the R-2 Activities.

FY 2005 Accomplishments:

- Continued development of multistatic sonar signal classification algorithms for coherent sources.
- Continued concept of operations development and performance requirements for multistatic sonar employing remotely operated sound sources and receivers
- Continued at-sea demonstrations and data collections with the Compact Deployable Multistatic Receiver (CDMR) Advanced Development Model (ADM).
– Continued development and testing of Deployable Autonomous Distributed System (DADS) technologies in preparation for a barrier demonstration.
– Continued planning for and conduct of DADS barrier demonstration. - Initiated the writing of DADS system documentation.

FY 2006 Plans:

- Continue all FY 2005 efforts less those noted as completed.
- Complete development of multistatic sonar signal classification algorithms for coherent sources.
- Complete concept of operations development and performance requirements for multistatic sonar employing remotely operated sound sources and receivers.
- Complete development and testing of Deployable Autonomous Distributed System (DADS) technologies in preparation for a barrier demonstration.
- Complete planning for and conduct of DADS barrier demonstration.
- Complete writing of the DADS system documentation.

FY 2007 Plans:

- Continue all other FY 2006 efforts less those noted as completed.
- Continue Submarine Track and Trail-Baseline advanced research efforts in the areas of advanced undersea sensors, communications, and autonomy. This effort transferred to this PE from PE 0603114N due to Enabling Capability realignments.

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PROJECT NUMBER: 2916 PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

- Complete at-sea demonstrations and data collections with the CDMR ADM.
- Complete integrated at-sea testing of the multistatic system components (CDMR, Compact Deployable Multistatic Source, signal processing software, and “field-level” processing). This effort transitioned to this PE from PE 0602747N.
- Complete DADS deployment study to investigate various tactical deployment options. This effort transitioned from PE 0602747N.
- Initiate DADS deployment feasibility effort.
- Initiate testing of the PALANTIR (A non-acoustic surveillance system) sensor system.
- Initiate tactical test planning for the PALANTIR sensor.
- Initiate development of active sonar sensors and processing for wide area surveillance of deep ocean operating areas.

	FY 2005	FY 2006	FY 2007
BATTLEGROUP ANTI-SUBMARINE WARFARE (ASW) DEFENSE	5,362	14,596	8,618

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 detections inside 10 nautical miles. 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 arrays, large multi-line arrays, and submarine flank arrays all with environmental adaptation capabilities. This activity includes support to Project Morgan, the details of which are classified. Project Morgan funding transferred to PE 0603734N, Project 1804 in FY 2005 through FY 2007.

As described under the Cooperative ASW Activity, beginning in FY 2005 testing and demonstrations associated with LWAD will be reported as part of the overall technologies being tested/demonstrated in this PE. As a result, funding no longer is reported under Cooperative ASW, rather it is included in the other activities. This change causes an additional shift among the R-2 Activities.

FY 2005 Accomplishments:

- Continued development, demonstration and transition of Sonar Automation Technology (SAT) threat submarine detection and classification algorithms.
- Continued a performance evaluation of a Counter Torpedo Detection, Classification, and Localization (CTDCL)

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
PROJECT NUMBER: 2916 PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

prototype torpedo protection system capable of countering two torpedoes launched in rapid succession.
- Initiated integration of CTDCL processing with advanced sensors for outyear transition to the AN/WSQ-11 program via the Block II and III upgrades.
- Initiated Multi-Mode Magnetic Detection System (MMMDS) development of magnetometer sensor technologies and deliver the first AN/ASQ-233 magnetometer sensor.
- Initiated the integration of MMMDS sensor hardware/software into towed vehicles and fixed-wing Unmanned Air Vehicles (UAV).
- Initiated development of SAT algorithms for transition to the distributed ASW sensors of the Integrated Undersea Surveillance System, Naval Sea Systems Command (NAVSEA), PE 0204311N (Maritime Surveillance Program).

FY 2006 Plans:

- Continue all FY 2005 efforts less those noted as completed.
- Complete performance evaluation of a CTDCL prototype torpedo protection system capable of countering two torpedoes launched in rapid succession. All CTDCL efforts transfer to and are reported under PE 0603123N in FY 2007.
- Complete collection and analysis of MMMDS performance data. This work transitioned from PE 0602747N.
- Complete evaluation of proposed MMMDS processing approaches and down-select to one approach. This work transitioned from PE 0602747N.
- Complete planning for MMMDS tests that utilize fixed wing aircraft, helicopter, and UAV platforms.

FY 2007 Plans:

- Continue all FY 2006 efforts less those noted as completed.
- Complete development and demonstration of SAT threat submarine detection and classification algorithms; transition to NAVSEA under PE 0603561N (Advanced Submarine System Development), Project 0223 (Submarine Combat Systems Improvements) and PE 0204311N (Maritime Surveillance Program).
- Complete MMMDS development of magnetometer sensor technologies.
- Complete test flights to collect relevant MMMDS data.

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
PROJECT NUMBER: 2916 PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

	FY 2005	FY 2006	FY 2007
COOPERATIVE ANTI-SUBMARINE WARFARE (ASW)	2,366	0	0

Cooperative ASW technology developments enable ASW platforms to work together effectively to detect, classify and localize very quiet undersea targets. The Integrated ASW (IASW) effort has since been terminated due to budget reductions. The focus of this project is to demonstrate the operational utility of employing these IASW tools together with ASW sensor technologies developed as part of the Battlegroup ASW Defense, Wide Area ASW Surveillance, and Neutralization program areas. Demonstrations are conducted primarily in conjunction with Fleet platforms and exercises. This activity includes support to Project Morgan the details of which are classified. Project Morgan funding transfered to PE 0603734N, Project 1804 in FY 2005 through FY 2007.

Beginning in FY 2005 testing and demonstrations associated with LWAD are reported as part of the overall technologies being tested/demonstrated in this PE. As a result, funding no longer is reported under Cooperative ASW, rather it is included in the other activities. This change causes an additional shift among the R-2 Activities.

FY 2005 Accomplishments:

- Continued LWAD activities for two littoral ASW at-sea experiments.
- Testing and demonstrations associated with LWAD activities are reported in the future as an integral part of the overall technologies being tested/demonstrated in other PE 0603747N activities.

	FY 2005	FY 2006	FY 2007
NEUTRALIZATION	14,858	0	3,528

Neutralization focuses on undersea weapons technologies to counter threat submarines by increasing the Probability of Kill (PK). Weapon technology areas include: Torpedo Bridging Technologies (TBT) which addresses development of technologies to enable a heavyweight torpedo (HWT) and a shooting platform to be effectively employed as a fully-linked weapon system utilizing a fiber optic link, broadband signal processing, and behavior based control; and the SwampWorks advanced torpedo effort which demonstrates technologies to meet emerging challenges of low Doppler, small targets (diesel submarines), in harsh littoral

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
PROJECT NUMBER: 2916 PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

environments. The ultimate goals of Neutralization efforts are to develop reduced size advanced undersea weapons with revolutionary capabilities and to fill Sea Shield mission capability gaps and demonstrate transformational capabilities for anti-submarine warfare weapons.

As described under the Cooperative ASW Activity, beginning in FY 2005 testing and demonstrations associated with LWAD will be reported as part of the overall technologies being tested/demonstrated in this PE. As a result, funding no longer is reported under Cooperative ASW, rather it is included in the other activities. This change causes an additional shift among the R-2 Activities.

FY 2006 reflects the transfer of funds requirements associated with Swampworks to PE 0603758N. FY 2007 reflects continuation of TBT development efforts funded in FY 2005.

FY 2005 Accomplishments:

- Continued demonstration of the SwampWorks advanced half-length torpedo vehicle including self noise, stability and control, and a proof-of-concept littoral upgrade to the MK48 Advanced Capability sonar
- Continued transition of broadband signal processing algorithms to Naval Sea Systems Command (NAVSEA) Advanced Systems Technology Office Advanced Processing Build (APB) – Acoustic in PE 0603561N.
- Continued planning and logistics for in-water demonstration of an improved PK for close-in, submarine-on-submarine engagements. (SwampWorks)
- Continued the development and transition (PE 0603561N) of a sonar for the new lightweight torpedo, MK54, under the auspices of SwampWorks.
- Completed development and demonstration of technologies to enable a torpedo and a shooting platform to be effectively employed as a fully linked weapon system incorporating TBT.
- Initiated and completed transition of TBT weapon control tactics to conduct advanced counter-countermeasure algorithms and Initiated and completed area of uncertainty multi-way-point search to NAVSEA MK48 Common Broadband Sonar System (CBASS) program. (PE 0603561N)
- Initiated and completed transition of dual band frequency agile signal processing software, documentation, and data developed under TBT to the NAVSEA(PMS404) MK48 CBASS program. (PE 0603561N)
- Initiated and completed development, integration, and closed loop in-water demonstration of a fully coherent broadband signal processing sonar system with advanced tactics in a behavior based Torpedo Intelligent Controller (TIC) for transition to the MK48 CBASS torpedo (TBT).
- Initiated and completed transition of a narrow band adaptive beamforming simulation module and weapon source code algorithm developed under TBT to the new common baseline MK54/MK48 CBASS software APB process (PMS404)

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PROJECT NUMBER: 2916 PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

which will operate with MK48 ADCAP or MK54 lightweight torpedo (LWT) waveforms. (PE 0603561N)
- Initiated and completed transition of fully coherent broadband Low Doppler signal processing software, documentation and data developed under TBT to the MK48 CBASS program (PMS404). (PE 0603561N)
- Initiated and completed transition of the TBT developed TIC architecture, source code, documentation and development tools with completed area of uncertainty based search, classification, homing, countermeasure and terminal homing behaviors to the MK48 CBASS program (PMS404) via the Torpedo APB process. (PE 0603561N)
- Initiated and completed transition of the integration and validation of a high fidelity bottom model (developed under 0602747N) capable of simulating statistical and fixed position ocean bottom false alarms and false targets at undersea weapons frequencies and initiated reuse development and integration of this model across the undersea weapon simulation community.
- Initiated and completed TBT high fidelity simulation based evaluation of weapon signal processing and HWT tactical control technologies.

FY 2006 Plans:

- All SwampWorks related activities will transfer to PE 0603758N in FY 2006 and out.

FY 2007 Plans:

- Initiate LWT Technology (LWTT) integration of broadband and adjunct sensors for in-water data collection to result in a new dual-mode sensor guidance and control system.
- Initiate LWTT scale up and testing of a directed blast warhead prototype using approved insensitive explosives to quantify attainable ASW and antisurface warfare lethality in the Mk 54 form factor.

C. OTHER PROGRAM FUNDING SUMMARY:
NAVY RELATED RDT&E:
PE 0204311N (Integrated Surveillance System)
PE 0205620N (Surface ASW Combat System Integration)
PE 0601153N (Defense Research Sciences)
PE 0602235N (Common Picture Applied Research)
PE 0602435N (Ocean Warfighting Environment Applied Research)
PE 0602747N (Undersea Warfare Applied Research)
PE 0602782N (Mine and Expeditionary Warfare Applied Research)
PE 0603235N (Common Picture Advanced Technology)

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
PROJECT NUMBER: 2916 PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

PE 0603254N (ASW Systems Development)
PE 0603506N (Surface Ship Torpedo Defense)
PE 0603513N (Shipboard System Component Development)
PE 0603553N (Surface ASW)
PE 0603734N (CHALK CORAL)
PE 0604221N (P-3 Modernization Program)
PE 0604261N (Acoustic Search Sensors)
PE 0604503N (SSN-688 and Trident Modernization)
PE 0604784N (Distributed Surveillance System)

NON-NAVY RELATED RDT&E:
PE 0603175C (Ballistic Missile Defense Technology)
PE 0602702E (Tactical Technology)
PE 0603739E (Advanced Electronics Technologies)
PE 0603763E (Marine Technology)

D. ACQUISITION STRATEGY:
Not applicable.

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
PROJECT NUMBER: 9999 PROJECT TITLE: Congressional Plus-Ups

CONGRESSIONAL PLUS-UPS:

	FY 2005	FY 2006
HAWAII UNDERSEA VEHICLE TEST AND TRAINING ENVIRONMENT	2,507	1,700

FY 2005 - Developed and tested advanced technologies to meet operational requirements related to the Advanced Swimmer Delivery Vehicle.

FY 2006 - This effort supports the Hawaii undersea vehicle test and training environment.

	FY 2005	FY 2006
LITTORAL AWS MISSION FOR RIGID HULL-INFLATABLE BOAT (RHIB)	964	0

Initiated adaptation and testing of a Variable Depth Sonar System Anti-Submarine Warfare mission package for the Rigid Hull-Inflatable Boat.

	FY 2005	FY 2006
MPP/APB TORPEDO IMPROVEMENT PROGRAM	0	4,000

This effort supports the MPP/APB torpedo improvement program.

	FY 2005	FY 2006
SAUVIM	1,254	1,000

FY 2005 - Continued development and demonstration of an unmanned, underwater vehicle capable of navigation, station keeping and performing complex tasks using a robotic arm, all with minimal interaction from an operator stationed on the ocean surface. Strong underwater currents and limited visibility exacerbate the problem of vehicle navigation and control. Performing tasks with the arm requires the development of complex robotic control algorithms and the capability to recognize and determine the dimensions of underwater objects.

FY 2006 - This effort supports SAUVIM research.

BUDGET ACTIVITY: 03
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PROJECT NUMBER: 9999 PROJECT TITLE: Congressional Plus-Ups

	FY 2005	FY 2006
SEA TEST FOR TOWED ACOUSTIC ARRAYS	1,928	0

Expanded the previous at-sea test to extend the existing array shape prediction capability to include the TB-16 towed array under drastic maneuvering and high speed conditions.

	FY 2005	FY 2006
VALIDATION AND IMPLEMENTATION OF SENSOR SWEET SPOT SELECTION ALGORITHMS	0	1,250

This effort supports validation and implementation of sensor sweet spot selection algorithms research.