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

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

COST: (Dollars in Thousands)

Project Number & Title	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
Total PE	34,239	75,422	81,490	74,747	56,626	52,470	61,256
2916 UNDERSEA WARFARE ADVANCED TECHNOLOGY	29,382	72,243	81,490	74,747	56,626	52,470	61,256
9999 CONGRESSIONAL PLUS-UPS	4,857	3,179	0	0	0	0	0

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

All Navy advanced technology development in undersea target detection, classification, localization, tracking and neutralization is funded through this 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 2007	FY 2008	FY 2009
FY 2008/FY 2009 President's Budget Submission	34,888	73,626	79,450
Congressional Action	0	3,200	0
Congressional Undistributed Reductions/Rescissions	0	-504	0
Program Adjustments	0	0	1,937
Rate Adjustments	0	0	103
SBIR Assessment	-649	-900	0
FY 2009 President's Budget Submission	34,239	75,422	81,490

PROGRAM CHANGE SUMMARY EXPLANATION:
Technical: FY 2007 reflects a $5M Congressional reduction. The following efforts are impacted as a result.
- Lightweight Torpedo Technologies (LTT)(-2,412K): Decrease at-sea test and demonstration phase of LTT project from four years to three years. This increases risk of being ready to conduct final LTT system demonstration in FY 2010 per the approved Technology Transition Agreement with the Naval Sea Systems Command (NAVSEA).
- Reduces demonstration candidates for adjunct sensing methods thus increasing risk of project failure.
- Terminated test of a directed blast prototype for a new LTT warhead.

The funding increase from FY 2007 to FY 2008 and FY 2009 is due to the initiation of Distributed System Processing (DSP), On-Demand Detection Classification and Localization (ODDCL), Innovative Naval Prototype (INP) Persistent Littoral Undersea Surveillance (PLUS) as well as expanded efforts in Deployable Autonomous Distributed System Deployability (DADS-D), Palantir, Submarine Track & Trail, and Deep Water Active Deployable System (DWADS). Further details are provided under the Wide Area ASW Surveillance activity.

Schedule: The following schedule delays were caused by the FY 2007 Congressional reduction of $5M:
- Compact Rapid Attack Weapon (CRAW)(-874K): Delay initiation of CRAW demonstrations from FY 2007 to FY 2008.
- Submarine Track & Trail (STT) (-1,714K): Delay integration of the STT sensor with submersible, checkout testing at-sea, and development and evaluation of tracking algorithms.

BUDGET ACTIVITY: 03
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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, and 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, while reducing size and power requirements.

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

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

COST: (Dollars in Thousands)

Project Number & Title	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
2916 UNDERSEA WARFARE ADVANCED TECHNOLOGY	29,382	72,243	81,490	74,747	56,626	52,470	61,256

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: All Navy advanced technology developments in undersea target detection, classification, localization, tracking and neutralization are 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 2007	FY 2008	FY 2009
WIDE AREA ANTI-SUBMARINE WARFARE (ASW) SURVEILLANCE	19,779	49,534	58,254

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.

The net increase from FY 2007 to FY 2008 is due to the initiation of DSP, ODDCL, and INP-PLUS and expanded efforts in DADS-D, Palantir, STT, and DWADS. The further expansion of efforts in DADS-D, Palantir, STT, DWADS, DSP, ODDCL, and INP-PLUS contributes to the net funding increase from FY 2008 to FY 2009.

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
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Additionally, the increase in Wide Area ASW Surveillance supports a basic shift in Naval strategy away from platform-based undersea surveillance systems toward deployable, distributed systems. The initiation of two and ramp-up of five Future Naval Capabilities (FNC) projects directly supports the shift in Naval strategy to off-board distributed systems and contribute to fleet operational requirements. These efforts are funded in accordance with the FNC process and are approved by the Technology Oversight Group.

FY 2007 Accomplishments:

- Continued STT-Baseline advanced research efforts in the areas of advanced undersea sensors, communications, autonomy, and sensor data collection and analysis to support tracking algorithm and automated processing development. This effort transferred to this PE from PE 0603114N due to Enabling Capability realignments.
- Completed at-sea demonstrations and data collections with the Compact Deployable Multistatic Receiver (CDMR) advanced development model.
- Completed integrated at-sea testing of the multistatic system components (CDMR, Compact Deployable Multistatic Source (CDMS), signal processing software, and "field-level" processing). This effort transitioned from PE 0602747N.
- Completed DADS deployability study to investigate various tactical deployment options. This effort transitioned from PE 0602747N.
- Initiated DADS deployability, survivability and classification performance improvement effort.
- Initiated testing of the Palantir (a non-acoustic surveillance system) sensor system. The related test planning is conducted in PE 0602747N.
- Initiated and completed design improvements of the Palantir sensor/data collection system and conduct an FY 2007 data collection exercise.
- Initiated tactical test planning for the Palantir sensor.
- Initiated development of active sonar sensors and processing for wide area surveillance of deep ocean operating areas.
- Initiated STT sensor integration with an undersea submersible.
- Initiated development of an experimental design model of a DWADS for surveillance of deep ocean submarine threats.

FY 2008 Plans:

- Continue all FY 2007 efforts less those noted as completed.
- Complete integration of STT sensors with undersea submersibles.

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

- Complete all Littoral ASW Multistatic Project efforts for CDMR, CDMS, and development of multistatic signal processing algorithms and transition products to PMA-264, Air Anti-Submarine Warfare Assault and Special Missions Program Office, PE 0603254N, Project 1292.
- Complete development of and test an experimental design model of a DWADS system for surveillance of deep ocean submarine threats.
- Initiate DADS at-sea classification performance improvement testing.
- Initiate at-sea testing of integrated STT submersibles and evaluate overall system performance.
- Initiate integration and evaluation of STT tracking algorithms and automated processing.
- Initiate and complete design improvements of the Palantir sensor/data collection system and conduct an FY 2008 data collection exercise.
- Initiate development of DSP threat submarine feature association and field tracking algorithms for active and passive distributed acoustic ASW systems.
- Initiate the ODDCL effort focusing on the development of sensor and platform designs and key components compatible with a notional Concept of Operations.
- Initiate development of an advanced development model of a DWADS System for surveillance of deep ocean submarine threats.
- Initiate development of a tactical area prototype system for PLUS. This effort transferred to this PE from PE 0602747N.

FY 2009 Plans:

- Continue all FY 2008 efforts less those noted as completed.
- Continue development of a tactical area prototype system for PLUS.
- Complete development of and demonstrate an advanced development model of a DWADS System for surveillance of deep ocean submarine threats.
- Complete development of active sonar sensors and processing for wide area surveillance of deep ocean operating areas.
- Complete integration and evaluation of STT tracking algorithms and automated processing.
- Initiate simulation test of the PLUS prototype system in preparation for at-sea experiments.
- Initiate analysis of data collected during the PLUS at-sea experiments.
- Initiate two at-sea experiments of the prototype system for PLUS.
- Initiate DADS deployability, covert communications and survivability testing.
- Initiate system level design and integration for ODDCL.
- Initiate at-sea demonstrations of STT submersible with fully integrated sensor package.

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

- Initiate test planning of source algorithms to be used to determine the optimal initial placement of uncontrolled drifting distributed systems.
- Initiate research effort aimed at the ideal placement and control of acoustic sources and drifting sensor systems.
- Initiate a research effort focusing on distributed system in-situational environmental characterization and system monitoring.
- Initiate a research effort to determine the placement of and follow-on control and pattern keeping of acoustic sources and distributed sensor systems.

	FY 2007	FY 2008	FY 2009
BATTLEGROUP ANTI-SUBMARINE WARFARE (ASW) DEFENSE	8,458	2,887	0

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.

The net decrease from FY 2007 to FY 2008 is due to the planned phase-down of Multi-Mode Magnetic Detection System (MMMDS) and the transition/completion of the Sonar Automation Technology (SAT) and Shallow Water Array Performance (SWAP) efforts. The net decrease in funding from FY 2008 to FY 2009 is due to the transition/completion of the MMMDS project in FY 2008.

FY 2007 Accomplishments:

- Continued the integration of MMMDS sensor hardware/software into towed vehicles and fixed-wing Unmanned Air Vehicles (UAV).
- Completed 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).
- Completed MMMDS development of magnetometer sensor technologies.
- Initiated and completed test flights to collect relevant MMMDS data.

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
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FY 2008 Plans:

- Complete the integration of MMMDS sensor hardware/software into towed vehicles flown by vertical takeoff unmanned aerial vehicle surrogates.
- Complete MMMDS final reporting; transition to NAVAIR.
- Initiate/complete MMMDS planning and execution of final over water demonstration with realistic target.

	FY 2007	FY 2008	FY 2009
NEUTRALIZATION	1,145	19,822	23,236

Neutralization focuses on undersea weapons technologies to counter threat submarines by increasing the Probability of Kill (PK). 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 ASW weapons.

The increase in funding from FY 2007 through FY 2009 is due to the Lightweight Torpedo Technologies (LTT), which provides a tactically revolutionary PK against quiet diesel-electric submarines operating in harsh shallow water environments, and CRAW which is capable of deployment from an air-vehicle at low altitude to neutralize undersea threat targets from the stand-off ranges of US Naval vessels. These research efforts initiate in FY 2007 and continue for five years and are targeted for transition in FY 2010 and FY 2011 respectively. This project is funded in accordance with the FNC process and is approved by the Technology Oversight Group.

FY 2007 Accomplishments:

- Initiated LTT integration of broadband and adjunct sensors for in-water data collection to result in a new dual-mode sensor guidance and control system for at-sea testing.

FY 2008 Plans:

- Continue all FY 2007 efforts.
- Continue 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. (Transitioned from PE

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
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0602747N)
- Continue 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 (LWT). (Transitioned from PE 0602747N)
- Continue 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 LWT demonstration). (Transitioned from PE 0602747N)
- Continue data collection for LWT 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. (Transitioned from PE 0602747N)
- Continue LTT sensor package development to achieve integrated coherent broadband sonar and novel adjunct sensors homing and classification capabilities for LWT. (Transitioned from PE 0602747N)
- Continue LTT advanced counter-countermeasure algorithm and tactics development for LWT. (Transitioned from PE 0602747N)
- Continue feasibility assessment of LTT to best utilize precision targeting and distributed sensors for weapon employment from high altitude and standoff range. (Transitioned from PE 0602747N)
- Continue 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. (Transitioned from PE 0602747N)
- Continue a high fidelity weapon frequency model development effort to parallel adjunct sensor developments and provide accurate synthetic data for algorithm design and measurement. (Transitioned from PE 0602747N)
- Complete LTT feasibility investigations addressing adjunct sensor configurations, stealth and propulsion technologies, and geo-coordinate based navigation systems. (Transitioned from PE 0602747N)
- Initiate in-water data collection for development of advanced counter countermeasure processing, weapon-to-weapon acoustic communication and a salvo vehicle intelligent controller.
- Initiate development of a high channel count LTT broadband transmitter.
- Initiate development and integration of a total LTT system prototype in the Mk 54 torpedo form factor for at sea demonstrations.
- 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 CRAW in water data collection to support development of guidance and control algorithms enabling an ASW offensive capability in the Common Very Lightweight Torpedo.
- Initiate tests to support the development of a CRAW warhead that will achieve required performance against submarine targets, and demonstrate feasibility of achieving final goal.

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FY 2009 Plans:

- Continue all FY 2008 efforts less those noted as completed.
- Complete LTT development, scale up and testing prototype components.
- Complete LTT advanced counter-countermeasure algorithm and tactics development for LWT.
- Initiate demonstration of LTT underwater acoustic communications capability to enable coordinated attack and net-centric connectivity. (Transitioned from PE 0602747N)
- Initiate demonstration of LTT weapon salvo capability utilizing behavior-based control (Transitioned from PE 0602747N)
- Initiate development of an integrated LTT set-to-hit simulation capability to evaluate weapon performance gains to include robust representations of component technologies developed and demonstrated under the LTT project.
- Initiate design and development of an integrated LTT full system prototype consisting of hardware and software upgrades for a final at-sea demonstrations to be conducted in FY 2010.
- Initiate in-water data collection on CRAW homing in presence of countermeasures.

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
PE 0603254N ASW Systems Development
PE 0603506N Surface Ship Torpedo Defense
PE 0603513N Shipboard System Component Development
PE 0603553N Surface ASW
PE 0603561N Advanced Submarine System Development
PE 0603734N CHALK CORAL
PE 0603782N Mine and Expeditionary Warfare Advanced Technology
PE 0604221N P-3 Modernization Program

BUDGET ACTIVITY: 03
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PE 0604261N Acoustic Search Sensors
PE 0604503N SSN-688 and Trident Modernization
PE 0604784N Distributed Surveillance System

OTHER PROGRAM FUNDING SUMMARY - NON-NAVY RELATED RDT&E:
PE 0602702E Tactical Technology
PE 0603175C Ballistic Missile Defense Technology
PE 0603739E Advanced Electronics Technologies

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 2007	FY 2008
DEEP WATER ACOUSTIC DETECTION SYSTEM	0	3,179

The goal of this effort is to develop a full-scale prototype of a wave-harvesting buoy to operate a moored autonomous sonar continuously for more than a month while reducing the buoy size by ten percent over the previous design.

	FY 2007	FY 2008
DEMONSTRATION WAVE POWER BUOY FOR ADVANCED DEPLOYABLE SYSTEM	1,749	0

This effort defined requirements for the Ocean Test Article (OTA) PowerBuoy, anchor, mooring, riser, and deployment/retrieval and testing system; fabricated the OTA PowerBuoy Subsystem, conducted a sea trial, and optimized the PowerBuoy design for Advanced Development Model applications.

	FY 2007	FY 2008
UNDERSEA VEHICLE TEST AND TRAINING ENVIRONMENT	3,108	0

This effort developed and tested advanced technologies for the Naval Special Warfare (NSW) Swimmer Delivery Vehicle.