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

BA: 02 PROGRAM ELEMENT: 0602123N
PROGRAM ELEMENT TITLE: Force Protection Applied Research

COST: (Dollars in Thousands)

Project Number & Title	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Force Protection Applied Research	113,066	112,868	96,269	98,643	125,631	124,475	121,493

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. It supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial and air) and the protection of those platforms. The goal 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. 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. This is accomplished by improvements in platform offensive performance, stealth and self defense. This program supports the Fleet and Force Protection and Missile Defense and Advanced Capability Electric System (ACES) Future Naval Capabilities (FNC).

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

PROGRAM CHANGE SUMMARY:

	FY 2003	FY 2004	FY 2005
FY 2004-2005 President's Budget Submission	118,413	75,909	98,763
Cong. Rescissions/Adjustments/Undist.Reductions	0	-1,311	0
Congressional Actions	0	38,275	0
Execution Adjustments	-3,220	0	0
FY03 Fed Tech Transfer	-27	0	0
Inflation Savings	0	0	-317
Rate Adjustments	0	-5	-177

SBIR Assessment	-2,100	0	0
Technical Adjustments	0	0	-2,000
FY 2005 President's Budget Submission	113,066	112,868	96,269

PROGRAM CHANGE SUMMARY EXPLANATION:

Technical: Not Applicable.

Schedule: Not Applicable.

FY 2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: Feb 2004

Exhibit R-2a

BA: 02 PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: Force Protection Applied Research

PROJECT TITLE: Force Protection Applied Research

COST: (Dollars in Thousands)

Project Number & Title	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Force Protection Applied Research	113,066	112,868	96,269	98,643	125,631	124,475	121,493

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. It supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial and air) and the protection of those platforms. The goal 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. 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. This effort supports the Fleet and Force Protection, Missile Defense and Advanced Capability Electric System (ACES) Future Naval Capabilities (FNC).

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2003	FY 2004	FY 2005
Surface Ship & Submarine Hull Mechanic & Electrical (HM&E)	42,995	44,890	59,934

Efforts include: signature reduction, hull life assurance, hydromechanics, distributed control for automated survivability, and advanced electrical power systems. Signature reduction addresses electromagnetic, infrared 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 weapons effects to control structural damage and the improvement of structural materials. Hydromechanics addresses hydrodynamic technologies, including the signature aspects of the hull-propulsor interface. 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. Advanced electrical power system addresses electrical and auxiliary system and component technology to provide improvement in energy and power density operating efficiency and recoverability from casualties. This effort supports the Fleet and

Force Protection, Missile Defense and Advanced Capability Electric System (ACES) Future Naval Capabilities (FNC). Increased funding in FY 2005 will be used to advance technology in the areas of fast-high power switches, capacitors, power and thermal management, fuel cells and advanced power generation.

FY 2003 Accomplishments:

- Completed the preliminary version of Next Generation Infrared (IR) Code. The code is now subject to verification and validation.
- Developed tools to describe failure mechanisms of sandwich composites.
- Finalized component design for dynamic ship protection system.
- Completed Dynamic Behavior of Composite Ship Structures (DYCOSS) joint effort with Dutch Navy.
- Developed a notional payload module for a submarine modular hull application. Continued development of analytical models to further define submarine modular hull concepts.
- Developed technology basis for a family of electromechanical actuators.
- Developed thermal management concepts and components for high powered electrical systems.
- Developed compact, high-powered solid state switching technology for the Electro-Magnetic Aircraft Launching System (EMALS) and other pulsed and steady state applications. Transitioned some hardware, applications, and software system managers to the EMALS program office.
- Investigated potential applications of silicon-carbide in future high voltage and high power applications.
- Designed software for system manager for Universal Control Architecture (UCA).
- Initiated the next generation infrared (IR) scene model for surface ships by development of mitigation strategy supporting low observable infrared platforms, development of supporting physics and prototype measurement techniques.
- Commenced feasibility study of distributed pump-jet propulsion system (DPJP) concept for submarines.
- Initiated evaluation of an Integrated Engineering Plant (IEP) concept to provide improved survivability of auxiliary systems that support combat systems.
- Initiated development of X-Craft experimentation plan and model testing effort.
- Continued advanced numerical acoustic codes (and gridding methods for those codes) for submarines.
- Continued development of analytical models to further define modular submarine hull concepts.
- Continued algorithm/finite element model validation for submarine advanced degaussing/deamping.
- Continued physics based numerical model for electromagnetic scattering of hydrodynamic disturbances for Surface Ships.
- Continued development of surface ship acoustic flow noise model. Performed tank test for surface ship acoustic behavior validation.
- Continued to develop design tool for integrated antenna and composite topside.

- Continued development of reliability based design and structural analysis code development.
- Continued to investigate improved maneuvering simulation capability for submarines.
- Continued analytical and modeling investigation of cavitation, powering and acoustic performance of submarine propellers.
- Continued study of flow noise over submarine control surfaces.

FY 2004 Plans:

- Continue all efforts of FY 2003 less those noted as completed above.
- Fabricate prototype acoustic wireless sensor array for submarines.
- Evaluate Advanced Ducted Electric Propulsion Pod (ADEPP) model hydrodynamic performance in the Large Cavitation Channel (LCC).
- Develop, validate, and apply numerical codes to integrated propulsor/hull for advanced surface ship configurations.
- Validate advanced prediction code for large amplitude non-linear motion of advanced surface ship hulls.

FY 2005 Plans:

- Continue all efforts of FY 2004.
- Complete demonstration of prototype acoustic wireless sensor array system incorporating self powering, radio frequency unit and sensors.
- Deliver next generation IR scene model and next generation IR code.
- Validate prediction methods which relate ship hydrodynamics and ship signatures.
- Develop quiet control surface design tool based on control surface flow noise studies.
- Complete and document reliability based design method for application to ship design.
- Initiate development structural analysis codes describing failure mechanisms of sandwich composites.
- Initiate work to assess cavitation performance of loop-bladed propulsor concept.
- The following efforts reflect the investment in electrical technology:
  - Accelerate ship service fuel cell development leading to at sea demo by FY 2006.
  - Commence development of test vessel and technology to evaluate performance and signature associated with electrically driven waterjets (AWJ-21) and Rim-drive motor (Advanced Hull-form Inshore Demonstrator - AHFID).
  - Initiate multi-year program to directly convert thermal energy to electricity. Such a capability would allow elimination of the steam cycle on an electric warship.
  - Accelerate development of thermal management technology for shipboard power distribution.
  - Accelerate development of pulsed power technology, to include pulsed alternators and capacitors.

	FY 2003	FY 2004	FY 2005
Advanced Energetics	10,116	0	12,416

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. 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 2003 Accomplishments:

- Energetics development of composition synthesis and process for the Thermobaric Warhead Explosive Fill Advance Concept Technology Demonstration (ACTD).
- Conducted a parametric study of candidate explosive systems to determine each component's contribution to internal blast overpressure and impulse. This study will guide future formulation selection and optimization.
- Internal blast performance was determined in a closed chamber bombproof test series. Sub-scale tunnels were used to experimentally determine the performance of internal blast/thermobaric explosives in geometries similar to those expected in operational use.
- Nine candidate explosive formulations were down selected from the small-scale tunnel test phase and tested for performance in a "mid-scale" tunnel test series.
- Small-scale explosive survivability tests were developed and conducted to evaluate their suitability for thermobaric applications under the compression/shear environment that the weapon is expected to encounter in operation.
- Plans were developed for qualification and testing of downselected candidate explosive composition(s) for Insensitive Munitions.
- Continued Advanced Energetics development of composition synthesis and process for the Thermobaric ACTD.

FY 2004 Plans:

- Continue FY 2003 funded work (in next generation reactive materials, diafloramine ingredients and formulations and advanced directed energy warheads) not finished in FY 2003.

- Postpone new work in this PE until FY 2005.

FY 2005 Plans:

- Continue all efforts of FY 2004.
- Initiate work to determine feasibility of achieving insensitive warheads without compromising performance. This work may require development of advanced energetic ingredients and processing concepts.

	FY 2003	FY 2004	FY 2005
Aircraft Technology	6,510	6,242	6,037

The Aircraft Technology activity develops high impact, scaleable Naval air vehicle technologies, such as structures and flight controls for future and legacy air vehicles, integrated avionics, advanced electrical power systems, and aerodynamics, which significantly increase the Naval warfighter's capabilities, effectiveness, readiness and safety, while reducing life cycle cost. This activity directly supports the naval aviation vision, providing a robust and credible forward presence through flexible response and dominate power projection from the sea.

FY 2003 Accomplishments:

- Investigated in-flight, autonomously reconfigurable air vehicles (studies and workshops).
- Developed Computational Fluid Dynamics (CFD) modeling of ship airwake flows to provide higher fidelity simulations.
- Developed Observables technology (classified).
- Performed piloted simulation of intelligent flight control prognostics and reconfiguration algorithms.
- Developed and simulated advanced control laws for shipboard auto-land of unconventional vehicles.
- Developed and simulated automated maneuvering algorithms.
- Developed and verified Figures-of-Merit, validated CFD, and developed wind tunnel techniques to mitigate/eliminate Abrupt Wing Stall (AWS) on current/future fighter/aircraft.
- Continued design for demonstration of an all-composite replacement for dynamically loaded control surfaces for tactical aircraft.

FY 2004 Plans:

- Continue all efforts of FY 2003.
- Develop survivability/reduced observables technology (classified).

- Investigate in-flight, autonomously reconfigurable air vehicles.
- Demonstrate intelligent flight control prognostics and reconfiguration algorithm.
- Initiate Persistent Intelligence, Surveillance, and Reconnaissance (ISR) Unmanned Air Vehicle (UAV) System (PERSIUS): Capability tailored to the Expeditionary Strike Group (ESG), a high endurance sensor and communication capability focused on disparate structurally integrated sensors (Electro-Optic (EO), Infrared (IR), Radio Frequency (RF)), electronic support, and communications packages, low volume high power generation capability, high capacity miniaturized data transmission, and short take off.
- Initiate Joint Transformational Strike (JTS) technology addressing Automatic Target Recognition (ATR) and Combat Identification (CID).

FY 2005 Plans:

- Continue all efforts of FY 2004.

	FY 2003	FY 2004	FY 2005
Missile Defense (MD)	9,215	8,575	11,378

This activity describes two efforts of the Missile Defense Future Naval Capabilities (FNC) program: Distributed Weapons Coordination (DWC) (including sensor coordination), and Littoral Affordability (classified program).

FY 2003 Accomplishments:

- Completed the Tactical Missile System-Penetrator (TACMS-P) Advance Concept Technology Demonstration (ACTD) critical review. (Not a Missile Defense FNC effort).
- Continued Littoral Affordability (classified program).
- Continued development of DWC algorithms for the naval open architecture combat system, common threat evaluation (CTE) and preferred shooter recommendation (PSR) functions. Demonstrated Navy anti-air warfare functionality in a laboratory simulation environment.
- Initiated articulation of requirements and methodology for sensor coordination in support of integrated fire control and theater-wide surveillance/tracking.
- Continued Littoral Affordability (classified program).
- Continued development of DWC algorithms for the naval open architecture combat system, common threat evaluation (CTE) and preferred shooter recommendation (PSR) functions. Demonstrated Navy anti-air warfare functionality in a laboratory simulation environment.

FY 2004 Plans:

• Continue all efforts of FY 2003 less those noted as completed above.

FY 2005 Plans:

• Continue all efforts of FY 2004.
• Initiate early phase conceptual studies and projects to determine the potential application of Low Observable technology to future naval platforms.

	FY 2003	FY 2004	FY 2005
Sensors & Associated (S&A) Processing	12,482	14,000	4,804

Activity focuses on applied research for complementary sensor and processing technologies for platform protection. Current small platforms (both surface and airborne) have little or no situational awareness (S&A) 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 multi-spectral (Electro-Optic (EO), Infrared (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 multi-spectral detection and distribution of specific threat information. This activity supports the Fleet and Force Protection Future Naval Capabilities (FNC) and Missile Defense FNC. Budget Activity 2 sensor efforts are co-funded by PE 0602235N and 0602271N. Funding decrease in FY 2005 reflects transfer of sensor effort to PEs 0602235N and 0602271N in FY 2005. Major efforts are summarized below:

For Aircraft -
• The Integrated Defensive Electronic Countermeasures (IDECM) P3I effort adds additional capability to the radio frequency countermeasures (RFCM) system for F/A-18 E/F self-protection. It consists of developing an improved decoy towline and applying wide band-gap semiconductor technology to design a prototype RF solid-state transmitter for the fiber optic towed decoy.
• The Missile Warning System (MWS) effort is designed to develop and demonstrate two-color infrared (IR) missile warning enabling technology that is compatible with the Tactical Aircraft Directed IR Countermeasures (TADIRCM).
• The EO/IR Laser Jammer for TACAIR effort develops and demonstrates advanced laser jammer enabling technology that is compatible with tactical air (TACAIR) signature, radar cross section (RCS), and drag requirements and is effective against surface-to-air missiles (SAM), air-to-air missiles (AAM), and advanced

imaging threats.

For Surface Ships –
• Distributed Aperture System (DAS) development: Develops the data processor and optical augmentation software algorithms for threat classification. This is an international effort. Examines and integrates sensor modules into a single system design to support shipboard combat operations.
• The Shipboard EO/IR Closed Loop Self-protection effort develops and demonstrates an integrated threat detection and closed-loop laser jamming system to counter Electro-Optic (EO)/Infrared (IR) guided anti-ship missile threats.

For Marine Corps –
• The End User Terminal (EUT) effort develops improved personal communications, situational awareness and sniper detection for ground troops.

FY 2003 Accomplishments:

• Missile Warning System - The Integrated Detector-Dewar-Cooler Assembly was delivered to NRL and began design verification testing. Excellent 256x256 40um pitch focal plane arrays (FPAs) were fabricated utilizing passivation (stoichiometric cadmium-telluride) and diode formation procedures (gold doping) developed under this program.
• EO/IR Jammer - The design for the pump laser and optical parametric oscillators (OPO) were validated and completed, and construction of a multi-band mid-wave infrared, solid-state, high power countermeasure laser began.
• EO/IR Closed Loop Self-protection: Completed initial evaluation of a visible-band, high frame-rate sensor and investigated alternate designs of a mid-wave infrared-band sensor for closed-loop processing. Specification and preliminary design of the combined multi-band mid-wave infrared-band/visible-band countermeasure laser was completed and includes an innovative thallium-fiber pump laser to achieve reduced packaging size and improved robustness.
• End User Terminal: Techniques to inject and fuse information from individual soldier-mounted sensors into the network were examined. Preliminary sensor selection for color night vision perimeter defense and sniper counter-fire validation were completed.
• Completed Chemical Sensing in the Marine Environment locating the source of chemical plumes in very shallow waters using sensors on autonomous underwater vehicles. The resulting field tests will demonstrate whether the onboard sensor systems possess the necessary sensitivity and speed to accurately locate unexploded ordnance (UXO).
• Completed Chemical Sensing in the Marine Environment characterization of chemical plume structure in

very shallow water regimes. Optimized search strategies were used onboard autonomous underwater vehicles (AUV) to trace chemical plume from UXO.
• Discontinued development of energy harvesting benthic fuel cells using bioelectrochemical mechanisms at the water-sediment interface.
• Discontinued efforts directed toward using TNT and other explosives sensors as AUV payloads for detection of UXO.
• Completed investigation of tailored acoustic materials for quieter platforms.
• Completed investigation of bio-inspired algorithms for image processing hardware development.
• Completed development of oligonucleotide taggants as molecular barcodes for naval applications.
• Completed development of novel nonporous fouling-resistant enzymatic composite membranes for wastewater treatment.
• Initiated development of stochastic chemical sensors for naval applications to provide single molecule detection.

FY 2004 Plans:

• Continue development of stochastic chemical sensors for naval applications to provide single molecule detection.
• Initiate development of reagentless sensors for Weapons of Mass Destruction.

FY 2005 Plans:

• Complete development of stochastic chemical sensors for naval applications to provide single molecule detection.
• Continue development of reagentless sensors for Weapons of Mass Destruction.
• Initiate development of novel biomimetic propulsion systems for autonomous underwater vehicles.

	FY 2003	FY 2004	FY 2005
Underwater (UW) Platform Self Defense	1,472	1,312	1,700

Activity develops enabling technologies for ultimate shipboard use that will increase the survivability of surface ship and submarine platforms against torpedo threats. These technologies should be developed to minimize shipboard impact and require minimal organizational maintenance. Specific technology includes two efforts. 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 for passive shipboard detection,

classification, and localization (DCL) of incoming torpedoes and an ATT to engage the threat torpedoes. This effort supports the Sea Shield pillar and the Fleet and Force Protection FNC.

FY 2003 Accomplishments:

- Completed Technology Requirements Model (TRM) study to evaluate ATT element based Low Frequency (LF) homing performance.
- Integrated adaptive beamforming technology into ATT TRM salvo simulation; baseline algorithm continues to be evaluated to understand how to incorporate beamforming into the ATT intercept phases of search and homing.
- Analyzed results of full-scale warhead detonation quarry testing to evaluate the impact of detonations on anti-torpedo torpedoes operating in salvo scenarios.
- ATT multi-target passive detection and contact clustering algorithms were defined, developed and integrated into the experimental two-on-two salvo software in TRM for evaluation prior to use in first quarter 2004 in-water experiments.
- Completed in-Water Testing of 1/2 Duplex Receiver Capability for Generation Countermeasure (NGCM), Limited In-Water Testing of Motor/Mobility Capability for NGCM, and Lethality demonstration of the ATT warhead against a specific threat.
- Continued development of technology for NGCM and Anti-Torpedo Torpedo (ATT) component technology in propulsion, Microelectromechanical Systems (MEMS), and Guidance and Control (G&C).

FY 2004 Plans:

- Continue development of technology for NGCM; ATT component technology, MEMS Inertial Measurement Unit (IMU), and G&C.
- Transition of Next Generation Countermeasure (NGCM).

FY 2005 Plans:

- Continue ATT, MEMS IMU and G&C efforts of FY 2004.

CONGRESSIONAL PLUS-UPS:

	FY 2003	FY 2004
ANTI-CORROSION MODELING SOFTWARE	1,198	0

Developed workable corrosion maintenance guidelines and criteria for high strength steel components, in particular arrestment gear of carrier aircraft. Airframe criteria calling for the repair and/or replacement of all corroded parts in the Fleet are very difficult to implement both with respect to time and resources. The results of this effort will enable maintenance teams to delineate between various aircraft corrosion states, with potential safety impacts and identification of corrosion that is cosmetic.

	FY 2003	FY 2004
BATTERY CHARGING TECHNOLOGY	2,036	2,101

FY03: Completed a prototype battery charger for nickel cadmium and sealed lead acid batteries and delivered the unit to NAVSEA-Crane for 3rd party performance verification. Prototype testing demonstrated that the batteries tested under this tasking can be charged without heating in 20 to 30 minutes, and began life cycle testing. FY04: The technology will be improved to extend battery lifetimes by optimizing the charging algorithms for the chemistries above, and rapid charging capability for other battery chemistries will be demonstrated.

	FY 2003	FY 2004
CENTER FOR ADVANCED POWER SYSTEMS (CAPS)	4,858	3,955

FY03: Initiated testing of the 5MW Superconducting motor developed by American Superconductor, Inc. Purchased test facility equipment as follows: Controlled AC Bus with 5MW four quadrant converter/inverter and controls, and installation of two 2.5MW dynamometers. FY04: Funds will be used to purchase state of the art energy storage devices, DC experimental bus including controls and system integration, and completion of 5MW superconducting motor testing.

	FY 2003	FY 2004
CORROSION MODELING SOFTWARE	0	3,115

This effort will determine the impact corrosion has on a structural component in terms of strain life analysis. Corrosion will be mapped, as defined by a characterizing metric, to corresponding stress concentration factors. This will quantify corrosion maintenance on the same basis that fatigue lives are

specified.

	FY 2003	FY 2004
DEPLOYABLE FIBER OPTIC FORCE PROTECTION SYSTEM	0	989

Develop and demonstrate a smart video camera system and passive fiber optic hydrophone array and processor to provide security against a waterside terrorist threat approaching Navy ships.

	FY 2003	FY 2004
ENDEAVOR	3,238	3,362

FY03: Developed an integrated set of ship design tools, including structural loading and hydrodynamic modeling tools. FY04: Continue development and integration of design tools, and initiate transition of tools to Navy use at NSWC Carderock.

	FY 2003	FY 2004
FIBER REINFORCED POLYMER COMPOSITES RESEARCH	952	0

Initiated testing and analysis to quantify sources of material property variability within composite laminate panels of interest to US Navy ship applications.

	FY 2003	FY 2004
FUSION PROCESSOR AND INTEGRATED CONTEXTUAL REASONING	3,248	6,329

FY03: The effort developed a real-time airborne fusion processor and algorithms for the Navy Hyperspectral/Imaging for Surveillance and Targeting (HISTAR) program. Funding supported the development of a hyper-spectral sensor and signal processing for the Shared Reconnaissance Pod (SHARP) on the F/A-18 aircraft for real-time detection and classification of threat targets. FY04: Process HISTAR data using hyper-spectral target detection and discrimination algorithms in real-time to optimize performance to minimize false alarms.

	FY 2003	FY 2004
HIGH EFFICIENCY QUIET ELECTRIC DRIVE	0	1,384

Develop a quiet, efficient, electric drive to allow transition from mechanical to electric dive in submarines and smaller surface combatants.

	FY 2003	FY 2004
INTEGRATED FUEL PROCESSOR - FUEL CELL SYSTEM	1,737	2,374

FY03: Developed a novel fuel processing system to reform the JP-5 fuel used for naval aircraft. The fuel processor technology is integrated into a turnkey fuel cell system. If successful, the system may provide payoffs of increased efficiency and lower emissions of auxiliary power units used on board aircraft and ocean-going vessels. FY04: Continue development of integrated fuel processor leading to testing of prototype hardware.

	FY 2003	FY 2004
LASER WELDING AND CUTTING	1,909	0

Provided development of laser based fabrication for application in Navy shipbuilding, including welding and cutting technologies. Laser based cutting and welding technologies may enhance shipyard productivity/automation, reduce costs, enhance ship performance/reliability/maintainability, and reduce weld-induced distortion/associated rework costs/ship signature.

	FY 2003	FY 2004
LOW-COST, RAPID PROTOTYPE/PRODUCTION TECHNOLOGY FOR POLYMERIC AIRCRAFT COMPONENTS	0	1,483

Develop and qualify a rapid prototyping and production technology based on Selective Laser Sintering (SLS) which will be used for the design, development and qualification of advanced polymeric aircraft components. The SLS process uses a laser to fuse (sinter) plastic powders into complex shaped plastic parts. A part can be built using only the computer aided design (CAD) model downloaded directly to the laser-sintering machine. This technology will help reduce the weight and manufacturing costs of aircraft components while improving their performance.

	FY 2003	FY 2004
MINIATURE AUTONOMOUS VEHICLES	957	1,187

FY03: This effort developed a distributed communication and control architecture for a cooperating multi-vehicle fleet of autonomous underwater vehicles (AUV). Control architectures were validated by computer simulation. FY04: Modeling and simulation will be validated through in-water testing.

	FY 2003	FY 2004
MODULAR ADVANCED COMPOSITE HULL FORM	952	0

Investigated hybrid (composite to steel) joints for application to hybrid ship hulls and lifting bodies. The research explored joining concepts and developed experimental, theoretical, and analytical methods to assess their reliability under sea loads. The Hybrid Hull concept may facilitate the use of composites in naval combatants to help achieve stealth and survivability.

	FY 2003	FY 2004
NANOSTRUCTURED COMPOSITE MARINE COATINGS	0	2,472

Develop multifunctional, nanostructured materials that can improve corrosion resistance of naval materials. The approach is to explore a composite of polymeric inhibitors matrix embedded with nanoencapsulated chloride ion trap and nanoencapsulated phosphates that can be coated under conventional barrier coatings. These composites will not only enhance the corrosion resistance but also provide self-healing capability.

	FY 2003	FY 2004
SMALL WATERCRAFT DEMONSTRATOR	4,047	0

Initiated development of a small watercraft which attempts to demonstrate improved performance characteristics compared to existing small watercraft. Efforts focused on development of a very high power-to-weight ratio hybrid electric propulsion system, and hull form designs to optimize seakeeping at all speeds.

	FY 2003	FY 2004
SOLID OXIDE REGENERATIVE FUEL CELL	0	2,967

Conduct cycle and long-term operations testing to demonstrate the durability and reliability of a 1 KW regenerative solid oxide fuel cell. Solid oxide fuel cells may offer improved efficiencies and power densities over other options for naval vessel applications.

	FY 2003	FY 2004
STRUCTURAL RELIABILITY OF FRP COMPOSITES	0	1,978

Developing plans for extension of variability/reliability work to include composite sandwich panels.

	FY 2003	FY 2004
UNMANNED SEA SURFACE VEHICLE (USSV)	5,144	4,153

FY03: Initiated development of a surface craft optimized for unmanned missions. Primarily focused on enhanced speed, range, endurance, seakeeping, and payload fraction, considered in the context of potential unmanned vehicle missions. Issues of launch, recovery, and host platform compatibility were explored. FY04: Define operational concept and complete design of prototype unmanned surface vehicles. Initiate construction of one or more prototypes for at-sea testing. Develop launch and recovery testbed.

C. OTHER PROGRAM FUNDING SUMMARY:

NAVY RELATED RDT&E:
PE 0204152N (E-2 Squadrons)
PE 0205601N (HARM Improvement)
PE 0601153N (Defense Research Sciences)
PE 0602131M (Marine Corps Landing Force Technology)
PE 0602235N (Common Picture Applied Research)
PE 0602271N (RF Systems Applied Research)
PE 0603123N (Force Protection Advanced Technology)
PE 0603235N (Common Picture Advanced Technology)
PE 0603271N (RF Systems Advanced Technology)
PE 0603502N (Surface and Shallow Water Mine Countermeasures (MCM))
PE 0603513N (Shipboard System Component Development)

PE 0603553N (Surface Anti-Submarine Warfare)
PE 0603561N (Advanced Submarine Systems Development)
PE 0603573N (Advanced Surface Machinery Systems)
PE 0603609N (Conventional Munitions)
PE 0603640M (Marine Corps Advanced Technology Demonstrations)
PE 0604307N (Surface Combatant Combat System Engineering)
PE 0604518N (Combat Information Center Conversion)
PE 0604558N (New Design SSN)
PE 0604561N (SSN-21 Development Program)

NON NAVY RELATED RDT&E:
PE 0602270A (Electronic Warfare Technology)
PE 0602204F (Aerospace Sensors)

D. ACQUISITION STRATEGY:
Not Applicable