

UNCLASSIFIED

FY 2001 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602633N

DATE: February 2000

PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPONS TECHNOLOGY

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1999 ACTUAL	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
UNDERSEA WARFARE WEAPONS TECHNOLOGY	37,197	40,839	35,028	35,781	34,901	34,985	34,384	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program focuses on undersea warfare in support of Future Naval Capabilities in Littoral ASW, Platform Protection, and Time Critical Strike. Specific objectives endorsed by the Joint Chiefs of Staff include: (1) developing a range of tactical Anti-Submarine Warfare (ASW) capabilities that could be employed at the lower end of the full range of military operations with minimum risk of casualties or collateral damage to friendly forces, and (2) developing a robust world-wide capability for neutralizing undersea threats in decisive conflict, also with minimal casualties or collateral damage. Projects support the development of technologies associated with undersea target neutralization, force unit survival and undersea tactical control. Specifically:

(U) Littoral ASW is concerned with detection, classification, localization, and neutralization of enemy submarines and torpedoes in adverse acoustic environments. The objective is to dominate the undersea battlespace to enable timely execution of joint/combined operations and to ensure joint force sustainability. Programs address improved shallow-water operation, tactical control, torpedoes, torpedo countermeasures and hard-kill devices for surface battleforce and submarine self defense.

(U) Time Critical Strike addresses the application of precision offensive military force. Programs address new explosives for enhanced target damage effectiveness, and sensors and countermeasures to detect and neutralize undersea threats to the surface battleforce.

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(U) Platform protection is concerned with surface ship self defense against incoming torpedoes. This program addresses this concern through development of technology supporting counterweapons and countermeasures including the Anti Torpedo Torpedo.

(U) Success in neutralizing undersea threats to both submarines and surface ships not only requires successful detection, classification, localization and tracking, but also must culminate in an effective weapon which removes the threat and denies use of the battlespace to the enemy.

(U) Due to the sheer volume of efforts included in this Program Element, the programs described in the Accomplishments and Plans sections are representative selections of work included in this Program Element.

(U) The Navy S&T 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 solution of specific Naval problems, short of a major development effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1999 ACCOMPLISHMENTS:

- (U) GUIDANCE & CONTROL (G&C):
 - (U) Tested and evaluated multi-frequency and frequency agile processing for broadband G&C.
 - (U) Evaluated conformal array applications for improved G&C in shallow water.

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- (U) Designed single crystal material capabilities for future broadband array transduction.
- (U) Developed cooperative engagement and coordinated attack tactical methodologies.
- (U) PROPULSION:
 - (U) Tested lab prototype cells for high performance, low-cost rechargeable battery.
 - (U) Demonstrated pilot scale and brassboard components for 21 inch HYDROX high energy/power density thermal system.
 - (U) Designed and tested improved fuel utilization concepts for aluminum-seawater pilot scale vortex combustor.
 - (U) Continued Stirling engine development for use with wick combustor.
 - (U) Conducted laboratory testing of liquid catholyte semi-fuel cells with high efficiency design.
- (U) UNMANNED UNDERWATER VEHICLES (UUVs):
 - (U) Fabricated compact integrated Motor/Rotor propulsor for a 21 inch diameter UUV for increased volume (payload).
 - (U) Developed a model/simulation, for design and test purposes, of the affordable maximum volume covert submarine UUV launch and recovery subsystem, which minimizes the impact on the submarine modifications and operations.
 - (U) Developed a computer model for the design of an affordable precision gravity based navigation system for stealth and energy savings.
 - (U) Transitioned advanced underwater communications algorithms to the Tactical Acoustic Communications ATD (PE 0603792N) for enhanced performance in shallow water.
- (U) SILENCING:
 - (U) Tested and optimized MK48 ADCAP torpedo quiet exhaust system in water tunnel.
 - (U) Developed finite element noise model to predict and simulate torpedo noise sources.

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- (U) COUNTERWEAPON AND COUNTERMEASURES:
 - (U) Demonstrated homing and fuzing performance of counterweapon in the bubbly wake.
 - (U) Continued air dropped salvo simulation efforts.
 - (U) Incorporated hydrophone technology into smart, adaptive countermeasures (SACM) and conducted in-water tests.
 - (U) Conducted in-water test of micro electromechanical systems (MEMS)-based safe and arming device in 6.25 inch diameter weapon.
 - (U) Initiated terminal defense effort to develop technologies to defeat torpedoes in terminal layer.

- (U) WARHEADS:
 - (U) Developed validated second generation hydrocode with parallelized architecture resulting in order of magnitude reduction in solution time.
 - (U) Developed new high shock underwater formulations based upon novel fuel and oxidizers concept.
 - (U) Demonstrated burn through capability for neutralization of double-hull submarines in smaller warheads.
 - (U) Demonstrated effectiveness enhancement of reactive material shaped charges against undersea targets.
 - (U) Conducted in-water test of MEMS safety and arming device for torpedo applications.
 - (U) Conducted in-water demonstration of reduced volume electromagnetic (EM) fuze in support of reduced length torpedo concept.
 - (U) Evaluated multiple warhead concepts with the potential to provide 3-5X current capability for half length torpedo and other undersea applications.
 - (U) Developed capability to perform MEMS component design, test, and evaluation for undersea warhead applications

- (U) COMPUTATIONAL ENGINEERING
 - Developed Computational Fluid Dynamics (CFD) engineering tools required to support the design of maritime vehicles.

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- (U) COUNTERMEASURE AFFORDABILITY
 - (U) Developed affordable countermeasure technology by incorporating modular, common components with reduced life cycle costs including longer stowage life.

2. (U) FY 2000 PLAN:

- (U) G & C:
 - (U) Test and evaluate coherent broadband and simultaneous tones broadband processing techniques with in-water data.
 - (U) Integrate and evaluate use of simultaneous tones for improved counter countermeasures(CCM) performance.
 - (U) Design, fabricate and test integrated multiplexor chip for High Resolution Array.
 - (U) Perform a joint cooperative engagement experiment with the high frequency submarine sonar program.
- (U) PROPULSION:
 - (U) Conduct laboratory testing of alternative high energy density aerogel cathode materials and morphologies for affordable rechargeable batteries.
 - (U) Complete brassboard testing of components for 21 inch HYDROX.
 - (U) Investigate advanced metal fuels for aluminum seawater vortex combustor.
 - (U) Evaluate high efficiency semi-fuel cell with alternate metal anode and liquid catholyte.
 - (U) Integrate wick combustor with Stirling engine for laboratory system tests.
 - (U) Evaluate UUV propulsion concepts that incorporate commercial fuel cell technologies.
- (U) TORPEDO STEALTH:
 - (U) Validate physics-based noise model and transition to Simulation Based Design (SBD).
 - (U) Demonstrate active control on torpedo hull to reduce radiated noise in-water.
 - (U) Develop hybrid active-passive noise damping and mounts on torpedo.

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- (U) Initiate sensor self noise modeling and reduction.
- (U) Transition submarine propulsor technology to torpedo.
- (U) Develop coating and composite shell for torpedo afterbody.

- (U) TORPEDO DEFENSE:
 - (U) Continue most promising terminal defense efforts.
 - (U) Continue salvo and air dropped torpedo defense technology development.
 - (U) Transition SACM technology to PMS-415 (Submarine Regional Warfare Systems).
 - (U) Continue Detection, Classification, and Localization algorithm development.

- (U) WARHEADS:
 - (U) Transition validated second generation hydrocode with parallelized architecture resulting in order of magnitude reduction in solution time.
 - (U) Demonstrate robust in-wake electromagnetic fuzing concept for Lightweight Hybrid Torpedo.
 - (U) Establish feasibility, through numerical calculations and laboratory experiments, of the multiple bubble concept.

- (U) WEAPON DESIGN OPTIMIZATION
 - (U) Develop and implement design tools to perform trade-off analysis in support of the Common Broadband Advanced Sonar System (CBASS) for MK48 ADCAP upgrade.
 - (U) Develop multi-disciplinary design optimization schemes for torpedo design and analysis.

- (U) HIGH SPEED WEAPONS
 - (u) Develop supercavitating technologies for incorporation into a high speed test bed.

3. FY 2001 PLAN:

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- (U) G & C:
 - (U) Develop broadband monostatic and bi-static models for foreign diesel targets and compare with in-water data.
 - (U) Test and evaluate a coherent broadband Beam Space Canceler.
 - (U) Integrate and test Prototype Intelligent Controller (PIC) technologies for optimum waveform selection and shallow water countermeasure scenarios.
 - (U) Demonstrate 3D image processing, learning and data fusion in the context of an expanded intelligent controller architecture.

- (U) PROPULSION:
 - (U) Test laboratory prototype cells with high energy density aerogel cathodes for affordable rechargeable batteries.
 - (U) Demonstrate integrated HYDROX energy system.
 - (U) Design and develop brassboard aluminum seawater vortex combustor using advance metal fuels.
 - (U) Design and develop brassboard high efficiency semi-fuel energy system.
 - (U) Complete laboratory system tests on integrated wick combustor with Stirling engine.
 - (U) Design and test modified commercial lab-scale fuel cell units for undersea vehicles.

- (U) TORPEDO STEALTH:
 - (U) Implement self noise model on torpedo sensor design.
 - (U) Complete active control of radiated noise demonstration in water.
 - (U) Demonstrate active control technique on turbine noise.
 - (U) Demonstrate hybrid active-passive mounts on machinery noise suppression.
 - (U) Transition quiet exhaust system to MK48 ADCAP torpedo.
 - (U) Continue energy reclamation concept on torpedo vibration.
 - (U) Implement active fiber concept to control torpedo hull acoustic radiation and vibration.

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- (U) TORPEDO DEFENSE
 - (U) Continue most promising terminal defense efforts.
 - (U) Continue salvo and air dropped torpedo defense technology development.
 - (U) Continue Detection, Classification, and Localization algorithm development.

- (U) WARHEADS:
 - (U) Initiate large scale validation of coupled hydrocode for explosive prediction.
 - (U) Initiate flip chip technology development for reduces size MEMS-based Safety and Arming device.
 - (U) Demonstrate tunnel blast concept to increase warhead performance by at least 2x.

- (U) WEAPON DESIGN OPTIMIZATION:
 - (U) Implement collaborative design and simulation tools for torpedo optimization and trade off analysis.
 - (U) Implement design and optimization for weapon tactics development.
 - (U) Transition Computer Automated Virtual Environment (CAVE) for weapons simulation.

- (U) HIGH SPEED WEAPONS
 - (u) Continue development of supercavitating technologies for incorporation into high speed test bed.

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B. (U) PROGRAM CHANGE SUMMARY

	FY 1999	FY 2000	FY 2001
(U) FY 2000 President's Budget:	39,717	34,066	33,255
(U) Appropriated Value:	-	41,066	-
(U) Adjustments from FY 2000 PRESBDG:			
Program Adjustment	0	0	+1,618
SBIR/STTR Transfer	-608	0	
Various Rate Adjustment	0	0	+297
Congressional Plus ups	0	+7,000	0
Strategic Sourcing	0	0	-142
Congressional Rescission	0	-227	0
Inflation Adjusment	-185	0	0
Execution Adjustment	-1,727	0	0
(U) FY 2001 PRESBDG Submission:	37,197	40,839	35,028

(U) CHANGE SUMMARY EXPLANATION:

(U) SCHEDULE: Not applicable.

(U) TECHNICAL: In FY 2000 the Silencing and Long Range Vehicle Technologies projects will be combined into a single project named Torpedo Stealth to meet the emerging U.S. Navy requirement in torpedo quieting and performance. The Weapon Design Optimization effort was transferred from the Undersea Warfare Advanced Technology Program Element to better align with the technology development objectives.

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C. (U) OTHER PROGRAM FUNDING SUMMARY:

(U) OTHER APPROPRIATION FUNDS: Not applicable.

(U) RELATED RDT&E:

- (U) PE 0101224N (SSBN Security and Survivability Program)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602111N (Air and surface Launched Weapons Technology)
- (U) PE 0602121N (Ship, Submarine & Logistics Technology)
- (U) PE 0602314N (Undersea Warfare Surveillance Technology)
- (U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
- (U) PE 0602435N (Ocean and Atmospheric Technology)
- (U) PE 0603609N (Conventional Munitions)
- (U) PE 0603747N (Undersea Warfare Advanced Technology)
- (U) PE 0603763E (Marine Technology)
- (U) PE 0603739E (Advanced Electronics Technologies)
- (U) PE 0602702E (Tactical Technology)
- (U) PE 0602173C (Support Technologies-Applied Research)
- (U) PE 0603792N (Advanced Technology Transition)

(U) This program adheres to Defense Science and Technology Reliance Agreements on Conventional Weaponry with oversight provided by the Director Defense Research and Engineering.

(U) SCHEDULE PROFILE: Not applicable.

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