

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2

DATE: February 2007

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602123N
PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

COST: (Dollars in Thousands)

Project Number & Title	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
FORCE PROTECTION APPLIED RESEARCH	133,749	160,168	155,936	133,846	109,335	118,708	130,639	140,018

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) 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. This is accomplished by improvements in platform offensive performance, stealth, and self defense. This PE supports the Future Naval Capabilities (FNC) Program in the areas of Sea Shield, Sea Strike, and Cross Pillar Enablers.

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

UNCLASSIFIED

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Exhibit R-2

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BUDGET ACTIVITY: 02
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B. PROGRAM CHANGE SUMMARY:

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
FY 2007 President's Budget Submission	138,094	123,443	123,678	134,228
Congressional Action	0	55,750	0	0
Congressional Reduction	0	-18,400	0	0
Congressional Undistributed Reductions/Rescissions	-465	-625	0	0
Execution Adjustments	-1,311	0	0	0
Non-Pay Inflation Adjustments	0	0	-348	287
Pay Raise Adjustment	0	0	2	3
Program Adjustments	0	0	27,710	2,243
Program Realignment	0	0	4,828	-3,068
Rate Adjustments	0	0	66	153
SBIR Assessment	-2,569	0	0	0
FY 2008/FY 2009 President's Budget Submission	133,749	160,168	155,936	133,846

PROGRAM CHANGE SUMMARY EXPLANATION:

Technical: Not applicable.

Schedule: Not applicable.

C. OTHER PROGRAM FUNDING SUMMARY:

Not applicable.

D. ACQUISITION STRATEGY:

Not applicable.

UNCLASSIFIED

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E. PERFORMANCE METRICS:

This PE supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial and air) and the protection of those platforms. Each PE Activity has unique goals and metrics, some of which include classified quantitative measurements. Overall metric goals are focused on achieving sufficient improvement in component or system capability such that the 6.2 applied research projects meet the need of or produce a demand for inclusion in advanced technology that may lead to incorporation into acquisition programs or industry products available to acquisition programs.

Specific examples of metrics under this PE include:

- Reduce the weight of current structural protection systems by 30% maintaining current energy absorption capabilities by FY 2007.
- Provide improvements in electrical component and device technology as to allow a 50% reduction in motor propulsion and motor controllers weight and volume by FY 2009.
- Increase the hydrodynamic efficiency of current hull designs by 5% by FY 2010.
- Reduce electromagnetic vulnerability of ship hulls by 50% by FY 2011.
- Torpedo defense thresholds will be validated by modeling and simulation to satisfy the overall system performance specification of a Probability of Survival (PS) of the US Navy platform as specified in the draft Capabilities Development Document (CDD) for Surface Ship Torpedo Defense.
- Additional metrics are included within the Missile Defense Activity description.

UNCLASSIFIED

UNCLASSIFIED

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Exhibit R-2a

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The funding profile reflects the FY 2006 reorganization of FNC Program investments into Enabling Capabilities (ECs). As a result of this reorganization, funding for each EC has been aligned to a Budget Activity 2 and Budget Activity 3 PE as appropriate. This project reflects the alignment of investments for the following ECs: Fortified Position Security, Over-the-Horizon Missile Defense, Two-Torpedo Salvo Defense, Defense of Harbor and Near-Shore Naval Infrastructure Against Asymmetric Threats, Sea Based Missile Defense of Ships & Littoral Installations, Aircraft Integrated Self-Protection Suites, Hostile Fire Detection and Response Spirals 1 and 2, Shipboard Force Protection in Port and Restricted Waters - Detection and Classification, Underwater Total Ship Survivability, and Advanced Electronic Sensor Systems for Missile Defense.

FY 2008 reflects the initiation of the Large Vessel Stopping Program in response to the Chief of Naval Operations' Navy Strategic Plan which specified that the Navy must combat Weapons of Mass Destruction (WMD) at sea and ashore.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
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B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2006	FY 2007	FY 2008	FY 2009
STOPPAGE OF LARGE SURFACE VESSELS AT SEA	0	0	7,263	12,587

The Chief of Naval Operations (CNO) in the Navy Strategic Plan (NSP) has specified that the Navy must combat Weapons of Mass Destruction (WMD) at sea and ashore. To support this requirement, the Navy must be able to temporarily stop ships that are suspected of carrying WMDs or their component materials. This activity addresses the development of key technologies that will enable the Navy to use non-lethal methods for temporarily stopping and delaying large vessels at sea.

Funding increase from FY 2008 to FY 2009 is due to the natural growth of the program as technology development efforts increase.

FY 2008 Plans:

- Initiate investigation into technologies for a Large Vessel Stopping (LVS) program. This program will address a critical naval capability requirement to stop suspect vessels greater than 300 gross tons that will not comply with voice commands or warning devices. The technologies will be deployable by ship or aircraft and should be capable of disabling the vessel at safe distances from high-valued assets and infrastructures. Specific technologies that will be investigated and developed are electrical impulse technologies and surface/subsurface mechanical devices.

FY 2009 Plans:

- Continue LVS applicable technology development.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
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	FY 2006	FY 2007	FY 2008	FY 2009
SURFACE SHIP & SUBMARINE HULL MECHANIC & ELECTRICAL (HM&E)	46,371	58,401	86,059	77,591

Efforts include: signature reduction, hull life assurance, hydromechanics, distributed control for automated survivability (includes damage control), 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 and maneuvering. Distributed intelligence for automated survivability addresses both the basic technology of automating damage control systems, as well as, distributed control of systems utilizing self-healing capability. Advanced electrical power systems efforts address electrical and auxiliary system and component technology to provide improvement in energy and power density, operating efficiency and recoverability from casualties.

Major cost drivers that cause the funding increase in FY 2008 include planned growth for Payload Implosion and Platform Damage Avoidance (FNC Project) as well as work to enhance Solid Oxide Fuel Cell. The decrease in funding from FY 2008 to FY 2009 is due to reduced level of investment in Power and Energy initiatives.

FY 2006 Accomplishments:

Survivable Platforms - Reduced Signatures

- Continued advanced numerical acoustic codes (and gridding methods for those codes) for submarines.
- Continued development of surface ship acoustic flow noise model (joint effort with Dutch Navy).
- Continued mmWave Signatures measurement to identify key signature characteristics.
- Continued Alternating Current (AC) propagation experiments.
- Continued the next generation Infrared Electro-Optic Visual (IR/EO/VIS) model for surface ships by development of mitigation strategy supporting low observable infrared platforms, development of supporting physics, and prototype measurement techniques.
- Continued development of quiet control surface design tool based on control surface flow noise studies.
- Continued modeling of electric warship components and system electromagnetic signatures.
- Continued flow noise evaluations of surface ships with Advanced Electric Ship Demonstrator (AESD).

R1 Line Item 5

Page 6 of 33

UNCLASSIFIED

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N

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- Continued hull machinery noise measurements.
- Continued IR and radar detectability prediction capability.
- Continued assessment and predictive capability for another source of Radio Frequency (RF) and IR signatures.
- Continued investigation of distributed pump-jet propulsion (DPJP) acoustic performance.
- Continued surface ship super-conductive degaussing with laboratory demonstration loop for Electromagnetic (EM) field accuracy measurements and control methods.
- Completed validation of acoustics performance prediction method for DPJP concepts.
- Completed work to assess cavitation performance of loop-bladed propulsor concept.
- Initiated testing on AESD to assess energy propagation and acoustic radiation mechanisms and to develop mitigation concepts for surface ships.
- Initiated and completed two High Frequency (HF) calibrated ship measurements.
- Initiated IR assessment of two advanced treatments.
- Initiated first of a series of IR validation experiments and critical sensitivity analysis.
- Initiated Improved Corrosion Related Magnetic (CRM) Field Prediction Model to design compensation systems to reduce ship's CRM signature.

Survivable Platforms - Hull Life Assurance

- Continued development of global surface wave measurement capability for ship models.
- Continued Dynamic Behavior of Composite Ship Structures (DYCOSS) (joint effort with Dutch Navy).
- Continued development of structural analysis codes describing failure mechanism of sandwich composites.
- Continued Explosion Resistant Coatings (ERC) effort. These efforts will provide US input to trilateral agreement with UK and Australia.
- Continued Joint US/Japan Advanced Hull Materials & Structures Technology (AHM&ST) addressing hybrid hull concept and hybrid (steel/composite) joints in ship construction.
- Completed shock testing of composite hull section in cooperation with Germany.
- Completed the validation of circulation control and advanced control surfaces with experiments.
- Completed comparison of DYSMAS analysis with German ship trial data.
- Completed Joint Enhanced Explosion Resistant Coatings Exploitation (JEERCE) Advanced Concept Technology Demonstration (ACTD) support for ERC application to surface ships.
- Initiated composite and composite-metal hull performance characterization and testing including structural loading, thermal stress and signatures.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

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Survivable Platforms - Distributed Intelligence for Automated Survivability

- Continued development of modeling and simulation methods for robust design and virtual testing of integration of shipboard auxiliary systems including their control systems.
- Continued land-based test site (Purdue University and Naval Surface Warfare Center, Carderock Div.) that will evaluate Integrated Engineering Plant (IEP) conceptual architectures to provide improved survivability of auxiliary systems that support combat systems.
- Continue research into advanced H,M&E system reconfiguration approaches, including agent-based control systems and algorithms, and model-based reasoning.

Advanced Platforms - Advanced Platform Concepts and Designs

- Continued validation of asymmetric hull forms with experimental data.
- Continued development of analytical models to further define submarine modular hull concepts.
- Continued development of reliability based design and structural analysis code development.
- Continued to develop design tools for integrated antenna and composite topside.
- Continued aperstructure navigation radar technology demonstration.
- Completed development of flexible composite propeller concept.
- Continued circulation control analysis for three-dimensional flow effects.
- Continued development of test vessel and technology to evaluate performance and signature associated with electrically driven waterjets (AWJ-21) and Rim-drive motor.
- Initiated aperstructures microwave communication system.
- Initiated concept for Ultra High Frequency (UHF)/Very High Frequency (VHF) aperstructures opportunistic array (Advanced Hull-form Inshore Demonstrator - AHFID).

Advanced Platforms - Hydromechanics

- Continued experimental database/computational tools development for extreme submarine maneuvers (e.g., crashback).
- Continued the validation of circulation control and advanced control surfaces with experiments.
- Continued to investigate improved maneuvering simulation capability for submarines.
- Continued validation of Reynolds Average Navier-Stokes (RANS) code for advanced waterjet propulsor performance predictions.
- Continued validation of computational tools for ducted propulsor design/analysis.
- Completed feasibility study of DPJP system concept for submarines.
- Completed development of propeller sub-visual cavitation inception scaling law.
- Completed submarine propulsion jet cavitation analysis and experiments.

R1 Line Item 5

Page 8 of 33

UNCLASSIFIED

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

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- Completed analytical and modeling investigation of cavitation, powering, and acoustic performance of submarine propellers.
- Completed development of signature tools for DPJP concept for submarines.
- Completed validation of powering prediction method for DPJP concepts.
- Completed development of a low-cost submarine distributed propulsor concept (RED-I).
- Initiated development of two-phase flow waterjet concept, Detached Eddy Simulation (DES) method for crashback prediction and numerical prediction method(s) of waterjet cavitation.
- Initiated modeling of turbulent flow interaction with propeller Leading Edge (LE) and Trailing Edge (TE) and modeling and simulation of rough-wall boundary layer noise.
- Initiated prediction and validation of constrained and unconstrained capsize motions using advanced codes.

Advanced Naval Power Systems - Advanced Electrical Power Systems

- Continued demonstration of dynamic stability of an advanced intelligent, reconfigurable, solid-state-based, zonal-electrical power system that reconfigures within 10 milliseconds.
- Continued designing software for the system manager for the Universal Control Architecture (UCA).
- Continued development of thermal management technology for shipboard power distribution.
- Continued investigation of potential applications of silicon-carbide in future high voltage and high power applications.
- Continued improvements in electrical component and device technology allowing a reduction in motor propulsion and motor controllers weight and volume.
- Continued development of technologies to support dynamic reconfiguration of shipboard systems under conditions of stressing scenarios and/or system degradation.
- Continued multi-year program to directly convert thermal energy to electricity. Such a capability would allow elimination of the steam cycle on an electric warship.
- Continued development of pulsed power technologies, to include pulsed alternators and capacitors.
- Continued research into high power controller and generator applications by using mixed winding, high-phase-order induction machines actuated with multi-phase and multi-level inverters and rectifiers.
- Completed development of advanced power electronics for Electromagnetic Aircraft Launch System (EMALS) and ship main propulsion systems.
- Completed development of ship systems thermal model.
- Initiated studies of alternative cooling systems for future shipboard radar systems.
- Initiated studies of system design impact on the thermal performance and reliability of two-phase pumped cooling loops.

UNCLASSIFIED

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

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BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

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- Initiated development of structural macroscopic 3-dimensional battery.
- Initiated control surface actuator project focused on the technologies needed to define the design space for control surface actuators supporting submarines.

Advanced Naval Power Systems - Novel Power and Energy Transfer Systems (AN/NP)

- Continued ship service fuel cell development.

Naval Research Laboratory (NRL)

- Continued Biofilms on Scaffolds and Characterize Spatial Distribution and Chemistries. (NRL)
- Continued development of Bacterial Mixture to Optimize Charge Generating Capacity. (NRL)
- Continued High Surface Area Conducting Electrodes for use as Biofilm Scaffolds. (NRL)
- Continued technology development for alternate approaches to high voltage fast turn off switches. (NRL)
- Continued technology development for wafer bonded high voltage power switches. (NRL)
- Continued efforts to synthesize new metal sulfides as catalysts for fuel cells and evaluate their electrochemical performance. (NRL)
- Completed testing of high surface area electrodes in a miniature prototype microbial fuel cell. (NRL)
- Completed synthesis of new metal carbides as catalysts for fuel cells and evaluation of their electrochemical performance. (NRL)

FY 2007 Plans:

Survivable Platforms - Reduced Signatures

- Continue all efforts of FY 2006, less those noted as completed above.
- Complete development of surface ship acoustic flow noise model (joint effort with Dutch Navy).
- Complete flow noise evaluations of surface ships with the AESD.
- Complete and deliver ship IR scene model.
- Complete and deliver assessment and predictive capability for another source of RF and IR signatures.
- Complete AC field propagation modeling part of electric warship components and system electromagnetic signatures effort by delivering EM field propagation models.
- Complete surface ship superconductive degaussing system laboratory evaluations of single and multiple loop systems, operating parameters, mutual interference, control stability, and a second generation High-Temperature Superconductor (HTS) wire studies.
- Initiate assessment of ship bistatic Radar Cross Section (RCS).

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

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- Initiate large-scale tests on AESD to develop signature prediction and design tools for surface ship incorporating a variety of propulsion technologies including external podded propulsion.
- Initiate experimental effort to characterize electric drive motor signature mechanisms and verify modeling and simulation approaches for signature prediction.

Survivable Platforms - Hull Life Assurance

- Continue all efforts of FY 2006, less those noted as completed.
- Initiate effort on an advanced class of polymers as a follow-on to current ERC for application against advanced threats (GWOT).

Survivable Platforms - Distributed Intelligence for Automated Survivability

- Continue all efforts of FY 2006, less those noted as completed above.
- Complete evaluation of an IEP concept to provide improved survivability.

Advanced Platforms - Advanced Platform Concepts and Designs

- Continue all efforts of FY 2006, less those noted as completed above.
- Complete and deliver navigation radar aperstructures.

Advanced Platforms - Hydromechanics

- Continue all efforts of FY 2006, less those noted as completed above.
- Complete validation of computational tools for ducted propulsor design/analysis.
- Complete experiments of submarine crashback.
- Complete prediction of constrained (heave and roll) capsize motions using advanced codes.
- Initiate development of podded propulsor design/analysis tools.

Advanced Naval Power Systems - Advanced Electrical Power Systems

- Continue all efforts of FY 2006, less those noted as completed above.
- Initiated development of automated HVAC system architectures for future Naval platforms.

Advanced Naval Power Systems - Novel Power and Energy Transfer Systems

- Continue all efforts of FY 2006, less those noted as completed above.

Naval Research Laboratory (NRL)

- Continue all efforts of FY 2006, less those noted as completed above.

R1 Line Item 5

Page 11 of 33

UNCLASSIFIED

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

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- Complete fuel cell evaluation of carbide based catalysts as sulfur tolerant polymer fuel cell anodes (NRL).
- Complete scale-down (10x smaller) and testing of a biofilm-enhanced micro-microbial fuel cell (NRL)
- Initiate development of heterojunction power switching devices. (NRL)

FY 2008 Plans:

Survivable Platforms - Reduced Signatures

- Continue all efforts of FY 2007, less those noted as complete above.
- Complete hull machinery noise measurements.
- Complete development of test vessel and technology to evaluate performance and signature associated with electrically driven waterjets (AWJ-21) and Rim-drive motor (RIMJET).
- Complete modeling of electric warship components and system electromagnetic signatures with electric motor source control through motor configuration, off ship EM field control through compensation and investigation of other sources of EM fields.
- Initiate development of modeling methods and noise control concepts for modular/reconfigurable submarine architectures.
- Initiate investigation into hull treatment concepts for acoustic signature/vibration control for surface ships.
- Initiate development of advanced RF metamaterials for platform signature control.
- Initiate development of LPI technologies for surface ship emissions including communication, navigation, electronic warfare, and combat systems.

Survivable Platforms - Hull Life Assurance

- Continue all efforts of FY 2007.
- Initiate Payload Implosion and Platform Damage Avoidance efforts.

Survivable Platforms - Distributed Intelligence for Automated Survivability

- Continue all efforts of FY 2007, less those noted as complete above.

Advanced Platforms - Advanced Platform Concepts and Designs

- Continue all efforts of FY 2007, less those noted as complete above.

UNCLASSIFIED

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Advanced Platforms - Hydromechanics

- Continue all efforts of FY 2007, less those noted as complete above.
- Complete prediction and validation of unconstrained capsizes using advanced codes.
- Initiate prediction and validation of damaged stability and capsizes.
- Initiate non-body-of-revolution tool development for advanced submarine configurations.

Advanced Naval Power Systems - Advanced Electrical Power Systems

- Continue all efforts of FY 2007.
- Complete studies of the thermal performance and reliability of two-phase pumped cooling loops.
- Complete research into high power controller and generator applications by using mixed winding, high-phase-order induction machines actuated with multi-phase and multi-level inverters and rectifiers.
- Initiate development of shipboard waste heat driven chiller systems.

Advanced Naval Power Systems - Novel Power and Energy Transfer Systems

- Continue all efforts of FY 2007, less those noted as complete above.
- Initiate development of lightweight power generators based on mechanical conversion of heat or vibrations.
- Initiate program to develop and demonstrate 3 - 50 kW class solid oxide fuel cell onboard mobile power generation capabilities having compatibility with future logistics fuels to enable rapid recharge of batteries and direct power for C4ISR equipment.

Naval Research Laboratory (NRL)

- Continue all efforts of FY 2007, less those noted as complete above.

FY 2009 Plans:

Survivable Platforms - Reduced Signatures

- Continue all efforts of FY 2008, less those noted as complete above.
- Complete testing on AESD to assess energy propagation and acoustic radiation mechanisms and to develop hull treatment concepts for surface ships.
- Complete experimental effort to characterize electric drive motor signature mechanisms and verify modeling and simulation approaches for signature prediction.

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- Complete CRM Field Prediction Model with final validation by measurement of full scale ship to verify CRM Field Prediction against actual Impressed Current Cathodic Protection (ICCP) system layout for measured ship and magnetic/electric fields measured at Navy Magnetic Silencing Range Facility.

Survivable Platforms - Hull Life Assurance

- Continue all efforts of FY 2008.
- Complete Dynamic Behavior of Metal to Composite joints for Ship application (DYCOSS III) (joint effort with Dutch Navy).
- Complete composite and composite-metal hull performance characterization and testing including structural loading, thermal stress and signatures.

Survivable Platforms - Distributed Intelligence for Automated Survivability

- Continue all efforts of FY 2008.

Advanced Platforms - Advanced Platform Concepts and Designs

- Continue all efforts of FY 2008.

Advanced Platforms - Hydromechanics

- Continue all efforts of FY 2008, less those noted as complete above.
- Complete development of two-phase flow waterjet concept.
- Complete modeling and simulation of rough-wall boundary layer noise.
- Complete development of DES method for crashback prediction.

Advanced Naval Power Systems - Advanced Electrical Power Systems

- Continue all efforts of FY 2008, less those noted as complete above.
- Complete demonstrations of improvements in electrical component and device enabling technology allowing a reduction in motor propulsion and motor controllers weight and volume.
- Complete demonstration of full-scale Ship and Submarine Electric Actuators.
- Complete studies of alternative cooling systems for future shipboard radar systems.

Advanced Naval Power Systems - Novel Power and Energy Transfer Systems

- Continue all efforts of FY 2008.

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Naval Research Laboratory (NRL)

- Continue all efforts of FY 2008.
- Complete development of heterojunction power switching devices. (NRL)

	FY 2006	FY 2007	FY 2008	FY 2009
ADVANCED ENERGETICS	13,712	12,376	18,381	1,986

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 warheads, propellants, and reactive material based subsystems for both defensive and offensive applications. Efforts include: development of new fuels, oxidizers, explosive ingredients and formulations; and reliable simulation tools and diagnostics to develop and design superior-performance, and/or reduced-vulnerability systems tailored to specific warfighter missions.

Increased funding in FY 2008 supports two Advanced Energetics initiatives started in FY 2007: advanced multiphase blast concepts and the diagnostics of novel energy conversion concepts. Decreased funding in FY 2009 is due to the conclusion of Advanced Energetics efforts and the completion and transition of efforts to PEs 0603114N, 0602114N, and 0602747N.

FY 2006 Accomplishments:

- Continued Advanced Energetics research in technology development for the next generation reactive material warhead concepts (formulations, material properties, target interaction, lethality models, and experiments) for highly reactive materials, high density reactive materials and novel reactive structural materials. Explosive testing occurred in fourth quarter of FY 2006.
- Continued Advanced Energetics research in development and evaluation of advanced explosive/propellant/reactive ingredients and formulations for next generation higher performing systems. Explosive testing occurred in fourth quarter of FY 2006.
- Continued Advanced Energetics research in development of advanced directed hydro-reactive material warhead concepts to enhance performance of undersea warheads. Explosive testing occurred in fourth quarter of FY 2006.

UNCLASSIFIED

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- Continued proof of concept efforts to develop insensitive explosives, propellants, and munitions without compromising performance. This work involves development of high quality, small particle energetic ingredients, novel processing techniques, and advanced energy conversion concepts; and involves both theoretical and experimental efforts.
- Initiated Advanced Energetics research in advanced multiphase blast concepts employing dense metalized explosives to enhance performance of air and underwater blast warheads.
- Initiated Advanced Energetics research in development and diagnostics of novel energy conversion concepts to enhance performance, more efficiently exploit available energy, and more effectively couple energy to target for air, surface, and underwater warhead application.

FY 2007 Plans:

- Continue all efforts of FY 2006.

FY 2008 Plans:

- Continue all efforts of FY 2007.

FY 2009 Plans:

- Continue research in technology development for the next generation reactive material warhead concepts (formulations, material properties, and energy release experiments) for highly reactive materials, high density reactive materials and novel reactive structural materials. Transition applications to specific target interaction, lethality modeling and ordnance specific experiments and demonstrations to Electro-magnetic Rail Gun, PE 0603114N.
- Continue development of novel energy conversion concepts to enhance performance, more efficiently exploit available energy, and more effectively couple energy to target. Limit efforts to analytical and laboratory scale proof of concept experimental efforts.
- Continue development and evaluation of energetic ingredients and formulations for next generation higher performance applications. Conclude scale-up development and testing. Transition to Integrated High Payoff Rocket Propellant Program, PE 0602114N.
- Conclude proof of concept efforts to develop insensitive explosives, propellants, and munitions without compromising performance. Transition to Future Naval Capabilities Program.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

- Conclude development of and transition directed hydro-reactive material warhead concepts to Undersea Warheads Program, PE 0602747N.
- Conclude research in advanced multiphase blast concepts employing dense metalized explosives to enhance performance of air and underwater blast warheads.

	FY 2006	FY 2007	FY 2008	FY 2009
FLEET FORCE PROTECTION AND DEFENSE AGAINST UNDERSEA THREATS	13,399	14,106	13,174	12,200

Fleet Force Protection and Defense against Undersea Threats efforts include applied research for complementary sensor and processing technologies for platform protection and shipboard technologies to increase the survivability of surface ship and submarine platforms against torpedo threats and to develop the capability to interdict underwater asymmetric threats to ships and infrastructure in harbors. Current small platforms (both surface and airborne) have little to no situational awareness (SA) or self-protection against air, surface, and asymmetric threats. (Asymmetric threat efforts are co-funded by PE 0602131M.) A goal of this activity is to provide these platforms with effective self-protection. The technology areas specific to platform protection will develop individual, multispectral (EO, IR, RF, EM, visual, and acoustic), or chemical sensors/biosensors 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.

Another goal of this effort is to develop a torpedo defense capability to fill Sea Shield Warfighting Capability Gap/Enabling Capability: Platform Defense against Undersea Threats, including Two Torpedo Salvo Defense. This provides a capability to prevent any of the torpedoes, in up to two-torpedo salvos fired at high value units, from hitting those units. Specific technology includes two efforts. The first is Next Generation Countermeasure (NGCM), a mobile adaptive acoustic countermeasure with acoustic communication links among countermeasures. The second is Anti-Torpedo Torpedo (ATT)/Tripwire Demonstration, of an ATT to engage the detected threat torpedoes.

This activity supports the Fleet and Force Protection FNC and includes support to Sea Shield and Sea Strike Pillars and FNC Enabling Capabilities for: Aircraft Integrated Self-protection Suite; Fortified Position Security; Advanced Electronic Sensor Systems for Missile Defense; Hostile Fire Detection and Response Spirals 1 and 2; and Shipboard Force Protection in Port and Restricted Waters - Detection and Classification. Budget Activity 2 sensor efforts are co-funded by PEs 0602235N and 0602271N.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N

PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

The increase in FY 2007 is due to the initiation of the following NRL activities: DNA and antibody array analysis, demonstration of the capability for rapid screening and pathogen species confirmation, and the design and fabrication of self-reporting coatings for system failure detection. FY 2008 decrease is due to the realignment of Biocentric Technology to PE 0602236N.

FY 2006 Accomplishments:

Sensors & Associated Processing

- Continued the Shipboard EO/IR Closed Loop Self-Protection System effort by initial laboratory testing of the Mid-wave Infrared and Visible Laser System (MIRVLS) generating 15W in the 3-5um region.
- Continued the End User Terminal (EUT) effort by developing a prototype 2-way amplifier for the Secure Net (SECNET) 11 card that will increase by a factor of 9 the secure transmit/receive range between Dismounted-Data Automated Communications Terminals (D-DACT) in an urban environment.
- Continued development of compact sensor systems in support of responsive Intelligence, Surveillance, and Reconnaissance (ISR). (NRL)
- Continued efforts on Antibodies for biowarfare agents to be synthetically modified with enzymes and studied via surface plasmon resonance to gain a better understanding of the impact tagging these recognition sites have on molecular recognition (kinetics and selectivity) for sensor applications. (NRL)
- Continued efforts in biomimetic sonar systems for operation in air and aquatic environments based on bat echolocation neurophysiology and information processing algorithms.
- Continued development of reagentless sensors for weapons of mass destruction/explosives, including engineered protein based components for detection of explosives and other analyses in seawater (e.g., TNT, RDX). (Transferred from PE 0602435N in FY 2006)
- Continued design and fabrication of microfluidic nucleic acid extraction and enrichment methods and obtained funding for technology transfer. (NRL)
- Continued design and development of large (1.5m dia.) telescopes with associated adaptive optics for the Naval Prototype Optical Interferometer (NPOI). (NRL)
- Continued the design and development of integrated laser ground based, aircraft protection design to protect large aircraft from Infrared Surface to Air Missiles (SAMs) upon ingress and egress to an airport. (NRL)
- Continued development of solid projectile coilgun design, consumable casing material and improved railgun efficiency and developed method of reducing muzzle flash and surface wear of the rails. (NRL)
- Completed development of quantum dot reagents for real time chemical sensing.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

- Completed work on anti-tampering antenna isolation panels for NULKA decoys: fabricated hydrogen-bonded polymers and test for sensitivity to water degradation. Test isolation performance of new microwave absorbing composites. (NRL)
- Completed the Applied Research Phase (6.2) of the EO/IR Laser Jammer for Tactical Aircraft (TACAIR) effort by performing baseline laboratory testing of SAM jam codes for all Tier 1 and 2 threat missiles. Effort continues under PE 0603123N.
- Completed the Applied Research Phase (6.2) of the Integrated Defensive Electronic Countermeasures Pre-Planned Product Improvement (IDECM P3I) effort by fabricating flexible .009 inch diameter conductors capable of sustained operation at 5 kilovolts and >1750 degrees Fahrenheit. Effort continues under PE 0603123N.
- Completed the EUT effort by developing low cost, lightweight gunfire detection architecture with a production goal of less than \$10,000 and weight of less than four pounds.
- Initiated efforts in biomimetic signal processing: panoramic periscope for submarines and temporal pattern recognition for Systems for Security Breaching Noise Detection.
- Initiated efforts in bioinspired quiet, efficient and maneuverable self-propelled line array using high-lift propulsors based on insect biomechanics.
- Initiated the Integrated EO/IR Self-protection Suite for Rotary Wing Aircraft effort by performing a platform integration analysis and design review.
- Initiated investigation of improved jam codes and closed-loop countermeasure techniques to integrate with the Shipboard Integrated Electro-Optic Defense Systems (SHIELDS) hardware for Shipboard EO/IR Closed Loop Self-protection.
- Initiated the development of low-cost, lightweight radar absorbing material (RAM) based on metalized cellulose in the form of fibers, fabric and paper. (NRL)
- Initiated design and testing of on-chip nucleic acid amplification and transfer technology. (NRL)
- Initiated studies to develop catalytic activity profile of bioactive coatings against chemical agents. Design and initiate fabrication of coatings to degrade both, chemical and biological agents. (NRL)
- Initiated development of a portable detection system for defense against small arms fire and rocket propelled grenades (RPG) using Field Programmable Gate Arrays (FPGAs), infrared focal plane arrays (IRFPA), and filtering algorithms. (NRL)

Underwater Platform Self-Defense

- Continued developing the mobile NGCM interface between guidance and control and signal generation electronics.
- Continued analysis of capability to enable limited acoustic communications among NGCM units.
- Continued incorporation of ATT warhead acoustic model into Technology Requirements Model (TRM).

R1 Line Item 5

Page 19 of 33

UNCLASSIFIED

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

- Completed merging the Smart Adaptive Countermeasure (SACM) Smart Adaptive Processor and a generic signal generator board into a single module suitable for both Acoustic Device, Countermeasure (ADC) MK2 and NGCM.
- Initiated and completed development work on improving imaging technologies (EO/IR/Laser) to support the Integrated Radar Optical Sighting & Surveillance (IROSS) Shipboard Protection System (SPS) Spiral for IROSS. (NRL)

FY 2007 Plans:

Sensors & Associated Processing

- Continue all efforts of FY 2006, less those noted as complete above.
- Continue advanced concept development to integrate object recognition and tracking algorithms, machine vision, multiple networked video streams into different classes of EO/IR sensors within the Intelligent Video Surveillance FNC product (transferred from PE 0602131M).
- Continue developing technologies to support the Intelligent Video Surveillance project which includes integration of object recognition and tracking algorithms, machine vision, and multiple networked video streams into different classes of EO/IR sensors. (Transferred into this PE from PE 0602131M.)
- Complete first demonstration of high resolution imaging of faint sources using the combined adaptive optics and optical interferometry at NPOI. (NRL)
- Complete development of reagentless sensors for weapons of mass destruction/explosives, using engineered protein based components for detection of explosives (e.g., TNT, RDX) and other analytes in seawater.
- Complete synthesis and acquisition of all the components needed for the fabrication of durable multifunctional coatings. (NRL)
- Initiate integration of DNA and antibody array analysis and demonstrate capability for rapid screening and pathogen species confirmation. (NRL)
- Initiate design and fabrication of self-reporting coatings for system failure detection. (NRL)
- Transfer the Shipboard EO/IR Closed Loop Self-Protection effort to PE 0602271N.

Underwater Platform Self-Defense

- Continue all efforts of FY 2006, less those noted as complete above.
- Continue advanced concept development of a scalable low frequency continuous wave acoustic weapon for use against underwater asymmetric threats (transferred from PE 0602131M).
- Complete processing algorithms for communications among NGCM units.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

FY 2008 Plans:

Sensors & Associated Processing

- Continue all efforts of FY 2007, less those noted as completed above.
- Complete the Integrated EO/IR Self Protect Suite for Rotary Wing Aircraft by conducting a laboratory demonstration of the integrated Missile Warning Sensor (MWS) and multi-band fiber coupled laser jammer.
- Complete development of solid projectile coilgun design, consumable casing material and improved railgun efficiency and developed method of reducing muzzle flash and surface wear of the rails. (NRL)
- Complete the design and development of integrated laser ground based, aircraft protection design to protect large aircraft from Infrared SAMs upon ingress and egress to an airport. (NRL)
- Complete the Intelligent Video Surveillance project including integration of object recognition and tracking algorithms, machine vision, and multiple networked video streams into different classes of EO/IR sensors.
- Transfer biomimetic signal processing efforts, including panoramic periscope and temporal pattern recognition for security breaching noise detection to PE 0602236N.
- Transfer efforts in bioinspired quiet, and maneuverable self-propelled line array using high-lift propulsors based on insect biomechanics to PE 0602236N.
- Transfer efforts in biomimetic sonar systems for operation in air and aquatic environments based on bat echolocation neurophysiology and information processing algorithms to PE 0602236N.
- Initiate new FNC EC Shipboard Force Protection in Port and Restricted Waters - Detection and Classification. This project will develop mission specific electro-optic/infrared sensors to detect, classify, and determine the intent of potential terrorist and special operations force threats to ships and craft in Port and transiting restricted waters.

Underwater Platform Self-Defense

- Continue all efforts of FY 2007, less those noted as complete above.
- Complete the scalable low frequency continuous wave acoustic weapon for use against underwater asymmetric threats.
- Initiate development of low-cost, light weight swimmer detection and localization technologies.

FY 2009 Plans:

Sensors & Associated Processing

- Continue all efforts of FY 2008, less those noted as complete above.

R1 Line Item 5

Page 21 of 33

UNCLASSIFIED

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

- Complete the development of low-cost, lightweight RAM based on metallized cellulose in the form of fibers, fabric and paper. (NRL)

Underwater Platform Self-Defense

- Continue all efforts of FY 2008, less those noted as complete above.

	FY 2006	FY 2007	FY 2008	FY 2009
AIRCRAFT TECHNOLOGY	12,109	14,368	16,472	15,755

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 Enterprise Science and Technology Strategic Plan, providing a robust and credible forward presence through flexible response and dominant power projection from the sea.

Increases in funding in FY 2007 and FY 2008 are due to the addition of new projects in Ship-To-Objective Maneuver (STOM) and Heavy Lift System Concept efforts.

FY 2006 Accomplishments:

- Continued development of survivability/reduced observables technology (classified).
- Continued demonstration of system integration of a shaped memory alloy into a Reconfigurable Rotor Blade system for improved range and lifting capacity in a tilt rotor aircraft.
- Completed development of a new class of practical Computational Fluid Dynamics (CFD)-based engineering analysis and design tools to facilitate design of advanced high performance rotors.
- Completed analysis of alternatives and initiated conceptual design of vertical lift aircraft to support STOM and Distributed Operations (DO).
- Completed CFD modeling of ship airwake flows to provide higher fidelity.
- Initiated design concepts for an experimental vertical lift utility Unmanned Air vehicles (UAV).
- Initiated development of flight control, intelligent autonomy, command & control, and multi-vehicle cooperation technologies for UAV.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

- Initiated development of a CFD based integration system to maximize operational capability of autonomous aircraft by choosing optimal flight pattern for any environmental condition including low speed operations and brownout.
- Initiated development effort to control flow and thermal dynamics in particle coating process and densification dynamics of large windows. (NRL)

FY 2007 Plans:

- Continue all efforts of FY 2006, less those noted as completed above.
- Complete design concepts and initiate technology development of an experimental vertical lift UAV.

FY 2008 Plans:

- Continue all efforts of FY 2007, less those noted as completed above.
- Continue vertical lift technology investments.
- Complete demonstration of system integration of a shaped memory alloy into a Reconfigurable Rotor Blade system for improved range and lifting capacity in a tilt rotor aircraft.
- Complete development effort to control flow and thermal dynamics in particle coating process and densification dynamics of large windows. (NRL)

FY 2009 Plans:

- Continue all efforts of FY 2008, less those noted as complete above.

	FY 2006	FY 2007	FY 2008	FY 2009
MISSILE DEFENSE (MD)	11,743	5,377	14,587	13,727

This activity describes Missile Defense S&T projects of the Sea Shield FNC program, non-FNC-related NRL research.

- Distributed Weapons Coordination (DWC) open architecture combat system algorithms for automated battle management aids (ABMA), including common threat evaluation (CTE) and preferred shooter recommendation (PSR) functions that will enable fleet units to defend against air and missile attacks with increased effectiveness and efficiency. Metrics for DWC include (a) increased effectiveness of combat resources through a theater-wide threat evaluation process; (b) increased efficiency of weapons resources through weapon assignment and

R1 Line Item 5

Page 23 of 33

UNCLASSIFIED

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

preferred shooter recommendations considering Theater Ballistic Missile Defense (TBMD) and Area/Ship Defense capability operating simultaneously; and (c) reduced "free riders" (threats not fired at) due to ineffective use of resources (unengaged targets) by 50% (threshold) 80% (objective).

- Littoral Affordability (classified program). This classified project completed at the end of FY06.
- Advanced Area Defense Interceptor (AADI) S&T planning effort for Navy - Marine Corps Air Directed Surface to Air Missile (ADSAM) live firing demonstration at White Sands Missile Range in FY 2008. The metric for AADI is execution of an ADSAM demonstration by the Navy and Marine Corps that establishes the basis for further development of an operational Naval Integrated Fire Control/Counter-Air (NIFC-CA) capability.
- Distributed Sensor Coordination (DSC) algorithms for airborne sensor management in ADSAM and multi-threat air defense engagements. The metric for DSC is effective coordination of airborne sensor resources to support NIFC-CA capability, evaluated using laboratory Monte Carlo simulations within simulated stressing air defense environments.
- Naval Interceptor Improvements (NII) technology upgrades for STANDARD Missile (SM) future fleet air defense missile. Metrics will be to achieve SM performance requirements in specified tactical rain environments and achieve SM performance requirements in all specified electronic countermeasures environments.
- Extended Distributed Weapons Coordination (EDWC) algorithms to extend DWC ABMA functionality to include coordination of passive defense measures (emission control, use of decoys, maneuvering). Metrics will be defined in a transition agreement to be signed with the Navy acquisition customer upon project initiation in 2008.
- Positive Control of Naval Weapons (PCNW) equipment and computer programs for an advanced multi-band weapon system / interceptor link to enable forward pass engagements and enhance link security in hostile environments. Metrics will be defined in a transition agreement to be signed with the Navy acquisition customer upon project initiation in 2008.
- Emerging technologies that support delivery of Technology Oversight Group (TOG)-approved FNC enabling capabilities (EC) structured to close operational capability gaps in missile defense.
- Non-FNC-related investigation of effects of charged particle layers on UHF to S-Band radars used to track space vehicles. (NRL)

Decrease in FY 2007 funding reflects impact of a congressional mark on overall funding for this activity. Funding increase in FY 2008 results from starting EDWC and PCNW projects as scheduled, as well as funding for culminating events in AADI ADSAM demonstration.

UNCLASSIFIED

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

FY 2006 Accomplishments:

- Continued development of DWC and DSC algorithms for use in air and missile defense ABMA.
- Completed Littoral Affordability effort (classified program).
- Initiated program to investigate effects of charged particle layers on UHF to S-Band radars used to track space vehicles. (NRL)

FY 2007 Plans:

- Continue all efforts of FY 2006, less those noted as completed above.
- Perform additional AADI S&T planning and coordination for the FY 2008 Navy ADSAM live-fire demonstration taking place under PE 0603123N.
- Complete development and documentation of DWC and DSC algorithms.
- Initiate NII project.

FY 2008 Plans:

- Continue all efforts of FY 2007, less those noted as complete above.
- Initiate EDWC and PCNW efforts.

FY 2009 Plans:

- Continue all FNC-related efforts of FY 2008.
- Complete non-FNC-related NRL program.
- Initiate TOG-approved FNC missile defense EC project(s).

CONGRESSIONAL PLUS-UPS:

	FY 2006	FY 2007
ADPICAS	0	1,594

Initiate development of intelligent composite active structures and systems to provide precision position control and vibration suppression for military and space structures to enhance their structural performance

R1 Line Item 5

Page 25 of 33

UNCLASSIFIED

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

and reduce their fuel consumption. Applications include fighter jets, helicopters, smart rockets, satellites, and space stations.

	FY 2006	FY 2007
ADVANCED FUSION PROCESSOR	2,495	0

Completed the development of an advanced fusion processing station for hyperspectral/panchromatic/SAR/ELINT data exploitation. Further developed a hyperspectral/panchromatic image data fusion capability for use in future Navy reconnaissance platforms and will extend it to fusion of hyperspectral data with SAR and ELINT. More specifically, it extends the hyperspectral processing capability to include long range oblique imagery, develops a compact processing capability using gate array technology, and verifies performance in flight tests.

	FY 2006	FY 2007
ADVANCED MATERIAL TECHNIQUES FOR LITHIUM ION LARGE CELL MANUFACTURING	0	2,290

Initiate advanced material techniques for lithium ion large cell manufacturing.

	FY 2006	FY 2007
ADVANCED RECEIVE-WHILE-TRANSMIT SONAR FOR UUVS	0	2,192

Initiate advanced receive-while-transmit sonar research for unmanned underwater vehicles.

	FY 2006	FY 2007
ADVANCED SIMULATION TOOLS FOR AIRCRAFT STRUCTURES MADE OF COMPOSITE MATERIALS	0	1,943

Develop and test a software analysis tool to support the development of a methodology to solve the local & global problem of aircraft composite structural analysis.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

	FY 2006	FY 2007
APERSTRUCTURES	0	21,719

Initiate efforts to demonstrate low observable integrated antenna technologies (aperstructures) using a series of structural (composite) and RF test articles. Address principal risk areas for future integrated ship-borne missile defense radars including structural integrity/shock, metrology and dynamic calibration, and deckhouse integration/signatures.

	FY 2006	FY 2007
BLAST RESISTANT ANECHOIC SPRAYABLE ELASTOMERIC COATING FOR SHIPS	0	996

Initiate development, testing, and evaluation of a new coating system that can be applied to metal ship bulkheads and armored vehicles providing blast protection to the occupants. The end of the first year of development will result in one or more fire retardant coating systems that can be applied to metal structures and provide blast protection.

	FY 2006	FY 2007
DIRECT MOTOR DRIVEN WATERJETS	0	996

Initiate direct motor driven waterjet efforts.

	FY 2006	FY 2007
FACIAL RECOGNITION TECHNOLOGY	1,341	996

FY 2006 - Continued technologies for facial (biometrics) recognition algorithms for heightened accuracy and speed for identification applications. Evaluated imaging technology and its impact on facial recognition performance. Build a forensics workstation for facial recognition performance in outdoor scenarios.
FY 2007 - Continue facial recognition technology research.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

	FY 2006	FY 2007
HIGH EFFICIENCY QUIET ELECTRIC DRIVE	1,443	0

Completed modification of the single-phase model to a three-phase model. Initiated test and evaluation.

	FY 2006	FY 2007
HIGH FREQUENCY ACOUSTIC SIGNAL PROCESSOR SYSTEM	2,874	2,690

FY 2006 - Continued development of a real time, high frequency, acoustic signal processor to aid in Harbor Surveillance, (Swimmer Detection) and Terrestrial Surveillance for Perimeter Security and Force Protection Applications both in CONUS and at forward deployed sites.

FY 2007 - Continue development of a high frequency acoustic signal processor system.

	FY 2006	FY 2007
LARGE UNMANNED UNDERWATER VEHICLE TECHNOLOGIES	0	996

Initiate development of improved energy storage and advanced propulsion technologies for large unmanned undersea vehicles.

	FY 2006	FY 2007
LIGHTWEIGHT SHIP STRUCTURES	480	0

Completed research to explore, develop and optimize alloys based on An-Zn-Mg-Sc-Zr. Efforts included alloy fabrication, microstructural and mechanical property characterization, stress corrosion cracking studies, development of cost-benefit analysis and an additional emphasis on assessing and enhancing weldability (both fusion and friction stir welding).

	FY 2006	FY 2007
LITHIUM ION BATTERY FOR MULTIPLE NAVY AIRCRAFT	1,448	0

Supported development of a volumetrically efficient prismatic cell design structure that is transitionable to

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

high speed production and easier to assemble into an operational battery that could support the Joint Unmanned Combat Air System (JUCAS). The battery design supports the battery operating in a floating (low current flow) electrical charge mode via a connection to a Navy aircraft DC distribution bus, and enable demonstration of the battery on a Navy aircraft such as the T-45 Jet Trainer.

	FY 2006	FY 2007
LOW-COST RAPID PROTOTYPE/PRODUCTION TECHNOLOGY FOR POLYMERIC AIRCRAFT COMPONENTS INITIATIVE	963	0

Completed the development and qualification of 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. Focused on material and process optimization with emphasis on meeting aerospace application requirements.

	FY 2006	FY 2007
MAGNETIC REFRIGERATION TECHNOLOGY FOR NAVAL APPLICATIONS	1,822	1,644

FY 2006 - Continued development of advanced magnetocaloric materials and active magnetic regenerators towards demonstration of a high temperature span magnetic refrigerator. A breadboard system based on Navy requirements will be constructed. A repeatable hydriding process will be developed to obtain materials with large magnetic entropy change and controllable Curie temperatures.
FY 2007 - Continue development of magnetic refrigeration technology for Naval applications.

	FY 2006	FY 2007
MARK V PATROL BOAT REPLACEMENT CRAFT	2,400	4,981

FY 2006 - Continued construction and operational testing of the new composite MK-V prototype craft.
FY 2007 - Initiate operational evaluation of prototype composite craft to existing MK-V Patrol Boat.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

	FY 2006	FY 2007
NANO-MAGNETIC MATERIALS FOR PROPULSION/ENERGY SYSTEMS	1,347	996

FY 2006 - Continued development of nanomagnetic materials and production processes research for future military propulsion and energy systems.

FY 2007 - Continue development of nanomagnetic materials for propulsion/energy systems.

	FY 2006	FY 2007
NANOSTRUCTURED COMPOSITE MARINE COATINGS	0	1,993

Initiate efforts to develop and exploit nanocomposites as environmental and wear coatings for systems operating in a marine environment.

	FY 2006	FY 2007
NAVAIR CORROSION MODELING SOFTWARE PROJECT	2,028	0

Completed development and testing of workable corrosion maintenance guidelines and criteria for high strength steel aircraft components. The validated results of this effort at the component level will enable maintenance teams to delineate between various aircraft corrosion states, with potential safety impacts and identification of corrosion that is cosmetic.

	FY 2006	FY 2007
PEM FUEL CELL FOR VEHICLE SENSORS	966	0

Completed an assessment of the feasibility of successfully developing a Proton Exchange Membrane (PEM) Fuel Cell (FC) / high capacity battery hybrid power system for application in Autonomous Surface Vehicles (ASV).

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

	FY 2006	FY 2007
PMRF FORCE PROTECTION LAB	3,257	3,188

FY 2006 - Continued development of force protection and security technologies by integrating, evaluating and demonstrating enabling technologies, tools, and processes. Approaches included integration of advanced sensor systems, novel sensor and data fusion processes, behavior modeling and analysis, and data mining and knowledge extraction techniques.

FY 2007 - Continue PMRF Force Protection Lab efforts.

	FY 2006	FY 2007
POLYMERIC AIRCRAFT COMPONENTS	961	0

Completed the development of Rapid Prototyping Technology (RPT) for use in aerospace component production applications. Specifically, this effort focused on completing the optimization of the RPT equipment and materials for use in rapid production, and then demonstrating the uniformity, repeatability and high quality provided by this technology in aerospace component manufacturing.

	FY 2006	FY 2007
SECURE INFRASTRUCTURE TECHNOLOGY LABORATORY	6,513	0

Developed a cost effective swimmer defense system which can be deployed from naval platform. The system uses real time measurements to argument now cast and forecasts of hydraulic and current information calculated by estuarine model appropriate for ports and harbors and use of knowledge of currents and other flow characteristics to maximize coverage while minimizing power requirements of self contained surveillance systems.

	FY 2006	FY 2007
SHIPBOARD PRODUCTION OF SYNTHETIC LOGISTICS AND AVIATION FUEL	0	996

Initiate shipboard production of synthetic logistics and aviation fuel efforts.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

BUDGET ACTIVITY: 02

PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

	FY 2006	FY 2007
SMALL WATERCRAFT PROPULSION DEMONSTRATOR	1,439	2,690

FY 2006 - Continued development of an advanced internal combustion engine and prototype power generation system.

FY 2007 - Continue development of small watercraft propulsion demonstrator.

	FY 2006	FY 2007
THIN FILM BATTERY	1,344	0

Completed development and optimization of chemical vapor deposition and plasma thin film deposition techniques for lithium, and lithium ion battery materials and cells. The goal was to prove the feasibility of manufacturing these types of batteries, which provides improved energy and power densities, safety and reliability over current technologies.

	FY 2006	FY 2007
UNDERSEA PERIMETER SECURITY INTEGRATED DEFENSE ENVIRONMENT	1,150	996

FY 2006 - Implemented a networked pilot beta test site on the RI/CT waterfronts which incorporates surface and undersea sensor/visual technologies from partnering companies to create an automated underwater perimeter detection and response system for system users. The pilot project provides direct test bed information enhancing existing facility security procedures, 24x7.

FY 2007 - Continue research on undersea perimeter security integrated defense environment.

	FY 2006	FY 2007
UNMANNED SEA SURFACE VEHICLES FOR MARITIME MISSIONS	2,144	0

Completed operational testing of two prototype vehicles to determine at-sea performance. Incorporated advanced power and autonomy technologies.

UNCLASSIFIED

FY 2008/2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2a

DATE: February 2007

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PROGRAM ELEMENT: 0602123N PROGRAM ELEMENT TITLE: FORCE PROTECTION APPLIED RESEARCH

PROJECT TITLE: FORCE PROTECTION APPLIED RESEARCH

	FY 2006	FY 2007
UTC SIMCENTER SOLID OXIDE FUEL CELL - MILITARY APPLICATIONS	0	1,644

Initiate UTC SIMCENTER solid oxide fuel cell efforts for military applications.

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)
PE 0603513N (Shipboard System Component Development)
PE 0603553N (Surface ASW)
PE 0603561N (Advanced Submarine System Development)
PE 0603609N (Conventional Munitions)
PE 0603640M (USMC Advanced Technology Demonstration (ATD))
PE 0604307N (Surface Combatant Combat System Engineering)
PE 0604518N (Combat Information Center Conversion)
PE 0604558N (New Design SSN)
PE 0604561N (SSN-21 Developments)

NON NAVY RELATED RDT&E:

PE 0602270A (Electronic Warfare Technology)
PE 0602204F (Aerospace Sensors)

D. ACQUISITION STRATEGY:

Not applicable.