FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE
ADVANCED TECHNOLOGY

-(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
X1933 Air Anti-submarine Warfare	10,625	11,619	0
R2142 Undersea Warfare Concepts	32,114	35,197	0
R2267 USW Weapons Advanced Technology	11,865	10,945	0
R2485 Terfenol-D	1,931	0	0
R2844 Magnetrestrictive Transduction	0	2,477	0
R2845 Prototype Multi-Function Radar	0	2,972	0
R2846 Low Frequency Broadband Acoustic Airgun Source	0	2,972	0
R2916/Undersea Warfare Advanced Technology	**	**	56,303
TOTAL	56,535	66,182	56,303

** The Science & Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & FY 2002 was funded in PEs 0603238N and 0603747N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) JUSTIFICATION FOR BUDGET ACTIVITY: All Navy advanced technology development in undersea target detection, classification, localization, tracking and neutralization is funded through this Program Element (PE). In countering the proliferation of quiet diesel submarines to third world countries and Russia’s continued heavy investment in submarine technology, work within this PE provides an enabling capability for power projection and force sustainability. This approach protects the country’s capital investment in surveillance, submarine, surface ship and air Anti-Submarine Warfare (ASW) assets both by exploring those high risk/high payoff technologies that promise to provide capabilities of exceptionally high military value in three to five years. Emphasis is on development of fieldable prototypes, components and systems necessary to demonstrate and validate concepts and techniques previously developed in 6.1 and

6.2, or developed and suggested by industry, academia, or military research laboratories/agencies. These technology options include advanced research in the following areas:

- Improving reliable undersea target detection and tracking to enable on-command application of precision offensive military force. Programs include undersea sensors and arrays to provide robust shallow water (SW) surveillance and reconnaissance, and to detect undersea threats to the surface battleforce.
- Dominating the undersea battlespace to enable timely execution of joint/combined operations and to ensure joint force sustainability. Programs include advanced sensors and arrays for both improved ASW surveillance and enhanced battleforce self-defense, ASW data fusion for better tactical control, and low frequency active sonar and rapidly deployable surveillance systems for covert/non-covert indication and warning.
- Improving reliable undersea target detection and tracking, thus enabling joint battleforce sustainability. Programs include the entire spectrum of technology development undertaken in support of the Littoral ASW (LASW) Future Naval Capability (FNC).
- Improving undersea weapons effectiveness while reducing overall costs through improvements to current systems as well as the development of new weapons concepts. The goal of Undersea Weaponry is to produce cost effective, quick reaction intelligent weapons incorporating broadband processing with battlegroup connectivity, intelligent countermeasures, hard kill torpedo defense, improved littoral operation, and weapon flexibility. Several S&T challenges must be addressed including cluttered operating environments, multipath acoustic propagation, low/no doppler targets, detonation physics, high density power sources, and fusing/safety/arming mechanics. The technology developed under this project will be transitioned to the acquisition community for incorporation into existing platforms. For a complete picture of these efforts, see also PE 0602747N. These efforts support the LASW (ASW), Autonomous Operations, and Platform Protection FNC.

(U) While the program addresses technical issues associated with a broad range of high interest operational areas, the emphasis is on SW environments.

(U) The Navy S&T program includes projects that focus on or have attributes that enhance the affordability of warfighting systems.

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

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing of prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE
ADVANCED TECHNOLOGY

(U) PROGRAM CHANGE FOR TOTAL PE:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	59,625	58,296	60,311
Adjustments from FY 2001 President's Budget:			
Execution Adjustment	-1,845		
SBIR/STTR Adjustment	-1,011		
Program Restructure			-3,980
NWCF Adjustments			-102
DOD Pay Inflation			+74
Congressional Plus-Ups		8,500	
Congressional Recission	-234	-614	
FY 2002 PRESIDENT'S Submission	56,535	66,182	56,303

The Science & Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & FY 2002 was funded in PEs 0603238N and 0603747N.

(U) Schedule: Not Applicable.

(U) Technical: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2916/Undersea Warfare Advanced Technology	**	**	56,303	40,677	40,755	39,560	46,390	50,648	CONT.	CONT.

** Due to the Science and Technology (S & T) Program Element (PE) restructuring in FY 2002, funding levels are unavailable, however, the work described in FY 2000 & FY 2001 was funded in PE 0603747N, projects R2142, R2267, and X1933.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) JUSTIFICATION FOR BUDGET ACTIVITY: All Navy advanced technology development in undersea target detection, classification, localization, tracking and neutralization is funded through this project. In countering the proliferation of quiet diesel submarines to third world countries and Russia's continued heavy investment in submarine technology, work within this project provides an enabling capability for power projection and force sustainability. This approach protects the country's capital investment in surveillance, submarine, surface ship and air Anti-Submarine Warfare (ASW) assets both by exploring those high risk/high payoff technologies that promise to provide capabilities of exceptionally high military value in three to five years. Emphasis is on development of fieldable prototypes, components and systems necessary to demonstrate and validate concepts and techniques previously developed in 6.1 and 6.2, or developed and suggested by industry, academia, or military research laboratories/agencies. These technology options include advanced research in the following areas:

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- Dominating the undersea battlespace to enable timely execution of joint/combined operations and to ensure joint force sustainability. Programs include advanced sensors and arrays for both improved ASW surveillance and enhanced

- battleforce self-defense, ASW data fusion for better tactical control, and low frequency active sonar and rapidly deployable surveillance systems for covert/non-covert indication and warning.
- Improving reliable undersea target detection and tracking, thus enabling joint battleforce sustainability. Programs include the entire spectrum of technology development undertaken in support of the Littoral ASW (LASW) Future Naval Capability (FNC).
- Improving undersea weapons effectiveness while reducing overall costs through improvements to current systems as well as the development of new weapons concepts. The goal of Undersea Weaponry is to produce cost effective, quick reaction intelligent weapons incorporating broadband processing with battlegroup connectivity, intelligent countermeasures, hard kill torpedo defense, improved littoral operation, and weapon flexibility. Several S&T challenges must be addressed including cluttered operating environments, multipath acoustic propagation, low/no doppler targets, detonation physics, high density power sources, and fusing/safety/arming mechanics. The technology developed under this project will be transitioned to the acquisition community for incorporation into existing platforms. For a complete picture of these efforts, see also PE 0602747N. These efforts support the LASW (ASW), Autonomous Operations, and Platform Protection FNC.

(U) While the program addresses technical issues associated with a broad range of high interest operational areas, the emphasis is on SW environments.

(U) The Navy S&T program includes projects that focus on or have attributes that enhance the affordability of warfighting systems.

(U) Due to the number of efforts in this project, the programs described are representative of the work included in this project.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing of prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
PROJECT NUMBER: R2916
PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

Wide Area Surveillance	FY00	FY01	FY02—$13,189
Initiate	• Development of a prototype Lead Zirconate Titanate (PZT) slotted cylinder element • Development of a PZT X-Spring Tonpilz broadband source • Development of a lightweight power amplifier as an enabling technology for acoustic sources • Sea testing of non-acoustic systems against shallow targets in littoral waters • Advanced development of a rapidly deployable, shallow water, autonomous distributed system (DADS). Integrate acoustic communication, acoustic and non-acoustic sensors, signal processing, data fusion and control technologies		• Automated active multi-static classification algorithm • Compact Deployable Multistatic Active Receiver (Super-ADAR) • Development of Compact Deployable LFA sources • Advanced development and test of Deployable LFA Multistatic technologies • Conduct at-sea tests of multiple offboard source prototypes

Continue	• Development and demonstration of "A"-size, PZT-driven, slotted cylinder sources for Air Deployed Low Frequency Projector (ADLFP) application • Development of the hybrid Terfenol-D/PZT Tonpilz broadband array segment • Single element development of an improved PZT slotted cylinder shell technology • Ultra-light Array technology development	• Development of lightweight power amplifier technology for acoustic sources • Demonstration of the hybrid Terfenol-D/PZT Tonpilz • Demonstration of improved slotted cylinder shell technology • Design/construction/testing of DADS in preparation for FY03 barrier demonstration • Development and demonstration of High Frequency Broadband Array Technologies	• Construction/testing of the Deployable Shallow Water Deployable System (DADS) in preparation for FY03 barrier demonstration
Complete		• Development and demonstration of a prototype PZT slotted cylinder transducer mini-array to address LLFA requirements • Demonstration of improved slotted cylinder shell technology • Development of "A" size slotted cylinder source elements/array design to support NAVAIR PMA 264 requirements for the ADLFP program • Delivery of a prototype lightweight power amplifier for acoustic sources	

Battlegroup ASW Defense	FY00	FY01	FY02—$31,387
Initiate	• C2 Cavitation autodetector • LWSS signal processing techniques, prototype impulsive sources, and conduct two sea tests • Cable Strum Mitigation • Improved Very Low Frequency (VLF) Type 1 autodetector • Spatial Doppler Reverberation Suppression • SXXX Version 2.0 autodetector • Development/operational demonstration of Environmentally Adaptive SQS-53C (EA-53C) sonar system • Procurement/integration of EA-53C controller/software for surface combatants	• Design and installation of an acoustic array testbed to support future passive sonar system designs • MSR feature detection • Sonar automation study to establish next generation Sonar Automation requirements • Auto-change detection, dwell time compensation for surveillance applications and multi-sensor auto-classification processing features for inclusion in the Interactively Trainable Passive Acoustic Classifier (IPAC) • Advanced development and testing of deployable LFA multistatic technologies. • Design and development of high frequency projector arrays for the Integrated Bow Conformal (IBC) program. • At-sea demonstrations of the EA-53C sonar system using fleet test platforms	• Sonar automation technology development plan
Continue	• Characterization of undersea threat signals and environmental clutter	• Characterization of undersea threat signals and environmental clutter	• Characterization of undersea threat signals and environmental clutter

	• Interactively Trainable Passive Acoustic Classifier (IPAC) • Design analysis of omni-charge (LWSS) source technology. • Single-Ping Hyperbolic Frequency Modulation (Markov Random Field (MRF))Cluster Version 2.0 pre-detection technique • Lightweight Broadband Variable Depth Sonar(LBVDS) system integration and verification; prepare for the initial at-sea engineering shakedown and operational test in FY01 • Analysis of Automatic Radar Periscope Detection and Discrimination (ARPDD) results from FY99 Airborne demonstrations; development of improved discrimination to reduce low sea state false alarms observed in airborne tests	• Cable Strum Mitigation technique • LWSS processing techniques and Impulsive omni-charge source technology development for SH-60R and other air platforms • Single-Ping Hyperbolic Frequency Modulation (Markov Random Field (MRF)) Cluster Version 2.0 pre-detection technique • Improved VLF Type 1 autodetector • Spatial Doppler Reverberation Suppression technique • SXXX Version 2.0 autodetector • Striation autodetector modified for IPAC • C2 cavitation autodetector • Integration and testing of LBVDS subsystems in preparation for the final fleet operational system demonstration in FY02 • At-sea engineering shakedown and structured operational test for LBVDS • Development of EA-53C signal processing and system control software	• Design and installation of an acoustic array testbed to support future passive sonar system designs • LWSS processing techniques, omni-charge technology, development of system concept, and preparation for transition in FY03 • MSR feature detection • Development of on-board, real-time processor and Engineering, Development and Manufacturing (EMD) assessment (Claymore Marine) • At-sea demonstration of LBVDS in an operational scenario • Development and fabricate a prototype of the high frequency transducer and array for the IBC program. • Conduct multiple EA-53C at-sea demonstrations using fleet test platforms
Complete	• Ridge Distance Measurement	• Transition of RDM active classification and Single-Ping	• Transition of Cable Strum Mitigation

	(RDM) classification • Single-Ping Range Rate detection • Single-Ping Cluster 1.0 detection	Range Rate detection techniques to the Advanced Processing Build (APB 01) • Transition of dwell-time compensation feature in IPAC for surveillance applications to APB 02 • ARPDD laboratory demonstration of reduced false alarm rate using data from FY99 airborne test; complete and publish final documentation	• Transition of the Single-Ping Hyperbolic Frequency Modulation Cluster Version 1.0 or the Hyperbolic Frequency Modulation (Markov Random Field)pre-detector to APB, depending on performance results • Transition of improved VLF Type 1 autodetector to APB 02 • Transition of Spatial Doppler Reverberation Suppression technique to APB 03 • Transition of C2 Cavitation Detector • Transition of SXXX Version 2.0 autodetector to APB 03 • Transition of MSR Feature detector to APB 03 • Transition of auto-change detection and multi-sensor auto-classification processing features of IPAC to APB 03 • Transition striation autodetector to APB 03 • Transition Single-ping Cluster to APB 03 • Transition of Improved Feature Space Classification technique • Analysis of system characterization test data and complete tactical testing (Claymore Marine)

Cooperative ASW	**FY00**	**FY01**	**FY02—$1,044**
Initiate	• Advanced Integrated ASW (IASW) data-fusion technologies • FY01 IASW sea-test planning • Active sonar/radar fusion and • Likelihood Ratio Tracking (LRT) for Extended Echo Ranging (EER) • IASW technology transition planning		
Continue	• Tactical ASW data-fusion and data-distribution architecture • Discrete bayesian data-fusion technologies • Littoral Warfare Advanced Development (LWAD) scientific support, fleet and research vessel coordination, test reconstruction, and environmental compliance support for three Littoral Anti-Submarine Warfare (LASW) at-sea experiments	• LWAD scientific support, fleet and research vessel coordination, test reconstruction, and environmental compliance support for three LASW at-sea experiments, one of which will be conducted overseas	• LWAD scientific support, fleet and research vessel coordination, test reconstruction, and environmental compliance support for two LASW Future Naval Capability (FNC)at-sea experiments and one overseas LASW FNC demonstration
Complete	• Data-collection efforts to support IASW data fusion algorithm development • Initial lab demonstration of	• Tactical ASW data-fusion and data-distribution architecture • Discrete bayesian data-fusion	

	IASW LRT EER data-fusion technologies	technologies • FY01 IASW sea-test planning • FY01 at-sea demonstration of IASW data-fusion capabilities • IASW technology transition planning to the Advanced Undersea Warfare Concept (AUSWC) program	

Although LWAD is applicable to all thrust areas, it is reflected in Cooperative ASW only to avoid redundancy of entries.

Neutrali-zation	**FY00**	**FY01**	**FY02—$10,683**
Initiate	• Rechargeable battery/fuel cell/other low-rate, long endurance power source development supporting undersea vehicle propulsion requirements • Dual-mode warhead concept for 6.25” vehicle	• Development of 6.25" diameter Anti-Torpedo Torpedo Tripwire System	• Development of weapon/platform connectivity technologies for integrated ASW capability demonstration
Continue	• Development of high-speed, supercavitating test bed; conduct preliminary wire-riding model tests • Frequency-agile, broadband-processing techniques in complex (countered) littoral engagements • Affordable countermeasure components in MK3 configuration and perform at-	• Rechargeable battery/fuel cell/other low-rate, long endurance power source development supporting undersea vehicle propulsion requirements • Frequency agility/optimum frequency selection using adaptive cancellation and low resolution imaging against countermeasures • Establish payoff in torpedo	• Development of broadband processing and intelligent control technologies for MK48 advanced capabilities (ADCAP) including integration with submarine HF sensors and surface ship active sensors • Development of broadband processing and intelligent control technologies for MK48 ADCAP including integration with

	sea testing	effectiveness of the baseline and Prototype Intelligent Controllers	submarine HF sensors
Complete	• Tactical control behavior design and coding representing full Anti-Submarine functionality	• Integrate affordable countermeasure components in MK4 configuration and perform at-sea testing • Dual-mode warhead concept for 6.25″ vehicle	

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy’s 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:
(U) (U) RELATED RDT&E:

- (U) PE 0204311N (Integrated Undersea Surveillance System)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602747N (Undersea Warfare Surveillance Research)
- (U) PE 0602782N (Mine and Expeditionary Warfare Applied Research)
- (U) PE 0602435N (Ocean Warfighting Environment Applied Research)
- (U) PE 0603254N (ASW Systems Development)
- (U) PE 0603506N (Surface Ship Torpedo Defense)
- (U) PE 0603553N (Surface ASW)
- (U) PE 0604221N (P-3 Modernization Program)
- (U) PE 0604261N (Acoustic Search Sensors (ENG))
- (U) PE 0604784N (Distributed Surveillance Systems)
- (U) PE 0604503N (SSN-688 and Trident Modernization)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3
PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
PROJECT NUMBER: R2916
PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

(U) NON-NAVY RELATED RDT&E:

- (U) PE 0602173C (Support Technologies Applied Research)
- (U) PE 0602702E (Tactical Technology)
- (U) PE 0603739E (Advanced Electronics Technologies)
- (U) PE 0603763E (Marine Technology)

(U) SCHEDULE PROFILE: Not applicable