FY 2004/2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2003
Exhibit R-2

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603123N
PROGRAM ELEMENT TITLE: Force Protection Advanced Technology

COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2002 ACTUAL	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	FY 2008 ESTIMATE	FY 2009 ESTIMATE
Force Protection Advanced Technology								
R2912 Force Protection Advanced Technology	87,869	49,808	50,620	73,903	53,137	54,242	59,535	60,295
R3049 Emerging Threats	0	6,515	5,160	8,651	3,152	3,600	3,674	3,748
R2706 Project M	2,703	2,078						
R2711 Superconducting DC Homopolar Motor	1,927	2,738						
R2826 Ship Service Fuel Cell		2,933						
R2828 Advanced Water Jet AWJ-21	3,372							
R2831 High Temperature Superconducting AC Synchronous Navy Propulsion Motor & Generator	3,862	4,890						
R2848 Hybrid Small Waterplane Area Catamaran (HYSWAC)	7,015							
R9013 Littoral Surface Craft – Experimental	15,549							
R9014 Curved Plate Technology	2,412							
R9015 Deployable SMARTLINK Communications Upgrade	1,445	1,467						
R9016 Real Time Fire and Smoke Prediction Tool	963							
R9017 Wireless Sensors for Total Ship Monitoring	2,697							
R9018 Knowledge Projection for Fleet Maintenance	2,410							
R9019 Wave Powered Electric Power Generating System for Remote Naval Sites	1,930	1,956						
R9120 High Speed Cargo Craft		734						
R9138 Center for Maritime Systems								

			1,368					
R9139	Graphite Fiber Sandwich Composites for Advanced Warship Design							
			977					
R9140	High Speed Permanent Magnet Generator							
			3,423					
R9141	Marine Direct Ship Service Fuel Cell Technology Validation Trainer							
			1,187					
R9142	Smart Micro-sensor Arrays for Shipboard Damage Control							
			5,169					
R9143	Smart Sensor Web							
			1,027					
Total	134,154	86,270	55,780	82,554	56,289	57,842	63,209	64,043

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Includes funds to develop and demonstrate advanced technologies that support naval platform self-protection and theatre wide missile defense of naval forces. The new capabilities include the areas of all-weather, day/night protection of naval platforms and forces against all weapon threats, counter-stealth and countermeasures. These new capabilities also include affordable technologies for platform structural systems as well as platform systems, sub-systems and components and aircraft vectoring technologies. Demonstrated capabilities support the ability to prevent or control platform damage while preserving operational capability. Within the Naval Transformational Roadmap, this investment directly supports the Theater Air and Missile Defense transformational capability required by Sea Shield and the Ship to Objective Maneuver key transformational capability within Sea Strike by virtue of improvements in platform offensive performance, stealth and self defense. Program supports the Fleet Force and Platform Protection, Electric Warship, Total Ownership Cost and Missile Defense Future Naval Capabilities (FNCs).

Due to the number of efforts in the PE, the programs described herein are representative of the work included in the PE.

FY 2004/2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2003
Exhibit R-2

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603123N
PROGRAM ELEMENT TITLE: Force Protection Advanced Technology

B. ACCOMPLISHMENTS/PLANNED PROGRAM: PROGRAM CHANGE SUMMARY:

	FY 2002	FY 2003	FY 2004	FY 2005
FY 2003 President's Budget Submission:	139,782	57,604	51,773	56,487
Adjustments from FY 2003 President's Budget:				
Congressional Plus-Ups		30,625		
High Speed Cargo Craft (realigned from 0708730N)	4,000			
SBIR Reduction	-2,115			
Execution Adjustments	-6,386			
Congressional Rescissions/Adjustments/Undistributed Reductions	-1,127	-1,022		
S&T Program Adjustments			5,748	28,198
NWCF Rate Adjustments			-147	-14
Efficiencies at NWCF Activities			-305	-338
Pay Raise/Inflation Adjustments		-937	-1,289	-1,779
FY 2004/2005 President's Budget Submission:	134,154	86,270	55,780	82,554

PROGRAM CHANGE SUMMARY EXPLANATION:
Schedule: Not Applicable.
Technical: Not Applicable.

FY 2004/2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2003
Exhibit R-2a

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603123N PROGRAM ELEMENT TITLE: Force Protection Advanced Technology

Project Number: R2912
Project Title: Force Protection Advanced Technology

COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2002 ACTUAL	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	FY 2008 ESTIMATE	FY 2009 ESTIMATE
R2912 Force Protection Advanced Technology	87,869	49,808	50,620	73,903	53,137	54,242	59,535	60,295

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. This project supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial and air) and the protection of those platforms. It supports the Fleet Force and Platform Protection, Electric Warship, Total Ownership Cost and Missile Defense Future Naval Capabilities (FNCs). The goal of this project is to provide the ability to win or avoid engagements with other platforms or weapons and, in the event of engagement, to resist and control damage while preserving operational capability.

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 02	FY 03	FY 04	FY 05
Surface Ship & Submarine Hull Mechanical & Electrical (HM&E)	36,001	34,237	29,582	57,323

Activity includes: Signature reduction, hull life assurance, distributed intelligence for automated survivability and advanced electric warship systems. Signature reduction addresses Electromagnetic (EM), infrared (IR) and acoustic signature tailoring, both topside and underwater. Hull life assurance addresses development of new structural system approaches for surface ships and submarines, including the management of weapon effects to control structural damage and the improvement of structural materials. Distributed intelligence for automated survivability addresses both the basic technology of automating damage control systems, as well as, distributed auxiliary control with self-healing capability. Electric warship area addresses electrical and auxiliary system and component technology to provide improvement in system energy and power density, system operating efficiency and recoverability from casualties.

FY 2002 ACCOMPLISHMENTS:

- Signature Reduction:

Initiated:

- Surface ship boundary element model development for application to near field de-amping.
- Adaptation and validation of an existing physical model of surface ship for near field de-amping demonstration.

- Stable algorithm development of near field de-amping system.

Continued:

- Large-scale truss element evaluation for Advanced Machinery Support System (AMSS).

Completed:

- AMSS condenser overboard discharge acoustic silencing demonstration.

- Hull Life Assurance:

Initiated:

- Ship test planning for passive ship protection. (Transitions to Project R3049 PE 0603123N in FY03)

Completed:

- Propellant characterization and thermochemical combustion model for passive ship protection.
- Tools for predicting the total response of stowed ordnance in a ship with and without protective elements of Anti-Fratricide Shielding and Explosive Load Reduction.
- Contracted to develop design for High Speed Cargo Craft.

- Distributed Intelligence for Automated Survivability:

Initiated:

- Advanced Damage Countermeasures - investigation of watermist firefighting application for electronic spaces. (Transitions to Project R3049 PE 0603123N in FY03)
- Development of an advanced volume sensor for fire and smoke detection. Data collection and field test of volume sensor. (Transitions to Project R3049 PE 0603123N in FY03)

- Electric Warship:

Initiated:

- Ground Combat Vehicle Testbed program by using DARPA Reconnaissance, Surveillance, Targeting Vehicle (RSTV).
- Development of advanced power electronics for Electromagnetic Aircraft Launch System (EMALS) and ship main propulsion.

Continued:

- Ship Service Fuel Cell Demonstration (625kW) including diesel fuel reforming technology for molten carbonate and proton exchange membrane (PEM) fuel cells.
- Quiet Electric Drive/Submarine Secondary Propulsion Unit (SPU).

Completed:

- Aircraft Electrical Servicing Station (AESS) Demonstration

FY 2003 PLANS:

- Signature Reduction

Continue:

- Large-scale truss development for Advanced Machinery Support system (AMSS).

Complete:

- Surface ship near field de-amping boundary element and physical model development (includes stable algorithm).

- Electric Warship:

Initiate:

- Development of design for advanced main propulsion superconducting motor.

Continue:

- Development of advanced power electronics for Electromagnetic Aircraft Launch System (EMALS) and ship main propulsion systems.
- Quiet Electric Drive development of secondary propulsion unit (SPU).
- Ship Service Fuel Cell Demonstration (625kW) including diesel fuel reforming technology for molten carbonate and proton exchange membrane (PEM) fuel cells.

Complete:

- Proving ground testing of RSTV vehicle.
- Development of design for advanced main propulsion superconducting motor.

FY 2004 PLANS:

- Signature Reduction:

Continue:

- Large-scale truss development for Advanced Machinery Support system (AMSS).

- Electric Warship:

Initiate:

- Development of technologies for future hybrid electric Marine Corps combat vehicle.
- Advanced main propulsion motor development program.
- Development of advanced fuel cell reformer technology.
- Development of electromagnetic gun technology, including focus on rail wear issues, energy storage, and pulsed power switching.

Continue:

- Quiet Electric Drive/Submarine secondary propulsion unit (SPU).
- Development of advanced power electronics for Electromagnetic Aircraft Launch System (EMALS) and ship main propulsion systems.

- Laboratory evaluation portion of 625kW molten carbonate fuel cell and reformer technology program.

Complete:

- Fabrication of 625kW PEM diesel fuel reformer.

FY 2005 PLANS:

- Signature Reduction:

Complete:

- Large-scale truss evaluation for Advanced Machinery Support System (AMSS)

- Electric Warship:

Initiate:

- Development of advanced energy storage technology.

Continue:

- Development of technologies for future Marine Corps combat vehicle.
- Development of advanced fuel cell reformer technology.
- Advanced main propulsion motor development program and development of advanced power electronics for main propulsion motor drive.
- Development of electromagnetic gun technology, including focus on rail wear issues, energy storage, and pulsed power switching.

Complete:

- Development of advanced power electronics for EMALS and main propulsion systems.
- Quiet Electric Drive/Submarine secondary propulsion unit (SPU).
- Laboratory evaluation of 625kW molten carbonate fuel cell and reformer.

	FY 02	FY 03	FY 04	FY 05
Advanced Energetics	--	--	3,663	--

Advanced Energetics efforts address technology development to provide substantial improvements in energetic material systems and subsystems primarily in terms of performance, but also addressing safety, reliability, and affordability concerns, and ultimately to transition advanced technology to the Fleet. Goals include: advanced energetic materials for thermobarics, agent defeat, and reactive material based warhead subsystems for both defensive and offensive applications. Efforts include development of new fuels, oxidizers, and explosive formulations, reliable simulation tools and diagnostics to develop and design superior performance reduced vulnerability systems tailored to specific warfighter missions.

FY 2002 ACCOMPLISHMENTS: Described in PE 0602123N

FY 2003 PLANS: Described in PE 0602123N

FY 2004 PLANS:

- Thermobaric Weapon ACTD:

Completed:

- Advanced energetics effort will complete the payload development of the Thermobaric Weapon ACTD with explosive fill optimization, scale up, full scale performance validation, and qualification.

	FY 02	FY 03	FY 04	FY 05
Sensors & Associated (S&A) Processing	5,150	4,866	4,310	4,512

Activity develops complementary sensor and processing technologies for 21st century warfighting success and platform protection. Current small platforms (both surface and airborne) have little or no situational awareness (SA) or self-protection against air, surface, and asymmetric threats. The goal of this activity is to provide these platforms with effective self-protection. The technology areas specific to platform protection will develop individual or multispectral [Electro-Optic (EO), Infra-Red (IR), Radio Frequency (RF), Electromagnetic (EM), visual and acoustic] sensors and associated processing. To defend platforms from current and advanced threats in at-sea littoral environments and in port, these technologies must improve multispectral detection and distribution of specific threat information.

FY 2002 ACCOMPLISHMENTS:

For Surface Ships:

Initiated

- The Navy launched a technology program (FY02 through FY06) for a ship-based Distributive Aperture System (DAS), Infrared Search and Track (IRST) for transition to DDX, CGX, and CVNX. The IRST system will enable a passive self-protection capability for U.S surface ships. The system will address the need for low radar cross-section sensor for surface naval ships. The system will provide 360-degree staring panoramic view and awareness at-sea and in port of the surface, air, and asymmetric target set. Each module of the staring system will consist of focal plane arrays, anamorphic optics, stabilization, and modularization techniques. The ship's combat center will control the DAS through a central computer high-speed processor. The DAS, consisting of eight modules for surface combatant ships will vary based on the size of ship. It will provide surface ships with a 360-degree panoramic staring view on the horizon to line of sight, and be able to detect, declare, and track air contacts and surface contacts within 2-3 seconds. The sensor modules will also be able to pan its view downward to view the surface from the ship to line of sight for

in port counter-terrorism awareness. DAS will address the surface naval ship's needs for a passive fighting and in-port security ability. The Navy will demonstrate a three-module prototype with a high-speed central computer in FY06. It is critical to demonstrate the technique to seam stitch three sensors panoramic view.

- The Shipboard electro-optic (EO)/IR closed loop Self Protection effort. Develops and demonstrates an integrated threat detection and closed-loop laser jamming system to counter EO/IR/laser guided threats to Naval combatants. Began integration of hardware for both the closed loop Infrared Countermeasures (IRCM) and open loop Electro-optic Countermeasures (EOCM) laboratory testing. The system will ultimately be demonstrated to be effective against video guided, laser designated, mid-wave IR and long-wave IR guided (both autonomous and man-in-the-loop) seekers from a land site over water.

For Naval Aircraft:

Initiated:

- The Missile Warning System (MWS) and EO/IR Laser Jammer effort will perform technology demonstrations of missile warning system components that are effective in detecting and locating threat missiles with the fidelity required for current and future tactical aircraft. A key component of the system is the development of a two color sensor using a solid state mercury cadmium telluride (MCT) focal plane array (FPA) that will demonstrate a 99% focal plane array operability with an increase in operating temperature from 90° Kelvin to 140° Kelvin and a 100% improvement in the FPA cryogenic cooling efficiency. The FPA was designed and constructed in preparation for laboratory testing along with the high efficiency cooler system.

For Small Platforms:

Initiated:

- Work on the EO/IR self-protection for Small Surface Vehicles is focusing on breadboard demonstration of optical waveguide assemblies and suitable missile warning receivers to provide an automatic response for small platform and local area protection against IR guided and laser designated missiles and munitions. This work is continued within the Electronic Warfare Integrated System for Small Platforms (EWISSP) effort in PE 0603235N in FY03.

For Marine Corps:

Initiated:

- The End User Terminal (EUT) took delivery of and demonstrated the "ruggidized" 6-inch Organic Light Emitting Diode (OLED) display.

FY 2003 PLANS:

For Surface Ships:

Continue:

- Development and packaging of prototype sensor module for IRST Program.

- The Shipboard EO/IR closed loop self-protection effort, designed to increase platform survivability by the detection, classification and jamming of EO/IR/Laser guided threats, will conduct a functional demonstration of its mid-wave IR laser; receive and evaluate a Deuterium Fluoride pulsed chemical laser; and prepare for closed loop IRCM system demonstration in FY04.

For Naval Aircraft:

Continue:

- The Missile Warning System (MWS) and EO/IR Laser Jammer will conduct laboratory common jam code demonstrations and pointer/tracker functional demonstrations. Missile signature data will be collected during live fire tests of opportunity. This live fire data is coupled with recorded urban signature clutter to determine statistically significant system performance improvements such as probability of declaration and false alarm rates. This data is used by the MWS to correctly identify the threat, determine the time-to-go accuracy necessary to track and engage the threat seeker with an Infrared Countermeasures (IRCM) system using common jam codes to cause the seeker to breaklock.

For Marine Corps:

Continue:

- The End User Terminal continued demonstration of the "ruggidized" 6-inch OLED display and proceeded with the design of an integrated antenna for the Dismounted Digital Automated Computing Terminal (D-DACT).

FY 2004 PLANS:

For Naval Aircraft:

Initiate:

- The Integrated Defensive Electronic Counter Measures (IDECM) will perform tests on a short sample of a new high temperature towline required to operate throughout the entire F/A-18 E/F flight envelope including maximum afterburner.

For Surface Ships:

Continue:

- Efforts are focused on design, development and testing of systems, subsystems, and components for integration of Distributive Aperture Systems (DAS) sensor modules and components into a DAS capability demonstration model.
- Shipboard Electro-optic (EO)/Infrared (IR) Closed Loop Self Protection effort will complete fabrication of the stabilized optical pointer tracker and conduct testing at the Naval Research Laboratory's Chesapeake Bay Detachment open-air test range.
- Development and packaging of prototype sensor module for IRST Program.

For Marine Corps:

Continue:

- The EUT will proceed by demonstrating fusing imagery and rifle fire detection.

For Naval Aircraft:

Complete:

- The Missile Warning System (MWS) will conduct testing to demonstrate a 75% increase in the minimum detection and declaration range for man portable infrared-guided surface-to-air missiles.

FY 2005 PLANS:

For Surface Ships:

Continue:

- Continue systems and component level development, integration, and testing supporting future Distributive Aperture Systems (DAS) capability demonstration.
- Continue the Shipboard Electro-optic (EO)/Infrared (IR) Closed Loop Self Protection effort demonstrating the compact, high power midwave IR laser at the Naval Research Laboratory's Chesapeake Bay Detachment open-air test range.
- Development and packaging of prototype sensor module for IRST Program.

For Naval Aircraft:

Continue:

- The IDECM effort will perform full-length acceptance testing on the new high temperature towline.
- The EO/IR Laser Jammer for Tactical Aircraft (TACAIR) will demonstrate the targeting Forward Looking IR (FLIR) function with the IRCM tracker.

For Marine Corps:

Continue:

- The EUT effort will integrate the enhanced Radio Frequency (RF) transmitter module with the wearable vest.

	FY 02	FY 03	FY 04	FY 05
Missile Defense (MD)	20,038	6,812	4,815	4,920

The Missile Defense Future Naval Capability (FNC) is intended to develop Littoral Theater Air and Missile Defense (TAMD) technology enhancements for transition to acquisition programs, which will interact efficiently, effectively, and in time to detect, control, and engage projected anti-ship cruise missiles, overland cruise missiles, aircraft and theater ballistic threats. The Missile Defense S&T efforts directly provide elements of the capability required by the Joint Requirements Oversight Council (JROC) Theater Air and Missile Defense (TAMD) Capstone Requirements Document (CRD) (2001). This PE includes those MD FNC elements that perform risk reduction for Force Protection Capability.

FY 2002 ACCOMPLISHMENTS:

- Missile Defense:

Initiated:

The Affordable Ground Based Radar (AGBR) effort initiated design and development of a sub-scale radar for surveillance, air control, and fire control system. It is to be mounted on a High Mobility Multi-Purpose

Wheeled Vehicle (HMMWV). The system will serve as risk reduction for the Multi-Role Radar System (MRRS). Continued in PE0603271N in FY03 and beyond.

- Littoral Affordability (classified program).
- The Advanced Area Defense Interceptor (AADI) effort initiated planning efforts for a Navy/Marine Corps air-directed, surface-to-air missile (ADSAM) live firing demonstration in FY 2007. Effort will coordinate with numerous Navy program sponsors and offices to formalize requirements, establish funding strategy, and prepare demonstration.
- Initiated design of a mass-focused Reactive Material Enhanced Warhead (RMEW), and test planning and Fragment Mat (FRAGMAT) warhead characterization tests.

• Total Ownership Costs:
Continued:

- Development and flight demonstration of Vectoring Extremely Short Take Off and Landing (ESTOL) Control Tailless Operation Research (VECTOR) air platform.

FY 2003 PLANS:

• Missile Defense:
Continue:

- The Reactive Warhead effort will continue in its development of a RMEW for STANDARD Missile, completing Phase I FRAGMAT tests to develop a physics-based damage prediction model and initiating effectiveness analyses of a mass-focused RMEW against Anti-Air Warfare (AAW) targets.
- Littoral Affordability (classified program).
- The AADI effort will continue with planning and coordination for a Navy - Marine Corps ADSAM live firing demonstration in FY 2007.

• Total Ownership Costs:
Complete:

- Development and flight demonstration of VECTOR air platform.

FY 2004 PLANS:

• Missile Defense:
Continue:

- Littoral Affordability (classified program)
- The AADI effort will continue with planning and coordination for a Navy - Marine Corps ADSAM live firing demonstration in FY 2007.

Complete:

- The Reactive Warhead effort will complete advanced design/development efforts for a reactive material warhead for STANDARD Missile, completing Phase II FRAGMAT tests to finalize the physics-based damage prediction model and complete effectiveness analyses of a mass-focused RMEW, and incorporate results into RMEW design.

FY 2005 PLANS:

- Missile Defense:

Initiate:

- The Distributed Weapons Coordination (DWC) effort will initiate advanced combat system integration of complex algorithms for Common Threat Evaluation (CTE), and Preferred Shooter Recommendation (PSR), developed under PE 0602123N, into a real-time open architecture distributed computing environment in preparation for transition to Naval Open Architecture combat systems.

Continue:

- The AADI effort will continue with detailed planning and coordination for a Navy - Marine Corps ADSAM live firing demonstration in FY 2007. This will include analysis and performance evaluation of advanced systems in an ADSAM environment.

Complete:

- Littoral Affordability (classified program).

	FY 02	FY 03	FY 04	FY 05
Underwater (UW) Platform Self Defense	6,680	3,893	3,250	7,148

Activity develops enabling technologies that will increase the survivability of surface ship and submarine platforms against torpedo threats. Proposed technologies focus on defeating high priority threats including torpedoes (i.e. straight running, wake homing, acoustic homing, high speed torpedoes, air dropped torpedoes, and salvoes of torpedoes). The long-term goal of the UW Platform Self Defense activity is to develop technologies that will ultimately be placed onboard ship. Technologies should be developed to minimize shipboard impact, allow automatic employment, and require no organizational maintenance. Specific technology includes two programs. The Next Generation Countermeasure (NGCM): A mobile adaptive acoustic countermeasure with acoustic communication links to enable countermeasure connectivity and group behavior to defeat threat torpedoes. The Anti-Torpedo Torpedo (ATT)/Tripwire Demonstration: Technologies that improved passive shipboard detection, classification, and localization (DCL) of incoming torpedoes and an ATT to engage the threat torpedoes.

FY 2002 ACCOMPLISHMENTS:

Continued:

- Development of ATT and Tripwire Technology Demonstration System (TDS) technology.
- Classified program.

FY 2003 PLANS:

Continue:

- Development of ATT and Tripwire TDS technology.
- Classified program.

FY 2004 PLANS:

Initiate:

- Transition of counter-torpedo technologies to Naval Sea Systems Command (NAVSEA) Tripwire Torpedo Defense System (AN/WSQ-11).

Continue:

- Development of ATT and Tripwire TDS technology.
- Classified program.

FY 2005 PLANS:

Initiate:

- Demonstration of guidance and control to increase effectiveness of ATT in shallow wake environments.
- Demonstration of full-duplex capability for NGCM with towed array fixture.

Continue:

- Development of ATT and Tripwire TDS technology.
- Classified program.
- Transition of counter-torpedo technologies to Naval Sea Systems Command (NAVSEA) (Tripwire Torpedo Defense System (AN/WSQ-11).

	FY 02	FY 03	FY 04	FY 05
Littoral Surface Craft – Experimental (LSC(X))	20,000	*	5,000	0

* FY03: $8,935 funded in PE 0603114N, Project R9013 for LSC(X).

X-Craft is envisioned as an S&T platform designed for experimentation with lifting bodies, drag reduction and mission modularity. A high-speed, all-aluminum catamaran, it displaces no more than 1100 tons at full load. Performance requirements are 50 knots at combat load, 40 knots in sea state 4, and a 4000 nautical miles range without replenishment. It will be capable of landing two helicopters up to the size of SH-60R, transporting and operating autonomous vehicles, and carrying several reconfigurable mission modules in standard Twenty-foot Equivalent Unit (TEU) boxes. The crew will be minimal and the vessel will be built to commercial American Bureau of Shipping (ABS) standards.

FY 2002 ACCOMPLISHMENTS:

Initiated:

- Development of technologies for small, fast craft in the 500-1000 ton range. These technologies enable a craft for missions such as littoral ASW and mine countermeasures.
- Contract level design and construction of the LSC(X) prototype craft.
- Design and development of lifting body and drag reduction system.
- Hullform selection, concept design.

FY 2003 PLANS:

Described in PE 0603114N, Project R9013.

FY 2004 PLANS:

Completed:

- Development of technologies for small, fast craft in the 500-1000 ton range. These technologies enable a craft for missions such as littoral ASW and mine countermeasures.
- Contract level design and construction of the LSC(X) prototype craft.
- Design and development of lifting body and drag reduction system.
- Hullform selection, concept design.

FY 2005 PLANS: Not Applicable

C. OTHER PROGRAM FUNDING SUMMARY:

RELATED RDT&E:

NAVY RELATED RDT&E:
PE 0204152N (E-2 Squadrons)

PE 0205601N (HARM Improvement)
PE 0206313M (Marine Air Communications System Computers & Intelligence)
PE 0601153N (Defense Research Sciences)
PE 0602123N (Force Protection Applied Research)
PE 0602131M (Marine Corps Landing Force Technology)
PE 0602235N (Common Picture Applied Research)
PE 0602271N (RF System Applied Research)
PE 0603235N (Common Picture Advanced Technology)
PE 0603271N (RF Systems Advanced Technology)
PE 0603502N (Surface and Shallow Water Mine Countermeasures)
PE 0603561N (Advanced Submarine System Development)
PE 0603563N (Ship Concept Advanced Design)
PE 0603564N (Ship Preliminary Design and Feasibility Studies) PE 0604307N (Surface Combatant Combat System Engineering)
PE 0603609N (Conventional Munitions)
PE 0603640M (Marine Corps Advanced Technology Demonstration, ATD)
PE 0604518N (Combat Information Center Conversion)
PE 0604558N (New Design SSN)

NON NAVY RELATED RDT&E: Not Applicable.

D. ACQUISITION STRATEGY: Not Applicable.

FY 2004/2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2003
Exhibit R-2a

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603123N PROJECT NUMBER: R3049
PROGRAM ELEMENT TITLE: Force Protection Advanced Technology PROJECT TITLE: Emerging Threats

COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2002 ACTUALS	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	FY 2008 ESTIMATE	FY 2009 ESTIMATE
R3049 Emerging Threats	0	6,515	5,160	8,651	3,152	3,600	3,674	3,748

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Includes funds to develop and demonstrate advanced technologies that support platform self-protection. The new capabilities include the areas of all-weather, day/night protection of naval platforms and forces against all weapon threats, counter-stealth and countermeasures. Demonstrated capabilities support the ability to prevent or control platform damage while preserving operational capability. Hull life assurance addresses development of new structural system approaches for surface ships and submarines, including the management of weapons effects to control structural damage and the improvement of structural materials. Distributed intelligence for automated survivability addressees both the basic technology of automating damage control systems as well as distributed auxiliary control with self-healing capability.

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 02	FY 03	FY 04	FY 05
Emerging Threats	0	6,515	5,160	8,651

Activity includes: Efforts in hull life assurance and distributed intelligence for automated survivability. Addresses the management of weapon effects to control structural damage and the improvement of structural materials. Distributed control for automated survivability addressees the basic technology of automating damage control systems.

FY 2002 ACCOMPLISHMENTS: Efforts funded and discussed in this PE Project R2912.

FY 2003 PLANS:

- Hull Life Assurance:

Initiate:

- Passive ship protection system design.
- Blast yield/propagation test for passive protection.

Complete:

- Ship test planning for passive ship protection full-scale test.
- Passive ship protection system design.
- Blast yield/propagation test for passive protection.

- Distributed Intelligence for Automated Survivability:

Initiate:

- Development of optical sensor prototype for volume sensor (fire & smoke detection) application.

Continue:

- Small scale testing of high efficiency watermist system for application to electronic spaces within advanced damage countermeasures program.
- Data collection and field test of optical sensor prototype for volume sensor.

FY 2004 PLANS:

- Hull Life Assurance:

Initiate and complete:

- Passive ship protection system test execution.

- Distributed Intelligence for Automated Survivability:

Continue:

- Full scale testing of high efficiency watermist system for application to electronic spaces within advanced damage countermeasures program.
- Real time optical sensor prototype for volume sensor (fire & smoke detection) application.
- Data collection and field test of volume sensor.

FY 2005 PLANS:

- Distributed Intelligence for Automated Survivability:

Complete:

- Full scale testing of high efficiency watermist system for application to electronic spaces within advanced damage countermeasures program.
- Real time optical sensor prototype for volume sensor (fire & smoke detection) application.
- Data collection and field test of volume sensor.

C. OTHER PROGRAM FUNDING SUMMARY:

NAVY RELATED RDT&E:
- PE 0601153N (Defense Research Sciences)
- PE 0602123N (Force Protection Applied Research)
- PE 0602235N (Common Picture Applied Research)
- PE 0603235N (Common Picture Advanced Technology)
- PE 0603502N (Surface and Shallow Water Mine Countermeasures)
- PE 0603561N (Advanced Submarine System Development)
- PE 0603563N (Ship Concept Advanced Design)
- PE 0603564N (Ship Preliminary Design and Feasibility Studies)
- PE 0604558N (New Design SSN)
- PE 0604561N (SSN-21 Developments)

NON NAVY RELATED RDT&E: Not Applicable.

D. ACQUISITION STRATEGY: Not Applicable.

Congressional Plus-Ups:

R2706	FY 02	FY 03
Project M	2,703	2,078

Demonstrate derivatives of Project M active control technology for active degaussing (reduction of electromagnetic signatures) of naval motors and for mitigation of shock on small naval craft.

R2711	FY 02	FY 03
Superconducting DC Homopolar Motor	1,927	2,738

Advanced technology supporting preliminary design and construction of a 3.7 MW subscale motor. Motor design addresses development of an advanced acyclic motor with superconducting windings. The design effort addresses the complete machine design, including issues such as high reaction forces resulting from high magnetic fields, mechanical and cooling issues.

R2826	FY 02	FY 03
Ship Service Fuel Cell	0	2,933

Develop and conduct land-based testing of a 625KW molten carbonate marine fuel cell power system capable of running on logistic fuel. This system should be capable of achieving a 50% specific fuel efficiency. Detailed design has been completed and the unit is currently being assembled. Testing will be conducted at the manufacturer’s facility and a Navy laboratory early in FY04.

R2828	FY 02	FY 03
Advanced Waterjet-21 (AWJ-21)	3,372	0

Tested a 1/4 scale unit of the advanced waterjet and subsequent technology demonstration on a scaled platform. Performance of the scaled unit was established and the results were extrapolated to establish the anticipated performance of a full scale pump. A focus of the evaluation was cavitation performance and its impact on propulsive efficiency and acoustic performance characteristics. The propulsive efficiency and signature characteristics of the advanced design were evaluated and established.

R2831	FY 02	FY 03
High Temperature Superconducting AC Synchronous Navy Propulsion Motor & Generator	3,862	4,890

FY02 effort provided design tradeoffs and final design selection for an HTS high power density propulsion motor. Tradeoff and final design addresses all aspects of electromagnetic and mechanical design, including addressing the aspects of high field levels in superconducting windings and the influence of subsequent high forces on the mechanical design of the machine. FY03 begins construction of the HTS propulsion motor and power electronics.

R2848	FY 02	FY 03
Hybrid Small Waterplane Area Catamaran (HYSWAC)	7,015	0

The effort supported modification of the SES platform to a HYSWAC configuration. This modification entails removing the air lift fans and flexible skirts, and adding SLICE-styled pods to partially lift the vessel out of the water with SLICE-like pods. Redesign, conversion and testing of the SES vessel to the new Support at-sea testing for evaluation of the HYSWAC concept.

R9013	FY 02	FY 03
Littoral Suface Craft-Experimental (LSC-X)	15,549	*

(Appropriated in FY03 in PE 0603114N, Project R9013,$8,935)

Design and construction for a Littoral Surface Craft - Experimental (LSC(X)) (now referred to as X-craft), envisioned as a small, fast, experimental ship designed to operate in the littorals. The ship, designed to carry a variety of mission modules, will serve as a testbed for new technologies and new operational concepts. Effort has included development of technologies design and development of lifting body and drag reduction system. Such technologies are suitable for small, fast craft to enable a craft for missions such as littoral ASW and mine countermeasures.

R9014	FY 02	FY 03
Curved Plate Technology	2,412	0

Effort addressed the development of curved plate technology in the construction of double hull vessels using steel and alloy metals with low magnetic, anti-corrosive properties. Demonstrating this application addressed welding technology for stainless steel that is different from conventional carbon steel approaches. The demonstration built full-scale hull sections that may be used for air-blast and underwater explosion resistance testing.

R9015	FY 02	FY 03
Deployable SMARTLINK Communications Upgrade	1,445	1,467

The effort provides advanced technology application to a Smart Link System. The prototype communication system has been demonstrated to provide an order of magnitude improvement in bandwidth for our sailors at sea. The system uses a revolutionary Flat Parabolic Surface (FLAPS) antenna system, which can transmit 12 phonecalls simultaneously (at a cost of about 10 cents per minute) and can provide video teleconferencing capability. The system is deployable, allowing it to occupy non-dedicated space, be quickly taken down and deployed elsewhere if necessary. The effort of FY02 and the planned effort for FY03 is to provide improved primary communication capabilities during operational deployment.

R9016	FY 02	FY 03
Real Time Fire and Smoke Prediction Tool	963	0

Effort focused on development of advanced technology to better model fire and smoke spread in a shipboard environment. Fire and Smoke Spread Prediction tool was developed to allow effective real time shipboard decision-making and damage control response. Prior modeling capabilities have not supported real time predictions. Verification will be performed on the ex-USS Shadwell via full scale testing.

R9017	FY 02	FY 03
Wireless Sensors for Total Ship Monitoring	2,697	0

Wireless sensor technology for monitoring all shipboard systems and providing situational awareness was addressed. These shipboard wireless sensor networks will enable reduced crewing concepts, collect, integrate and process machinery, combat systems and biomedical information enhancing situational awareness over equipment and personnel. This enhanced situational awareness offers more rapid response to changes in shipboard status. This effort has provided improvement in sensors, computers and software used to process, transmit, display, warn and remedy potentially fatal situations.

R9018	FY 02	FY 03
Knowledge Projection for Fleet Maintenance	2,410	0

Provide advanced technology for better management of fleet maintenance. Effort has developed a new system that will enable collection, processing, transmission and expert analysis of shipboard (Fleet) equipment health and

usage information. Concept will permit off-ship technical experts to assist ship's crew in ship system maintenance and repair.

R9019	FY 02	FY 03
Wave Powered Electric Power Generating System for Remote Naval Sites	1,930	1,956

Provide advanced technology support for the development of a power generating system driven by ocean wave motion. The FY02 effort provided testing, extended the hydrodynamic modeling of a buoy system and validated those models. FY03 effort will address environmental issues, means to improve reliability, increase energy efficiency. The issues associated with operation of a multi-buoy system will also be addressed.

R9120	FY 02	FY 03
High Speed Cargo Craft	*	734**

(*$3,852 Contained in Project R2912 in this PE in FY02)

(**FY03 Funds originally appropriated in PR 0708730N)

Construct and test a small prototype High Speed Cargo Craft. The prototype craft would demonstrate an advanced hull form incorporating a combination of catamaran and surface effect technologies with goal of evaluating the craft’s suitability as a high-speed cargo craft.

R9026	FY 02	FY 03
DDG-51 Composite Twisted Rudder Reconfigurable Ships	*	0

*$965 (Appropriated in FY02 in PE 0603508N)

Effort matures the process technology to fabricate a composite twisted rudder for transition to the DDG-51 and other Navy ships. Goal is to improve quality and solve excessive corrosion problems.

R9138	FY 02	FY 03
Center for Maritime Systems	0	1,368

Develop a rapidly implemented and integrated system of observing networks and forecasting models to provide real-time information on oceanographic and atmospheric conditions affecting Navy sensors and operations. Provide real time data/model uncertainty analysis and a display suitable for decision making. Provide high resolution surveillance of ship traffic oceanic and atmospheric conditions within a specified geographic region. Provide means of rapidly addressing security concerns at USN ship berths at any location in the world.

R9139	FY 02	FY 03
Graphite Fiber Sandwich Composites for Advanced Warship Design	0	977

Investigate the use of carbon sandwich materials for surface ship hull structure. Combine analytical and experimental investigations to address design, survivability and fatigue issues associated with the implementation of these materials for future Navy platforms.

R9140	FY 02	FY 03
High Speed Permanent Magnet Generator	0	3,423

The development of a high speed permanent magnet generator will be initiated with evaluation of heat removal techniques and the preliminary design of the generator. Generator design issues will be addressed to establish the best approach for the electromagnetic and mechanical design, including thermal design issues. Effort will provide assessment of machines potential efficiency and other performance characteristics.

R9141	FY 02	FY 03
Marine Direct Ship Service Fuel Cell Technology Validation Trainer	*	1,187

(*$1,933 Previously designated Project R2826 in FY02 PE 0603508N, Ship Service Fuel Cell Technology Verification & Training Program)

Complete installation of a land-based fuel cell to enable collection of operational data for use in supporting the modeling of system reliability and maintenance. Upon completion of this effort, the system could be made available to be used as a trainer.

R9142	FY 02	FY 03
Smart Microsensor Arrays for Shipboard Damage Control	0	5,169

Development of a high temperature cermet (ceramic-metallic) prototype smart microsensor array system for Navy damage control applications. The chemical microsensor array system offers a small size, light weight, and low cost alternative to conventional sensors and the potential for fabrication of smart sensor arrays with on-chip logic integration. The arrays will be networked using E-Smart (Environmental Systems Management, Analysis and Reporting network) system. Developing flexible readout circuitry using standard Si and then SOI microelectronics will offer high operating temperature control and logic circuitry applicable to shipboard damage control environments.

FY 2004/2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2003
Exhibit R-2a

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603123N Project Number: Various
PROGRAM ELEMENT TITLE: Force Protection Advanced Technology Project Title: Congressional Plus-ups

R9143	FY 02	FY 03
Smart Sensor Web	0	1,027

Develop a network of smart, ground based sensors that can operate in an urban environment. The sensors will communicate via power lines or in a wireless mode in the absence of power lines. This technology will be applicable to a variety of operational environments including chemical and biological warfare. It is also applicable to Military Operations Other Than Warfare (MOOTW).