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

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602747N
PROGRAM ELEMENT TITLE: Undersea Warfare Applied Research

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
Undersea Warfare Applied Research	**	**	76,510

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PEs 0602315N, 0602633N and 0602314N.

(U) MISSION DESCRIPTION:

(U) In countering the proliferation of quiet diesel submarines to third world countries and Russia's continued investment in submarine technology, work within this Program Element (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 by exploring those high risk/high payoff technologies that promise to provide capabilities of exceptionally high military value in five to fifteen years. These technology options include 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 surveillance and reconnaissance, and to detect undersea threats to the surface battleforce. This effort also includes Navy unique research and technology issues associated with creating a timely and intelligible tactical picture of the undersea battlespace.
- 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 Science and

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Technology (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. These efforts support the Littoral ASW FNC.

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

(U) The Navy Science and Technology program includes projects that focus on or have attributes that enhance the affordability of warfighting systems.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the Applied Research Budget Activity because it investigates technological advances with possible applications toward solutions to specific Naval problems, short of an advanced development effort.

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(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

Wide Area Surveillance	**FY00**	**FY01**	**FY02—$14,657**
Initiate	• Contract for 2 re-useable test vehicle versions of the X-glider for sensor delivery and personnel recovery support.	• Advanced pattern-recognition processing development for synthetic aperture sonar • Development of structural magnetostrictive materials • Development of PZT materials for biased operation • New Hydra design capable of full aperture (8 KM) and full hydrophone complement (48) • Design/integration of Ultra-Low Frequency (ULF) and Extremely Low Frequency (ELF) Electromagnetic (EM) sensors, signal processing and environmental noise cancellation techniques for submarine detection onto the Vertical take-off Unmanned Air Vehicle (VUAV) • Sea tests of optical standoff sensor systems • Development of ultra low power electronics	• Evaluation and transition of non-traditional scattering and advanced processing for air deployed multistatics • Advanced multistatics development • Ultra wideband waveform processing • Advanced clutter detection and rejection techniques • Hydra adaptations for use as an off-board sensor for submarines • Project to miniaturize DADS sensor/control nodes by a factor of 10 with equal or better performance for littoral applications
Continue	• Non-traditional scattering development • Phase conjugation algorithm development and evaluation • Development of large aperture, bottom-mounted array/signal processing • Development of acoustic	• Development of acoustic signal processing DCL techniques for autonomous undersea applications • Ultra-light array technology in air/sub deployed configurations at-sea experiments	• Advanced pattern-recognition processing development for synthetic aperture sonar • Development of structural magnetostrictive materials • Development of PZT materials for biased operation

	signal processing detection, classification and localization (DCL)techniques for autonomous undersea applications • Development of a mid-frequency broadband panel projector utilizing active feedback • Development of low frequency, low profile cymbal transducer • Ultra-light array technology in air/sub deployed configurations at-sea experiments • Development of a family of ultra-lightweight, ultra-low power air-, surface ship- or submarine-deployable, Matched Field Tracking Arrays to be used for barrier (Hydra) or area (Kelp) surveillance or as organic off-board sensors for submarines • Development of Deployable Autonomous Distributed System (DADS) sensor/signal processing technology and simulation of intra-field data fusion and field-level control functions • Development of Extremely Low Frequency Emission (ELFE) technology through system demonstration	experiments • Development of a family of ultra-lightweight, ultra-low power air-, surface ship- or submarine-deployable, Matched Field Tracking Arrays to be used for barrier (Hydra) or area (Kelp) surveillance or as organic off-board sensors for submarines	• Ultra-light deployable arrays • Development of a family of ultra-lightweight, ultra-low power air-, surface ship- or submarine-deployable, Matched Field Tracking Arrays to be used for barrier (Hydra) or area (Kelp) surveillance or as organic off-board sensors for submarines • Sea tests of optical standoff sensor systems • Development of ultra low power electronics.

Complete	• Shallow Water Air Anti-Submarine Warfare (ASW) assessment for deployable sensors • Assessment and report on the role of bottom-moored shallow water Acoustic and non-Acoustic surveillance methods • Optical standoff sensor systems Exploratory Development Model (EDM); initiated at-sea testing • Documentation of the Multi-sensor Acoustic/Non-Acoustic Data Fusion (MANDF) algorithm	• Non-traditional scattering development • Phase conjugation algorithm development and evaluation • Development of large aperture, bottom-mounted array/signal processing • Development of a mid-frequency broadband panel projector utilizing active feedback • Development of low frequency, low profile cymbal transducer • Assessment and report on ASW performance of Hydra and Kelp during RDS-3 experiment (Sep/Oct 2000) • DADS sensor/signal processing development for autonomous detection/classification of submarines • ELFE through data analysis /final report of demonstrations and algorithm development	• Development of acoustic signal processing DCL techniques for autonomous undersea applications • Assessment and report on full aperture Hydra performance during Seaweb 2001 (Sep 2001) • Design/integration of ULF/ELF EM submarine detection system mounted on VUAVs

Battlegroup ASW Defense	**FY00**	**FY01**	**FY02—$35,910**
Initiate	• Evaluation of piezocomposites as broadband projector materials • Advanced compact multi-static active air deployed receiver (Super ADAR) w/active & passive In Buoy Signal	• Multi-static ASW Capabilities Enhancement (MACE) multi-static processing development • At sea testing and data analysis for multi-static processing algorithm development	• At sea testing in support of algorithm development, source reliability, and system component demonstrations using multiple multi-static sources • Compact low frequency multi-

	Processing design trade studies • Improved multi-static processing for the light weight sound system (LWSS) and air deployed impulsives • Advanced in-buoy automatic echo processing (S-ADAR)	• Design of magnetostrictive piezoelectric transducer (MPT) for high frequency (HF) submarine conformal bow program Integrated Bow Conformal(IBC) • Development of outboard power electronics for HF IBC • Development of single crystal piezoelectric materials • Development of HF broadband panel projector array for IBC • Demonstrate EAST signal processing techniques in a Fleet operational effort	static active receiver (Super ADAR) w/active & passive In Buoy Signal Processing • Passive Acoustic array testbed design and installation • Advanced Counter-Torpedo Detection, Classification, and Localization development for surface ship defense, including performance assessment, data collection, data analysis, algorithm developments.
Continue	• Development of signal processing methods/algorithms that enables improved target localization estimates and differentiation between man-made and natural transient noises • Development of off-board, Acoustic, multi-static source and associated on-board signal processing techniques • Development of Integrated Bow Conformal (IBC), Low Frequency Hull Array(LFHA), and Affordable/Volumetric towed arrays • Development of electrostrictive relaxor ceramics • Development of electroactive polymer broadband transducer	• Development of improved off-board, Acoustic multi-static source components, processing algorithms, and performance predictive tools • Development of IBC, LFHA, and Volumetric towed arrays • Development of electrostrictive relaxor ceramics • Development of electroactive polymer broadband transducer array • Development of high energy density, ambient temperature battery laboratory testing • Environmentally Adaptive Sonar Technology(EAST): Development of technical approaches for automating the operational configuration of sonar systems	• Development of improved off-board, Acoustic multi-static source components, processing algorithms, and performance predictive tools • Development of IBC, LFHA, and Volumetric towed arrays • Development of MPT array for HF IBC program • Development of outboard power electronics for HF IBC • Development of HF broadband panel projector array for IBC • Development of electrostrictive relaxor ceramics • Development of electroactive polymer broadband transducer array

	prototype • Transition and development of broadband hybrid transducer technology from weapon to submarine (SSBN) application • Development of high energy density, ambient temperature battery • Environmentally Adaptive Sonar Technology(EAST): Development of technical approaches for automating the operational configuration of sonar systems in response to real-time analysis of the Acoustic field and relevant (measured) environmental parameters	in response to real-time analysis of the Acoustic field and relevant (measured) environmental parameters • Improved multi-static processing for the light weight sound system (LWSS) and air deployed impulsives • Advanced in-buoy automatic echo processing (S-ADAR)	• Development of high energy density, ambient temperature battery • Environmentally Adaptive Sonar Technology(EAST): Development of technical approaches for automating the operational configuration of sonar systems in response to real-time analysis of the Acoustic field and relevant (measured) environmental parameters • Demonstrate EAST signal processing techniques in a Fleet operational effort • Improved multi-static processing for the light weight sound system (LWSS) and air deployed impulsives • Advanced in-buoy automatic echo processing (S-ADAR)
Complete	• Laboratory demonstration/integration of off-board source components. • Development of thin optical towed array; transition to TB-29 • Development of a high power, high energy density thermal battery	• Development of signal processing methods/algorithms that enables improved target localization estimates and differentiation between man-made and natural transient noises • Development of signal processing algorithms for submarine towed arrays that provide improved target localization estimates • Affordable towed array construction, demonstration	• Demonstration of multi-static processing

		and transition to TB-29 • Development of broadband hybrid transducer array for SSBN application • Evaluation of piezocomposites as broadband projector materials • Advanced compact multi-static active air deployed receiver (Super ADAR) w/active & passive In Buoy Signal Processing design trade studies	

Cooperative ASW	**FY00**	**FY01**	**FY02—$912**
Initiate			• Fishline fiber optic sensor designs for submarine, surface ship & air deployed ASW arrays
Continue	• Telesonar acoustic communications system for deployable systems	Telesonar acoustic communications system for deployable systems	• Telesonar acoustic communications system for deployable systems

Neutralization	**FY00**	**FY01**	**FY02—$25,031**
Initiate	• Develop a Computational Capability to Perform Weapon Design Optimization • Develop High Speed Supercavitating Vehicle Test Bed	• Stealth Homing Concepts • Platform/Weapon Connectivity	• Low noise integrated motor propulsor • Active control with active fiber composites

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Continue	• Broadband Processing and Intelligent Control for Torpedo Guidance and Control • Intelligent Counterweapons and Countermeasures for Integrated Torpedo Defense • Low Rate, Long Endurance Power Sources for Undersea Propulsion • High Rate/Hybrid Power Sources for Torpedoes • Feature Based Navigation and Mapping • Torpedo Noise Modeling and Control • Fuzing, Detonation processes and Target Interactions, and Enhanced Kill Mechanisms for Undersea Warheads • Development of active-passive vibration mounts	• Develop a Computational Capability to Perform Weapon Design Optimization • Develop a High Speed Supercavitating Vehicle Test Bed • Broadband Processing and Intelligent Control for Torpedo Guidance and Control • Intelligent Counterweapons and Countermeasures for Integrated Torpedo Defense • High Rate/Hybrid Power Sources for Torpedoes • Torpedo Noise Modeling and Control • Fuzing, Detonation processes and Target Interactions, and Enhanced Kill Mechanisms for Undersea Warheads • Development of active-passive vibration mounts	• Develop a Computational Capability to Perform Weapon Design Optimization • Develop a High Speed Supercavitating Vehicle concept and Test Bed • Development of Torpedo Intelligent Control Guidance and Control • Intelligent Counterweapons and Countermeasures for Integrated Torpedo Defense • Transition of Counter-torpedo technologies to PMS-415 Tripwire Torpedo Defense System Development of High Rate/Hybrid Power Sources for Torpedoes • Fuzing, Detonation processes and Target Interactions, and Enhanced Kill Mechanisms for Undersea Warheads • Development of Stealth Homing Concepts • Development of Platform/ Weapon Connectivity • Development of active-passive vibration mounts
Complete	• Unmanned Underwater Vehicles	• Feature Based Navigation and Mapping • Low Rate, Long Endurance Power Sources for Undersea Propulsion	• Development of Torpedo Noise Modeling • Development of Underwater explosive effects code • Development of Micro Electromechanical Systems (MEMs) Safing and Arming (S&A) technology (less

			Inertial Measurement Unit)

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(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	**	**	-
Adjustments from FY 2001 President's Budget:			
PE Restructuring			76,772
NWCF Adjustments			-250
Inflation Adjustment			82
Minor Adjustment			-94
FY 02 PRESBUDG Submission	**	**	76,510

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(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.
(U) Schedule: Not Applicable.

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

(U) NAVY RELATED RDT&E:

(U) PE 0601153N (Defense Research Science)
(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 0603758N (Navy Warfighting Experiments and Demonstrations)
(U) PE 0604221N (P-3 Modernization Program)
(U) PE 0604261N (Acoustic Search Sensors (ENG))
(U) PE 0604784N (Distributed Surveillance Systems)
(U) PE 0603747N (Undersea Warfare Advanced Technology)
(U) PE 0602114N (Power Projection)
(U) PE 0602123N (Force Protection)
(U) PE 0602782N (Mine & Expeditionary Warfare)
(U) PE 0603114N (Power Projection)
(U) PE 0603123N (Force Protection)

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(U) PE 0603758N (Naval Warfighting Experiment)

(U) NON NAVY RELATED RDT&E:
(U) PE 0603763E (Marine Technology)
(U) PE 0603739E (Advanced Electronics Technologies)
(U) PE 0602702E (Tactical Technology)
(U) PE 0602173C (Support Technologies – Applied Research)

(U) SCHEDULE PROFILE: Not applicable.