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

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603123N
PROGRAM ELEMENT TITLE: FORCE PROTECTION ADVANCED TECHNOLOGY

COST: (Dollars in Thousands)

Project Number & Title	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
Total PE	142,926	119,562	55,099	63,845	64,236	48,147	42,296
2912 FORCE PROTECTION ADVANCED TECHNOLOGY	55,323	67,552	52,863	61,468	61,712	45,575	39,671
3049 FORCE PROTECTION	2,602	2,079	2,236	2,377	2,524	2,572	2,625
9999 CONGRESSIONAL PLUS-UPS	85,001	49,931	0	0	0	0	0

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Jan 2007). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE addresses advanced technology development associated with providing the capability of Platform and Force Protection for the U.S. Navy. This program supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial and air) and the protection of those platforms. This PE supports the Future Naval Capabilities (FNC) in the areas of Sea Shield and Cross Pillar Enablers, and Enterprise and Platform Enablers (EPE). The goal of this program 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. Surface Ship & Submarine, Hull, Mechanical & Electrical (HM&E),

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Missile Defense, Fleet Force Protection and Defense against Undersea Threats, and Emerging Threats activities all support FNC efforts.

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

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B. PROGRAM CHANGE SUMMARY:

	FY 2007	FY 2008	FY 2009
FY 2008/FY 2009 President's Budget Submission	147,111	70,850	58,615
Congressional Action	1,300	50,250	0
Congressional Undistributed Reductions/Rescissions	-5	-787	0
Execution Adjustments	-2,184	0	0
Program Adjustments	0	0	-3,347
Rate Adjustments	0	0	-169
SBIR Assessment	-3,296	-751	0
FY 2009 President's Budget Submission	142,926	119,562	55,099

PROGRAM CHANGE SUMMARY EXPLANATION:
Technical: Not applicable.

Schedule: Not applicable.

C. OTHER PROGRAM FUNDING SUMMARY:
Not applicable.

D. ACQUISITION STRATEGY:
Not applicable.

E. PERFORMANCE METRICS:
The overall goals of this advanced technology program are the development of technologies which focus on the warfighter and providing 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. Overall metric goals are to transition the advanced technology projects into acquisition programs. Each Activity within this PE has unique goals and metrics, some of which include classified quantitative measurements.

Specific examples of metrics under this PE include:

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- Demonstrate improved performance of main propulsion electric motors and controllers (50% reduced weight and volume) by FY 2011.
- Demonstration of a Medium Voltage Direct Current (MVDC) architecture containing Commercial Off the Shelf (COTS) components to assess the viability of MVDC distribution for CG (X) cruiser by the end of FY 2011.
- In-water successful demonstration of warhead lethality against specified threat at required Closest Point of Approach (CPA).
- Items included within the Missile Defense Activity description.

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COST: (Dollars in Thousands)

Project Number & Title	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
2912 FORCE PROTECTION ADVANCED TECHNOLOGY	55,323	67,552	52,863	61,468	61,712	45,575	39,671

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project addresses advanced technology development associated with providing the capability of Platform and Force Protection for the U.S. Navy. This project supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. It supports the Sea Shield and Cross Pillar Enablers, and Enterprise and Platform Enablers (EPE) -- Future Naval Capabilities (FNCs). The goals of this project are 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.

This Project reflects the alignment of investments for the following ECs: Total Ship Survivability Damage Tolerance and Recoverability; 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; Four-Torpedo Salvo Defense; Shipboard Force Protection in Port and Restricted Waters - Detection and Classification; and Underwater Total Ship Survivability.

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B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2007	FY 2008	FY 2009
SURFACE SHIP & SUBMARINE HULL MECHANICAL & ELECTRICAL (HM&E)	16,889	10,160	18,439

Activity includes: Signature Reduction, Hull Life Assurance, and Advanced Capability Electric Systems. Signature Reduction addresses electromagnetic (EM), infrared (IR), and acoustic signature tailoring, both topside and underwater. Hull Life Assurance addresses development of new structural system approaches for surface ships and submarines, including the management of weapon effects to control structural damage and the improvement of structural materials. Advanced Capability Electric Systems area addresses electrical and auxiliary systems and component technology to provide improvements in system energy and power density, system operating efficiency, and recoverability from casualties. Advanced Damage Control Countermeasures addresses fire, smoke, and flooding detection using a volume sensor and the use of a hybrid water-mist for electronic space protection. This activity includes support to the Sea Strike, Cross Pillar Enablers, and Enterprise and Platform Enablers (EPE) FNC programs.

Funding decrease from FY 2007 to FY 2008 is due to completion of construction of the 36.5 MW Superconducting Motor and completion of Total Ownership Cost efforts. The increase of funding from FY 2008 to FY 2009 is due to the initiation of new FNC Enabling Capabilities including Underwater Total Ship Survivability, and Affordable Submarine Propulsion and Control Actuator; and the realignment of Compact Power Conversion Technologies from PE 0603236N/Turbine Engine Technology.

FY 2007 Accomplishments:

- Continued development of diesel fuel reforming technology for molten carbonate and proton exchange membrane fuel cells.
- Continued development of advanced superconducting homopolar main propulsion motor with General Atomics.
- Continued development of autonomous recovery system for Unmanned Sea Surface Vehicles from a host ship.
- Completed development of on-board vehicle power system technologies for future Marine Corps Battlefield Power System.
- Completed testing of superconducting synchronous main propulsion motor with American Superconductor.
- Initiated development of Integrated Damage Control Systems which includes Integrated Damage Control

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Communications and Advanced Magazine Protection System.

FY 2008 Plans:

- Continue all efforts of FY 2007, less those noted as completed above.
- Initiate Total Ship Survivability Damage Tolerance and Recoverability efforts which include integrated damage control situation awareness technologies.

FY 2009 Plans:

- Continue all efforts of FY 2008.
- Continue compact power conversion technologies FNC transitioned from PE 0603236N/Turbine Engine Technology.
- Initiate expansion of Next Generation Integrated Power Systems (NGIPS) technology development, to de-risk and demonstrate applicable Medium Voltage Direct Current (MVDC) power dense, efficient, and fault tolerant technologies needed for future surface, and subsurface platforms.
- Initiate expanded demonstration of superconductive degaussing coil in a relevant environment.
- Initiate Affordable Submarine Propulsion and Control Surface Actuator technologies focused on the development and demonstration of affordable composite propellers and torque dense and quiet actuation of submarine control surface efforts.
- Initiate Underwater Total Ship Survivability/Payload Implosion and Platform Damage Avoidance efforts.

	FY 2007	FY 2008	FY 2009
FLEET FORCE PROTECTION AND DEFENSE AGAINST UNDERSEA THREATS	25,551	21,846	13,976

Fleet Force Protection and Defense against Undersea Threats addresses efforts that 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.

The first major goal of this activity is to develop complementary sensor and processing technologies for 21st century warfighting success and platform protection. Current small platforms (both surface and airborne) have little or no situational awareness (SA) or self-protection against air, surface, and asymmetric threats. This activity will provide tactical aircraft (TACAIR) and other platforms with effective threat warning and self-

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protection. The technology areas specific to platform protection will develop individual or multi-spectral [Electro-Optic (EO), IR, radio frequency (RF), 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.

The Fleet Force Protection portion of this activity includes support to the FNC Enabling Capabilities for: Aircraft Integrated Self-protection Suites; Intent Determination – EO/IR Enhancements; Proof-of-Concept for Non-lethal Approach; Advanced Electronic Sensor Systems for Missile Defense; Hostile Fire Detection and Response Spirals 1 and 2; Defense of Harbor and Near-Shore Naval Infrastructure Against Asymmetric Threats; Four-Torpedo Salvo Defense; and Shipboard Force Protection in Port and Restricted Waters - Detection and Classification.

The second major goal of this activity is to develop enabling technologies that will increase the survivability of surface ship and submarine platforms against torpedo threats. Proposed technologies focus on defeating high priority threats including torpedoes (i.e. straight running, wake homing, acoustic homing, air dropped torpedoes, and salvoes of torpedoes). Technologies developed will minimize shipboard impact and require no shipboard organizational maintenance. Two major efforts are ongoing: 1) The Next Generation Countermeasure (NGCM) is a mobile adaptive acoustic countermeasure (CM) for defeating threat torpedoes; NGCM capabilities will include acoustic communication links to enable connectivity from each CM to other CMs (in the group) and to the host platform; and 2) The Anti-Torpedo Torpedo (ATT)/Tripwire provides technologies that enable an ATT to engage threat torpedoes detected by a surface ship towed sensor system. The ultimate goal is to develop technologies to enable a torpedo defense capability, including ship self-defense against salvo torpedo attacks, to fill the FNC Sea Shield Warfighting Capability Gap/Enabling Capability: Platform Defense against Undersea Threats. Ultimately the goal is to deliver a netted set of decoys and an anti-torpedo-torpedo for use in defeating a four-torpedo salvo attack against a surface or subsurface platform.

The funding decrease from FY 2007 to FY 2008 reflects completions and transitions of demonstration activities. The decrease from FY 2008 to FY 2009 reflects the completion of FNC Enabling Capabilities Two-Torpedo Salvo Defense, Aircraft Integrated Self-Protection Suites, and Hostile Fire Detection and Response Spiral 2; and decreased effort in Defense of Harbor and Near-Shore Naval Infrastructure Against Asymmetric Threats.

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FY 2007 Accomplishments:

Sensors & Associated Processing -

- Continued laboratory demonstration of a coated carbon fiber cable that survives 27 times longer than Zylon under direct flame at temperatures >1800 degrees Fahrenheit. Integrated Defensive Electronic Countermeasures Pre-Planned Product Improvement (IDECM P3I).
- Continued laboratory demonstration of the upgraded multiband laser towards a goal of 5W in all bands for EO/IR Jammer for TACAIR.
- Continued the End User Terminal (EUT) effort by conducting a side-by-side laboratory demonstration of the Dismounted-Digital Automated Computing Terminal (D-DACT) including the integrated 256 color Organic Light Emitting Diode (OLED) display with a Liquid Crystal Display D-DACT.
- Continued the Shipboard EO/IR Closed Loop Self-Protection effort by demonstrating a pulse-gated visible receiver operating at 10kHz frame rate.
- Continued the integration of the Gallium Arsenide (GaAs) transmitter with an ALE-55 sized Fiber-Optic Towed Decoy (FOTD) and onboard power supply for the Integrated Defensive Electronic Countermeasures Pre-Planned Product Improvement (IDECM P3I) effort.
- Continued the integration of a noncryogenic solid-state Mid-wave Infrared (MWIR) multiband laser into a prototype Tactical Aircraft Directed IR Countermeasures (TADIRCM) pod that will undergo an Early Operational Assessment (EOA) in FY06 (EO/IR Laser Jammer for TACAIR).
- Continued the Integrated EO/IR Self Protection Suite for Rotary Wing Aircraft effort by evaluating and demonstrating an uncooled missile warning system (MWS) sensor operating in the visible/near-infrared (500-1100 nanometer) spectral band.
- Continued the integration and laboratory testing of the multiband laser jammer, stabilized pointer, and closed-loop EO/IR receivers for the Shipboard EO/IR Closed-Loop Self Protection effort.
- Continued preparations for the completion of the EUT effort by planning a field demonstration of the full capabilities of the integrated personal communications, situational awareness, and gunfire detection system including the Monocular Display with a super video graphics adapter (SVGA) resolution of 800x600 pixels.
- Continued 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 from PE 0602131M in FY 2007.)
- Continued performance evaluation of a Counter Torpedo Detection, Classification and Localization (CTDCL) prototype torpedo protection system capable of countering two torpedoes launched in rapid succession. Transferred from PE 0603747N.

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- Transferred the Shipboard EO/IR Closed Loop Self-Protection effort to PE 0603271N.
- Transferred development work on improving imaging technologies (EO/IR/Laser) supporting Integrated Radar Optical Sighting & Surveillance (IROSS) Shipboard Protection System (SPS) Spiral for IROSS to PE 0602131M.
- Completed laboratory demonstration of the common jam code countermeasure jamming capability by demonstrating a 95% jamming effectiveness for all Tier 1 and 2 IR threats (EO/IR Laser Jammer for TACAIR).
- Completed flight tests against single and multiple, simultaneous threats employing the complete system capabilities, including new towline capable of continuous operation at temperatures exceeding 1800 degrees Fahrenheit, 80W output continuous wave RF decoy, and Electronic Countermeasure (ECM) techniques (IDECM P3I effort).

Underwater Platform Self-Defense -
- Continued development of technologies to support the Underwater Threat Neutralization project which include a scalable low frequency continuous wave acoustic weapon for use against underwater asymmetric threats.
- Completed closed loop in-water data collection experiments to collect ATT one-on-one (1x1) sensor data for improving operations in the wake.
- Completed closed loop in-water data collection efforts to evaluate the ATT two-on-two (2x2) salvo sonar technologies for improving operations outside the wake.
- Completed evaluation of NGCM mobility capabilities by in-tank tests.
- Completed open loop in-water demonstration of ATT one-on-one (1x1) engagement in the wake.
- Completed in-water demonstration of free swimming NGCM.
- Completed open loop in-water experiments to evaluate ATT salvo four-on-four (4x4) engagement technologies.
- Completed in-water tests evaluating the ability of ATTs to transmit and receive acoustic communication between vehicles.
- Initiated and completed demonstration of NGCM acoustic communication technologies and transition them to PMS415.
- Initiated and completed conduct of in-water demonstration of full duplex adaptive signal generation capability for NGCM.
- Initiated and completed in-tank experiments at Naval Undersea Warfare Center, Division Newport to evaluate NGCM group behavior technology.

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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 field demonstration of the integrated Missile Warning Sensor (MWS) and multi-band fiber coupled laser jammer.
- 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.
- Complete the IDECM P3I effort by conducting final flight testing of improved decoys and towlines.
- Complete performance evaluation of a CTDCL prototype torpedo protection system capable of countering two torpedoes launched in rapid succession.
- Initiate new FNC Enabling Capability (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 completed above.
- Complete the Underwater Threat Neutralization project including demonstration of a scalable low frequency continuous wave acoustic system for use against underwater asymmetric threats in port.
- 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 completed above.
- Continue new FNC EC entitled Shipboard Force Protection in Port and Restricted Waters - Detection and Classification, initiated, in FY 2008. This effort develops 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 inport and transiting restricted waters. Sensor projects included in this FNC EC include Distributed Millimeter Wave (DmmW) Sensor, Active/Passive Dual Imaging IR (MW/SW) Sensor, and Situational Panoramic Infrared (SPIR) Sensor.
- Initiate the Countermeasures for Advanced Imaging Infrared (IIR) Guided Missiles FNC effort by

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commencing IIR threat surrogate hardware development.
- Initiate the Countermeasures for Millimeter Wave Guided Missiles FNC effort by initiating wide band gap monolithic microwave integrated circuit (MMIC) Ka-band development.
- Initiate the Multifunction Capabilities for Missile Warning Sensors FNC effort by commencing signal processor development.

Underwater Platform Self-Defense -
- Continue all efforts of FY 2008, less those noted as completed above.
- Initiate expanded development of autonomous, underway refueling for Unmanned Sea Surface Vehicle Technologies.
- Initiate advanced development of software encoded algorithms for the Anti-Torpedo Torpedo (ATT) sensor and controller that will enable ATT's to successfully engage torpedo salvoes of up to four attacking units.

	FY 2007	FY 2008	FY 2009
MISSILE DEFENSE (MD)	9,910	35,546	20,448

This activity describes Missile Defense Science and Technology (S&T) projects of the Sea Shield Future Naval Capability (FNC) program and an OSD-funded Joint Integrated Fire Control (JIFC) demonstration.
- Advanced Area Defense Interceptor (AADI) S&T planning and data analysis 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 Weapons Coordination (DWC) open architecture combat system algorithms for Theater Air and Missile Defense (TAMD) 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 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). Transition to acquisition in FY 2008.
- 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

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support NIFC-CA capability, evaluated using laboratory Monte Carlo simulations within simulated stressing air defense environments. Transition to acquisition in FY 2008.

- Naval Interceptor Improvements (NII) technology upgrades for STANDARD Missile (SM) future TAMD missile. Metrics will be to achieve SM performance requirements in specified tactical rain environments and all specified electronic countermeasures environments. Transition anticipated in FY 2011.
- 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 improved probability of negation (Pneg) against advanced ballistic & cruise missile anti-ship threats that may be susceptible to decoys & jamming. Transition anticipated in FY 2011.
- 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 capabilities to receive in-flight update from TAMD systems including AEGIS combatants, airborne & land-based units, and ability to transmit status and target data to controlling unit and/or other interceptor missiles. Transition anticipated in FY 2011.
- Advanced technologies that support delivery of Technology Oversight Group (TOG)-approved FNC enabling capabilities (EC) structured to close operational capability gaps in missile defense.
- Joint Integrated Fire Control (JIFC) S&T planning and preparations, non-FNC expansion of the AADI ADSAM demonstration, to support participation of Army, Air Force and coalition sensor and weapon test assets. The metric for this expanded participation is a series of demonstrations in FY08-09 that show a technology basis for effective interoperability with Navy and Marine Corps participating systems. These additional demonstrations are designed to show the viability of a multi-Service/coalition JIFC capability to defend expeditionary forces from air and missile attacks.

Funding increase from FY 2007 to FY 2008 results from JIFC demonstration S&T efforts and initiation of EDWC and PCNW projects. Funding decrease in FY 2009 reflects near completion of AADI and completion of DWC and DSC projects.

FY 2007 Accomplishments:

- Continued AADI ADSAM demonstration planning and coordination efforts.
- Continued development of DSC algorithms and operational concept for TAMD sensor management.
- Continued testing and demonstration of DWC combat system algorithms developed under PE 0602123N.
- Continued AADI planning and coordination for FY 2008 Navy ADSAM live-fire demonstration.

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FY 2008 Plans:

- Continue all efforts of FY 2007.
- Complete testing and demonstration of DWC and DSC algorithms.
- Initiate EDWC, NII and PCNW project efforts.
- Initiate JIFC demonstration S&T planning and preparations.

FY 2009 Plans:

- Continue all efforts of FY 2008, less those noted as complete above.
- Complete AADI project and JIFC effort.

	FY 2007	FY 2008	FY 2009
HIGH SPEED CRAFT TECHNOLOGY	2,973	0	0

X-Craft is envisioned as an S&T platform designed for Littoral Combat Ship (LCS) risk reduction and mission module demonstration. A high-speed, all-aluminum catamaran, it displaces 1400 tons at full load. Performance requirements are 50 knots at combat load (about 1200 tons), 40 knots in sea state 4, and a 4000 nautical miles range without replenishment. It will be capable of landing two helicopters up to the size of SH-60R, transporting and operating autonomous vehicles, and carrying several reconfigurable mission modules in standard Twenty-foot Equivalent Unit (TEU) boxes. The crew will be minimal and the vessel will be built to commercial American Bureau of Shipping (ABS) standards.

FY 2007 Accomplishments:

- Completed development of drag reduction and lifting body technology and lifting body hull forms.

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C. OTHER PROGRAM FUNDING SUMMARY - NAVY RELATED RDT&E::
PE 0204152N E-2 Squadrons
PE 0205601N HARM Improvement
PE 0206313M Marine Corps Communications Systems
PE 0601153N Defense Research Sciences
PE 0602123N Force Protection Applied Research
PE 0602131M Marine Corps Landing Force Technology
PE 0602235N Common Picture Applied Research
PE 0602271N RF Systems Applied Research
PE 0603235N Common Picture Advanced Technology
PE 0603271N RF Systems Advanced Technology
PE 0603502N Surface and Shallow Water Mine Countermeasures
PE 0603561N Advanced Submarine System Development
PE 0603563N Ship Concept Advanced Design
PE 0603564N Ship Preliminary Design & Feasibility Studies
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

OTHER PROGRAM FUNDING SUMMARY - NON-NAVY RELATED RDT&E::
Not applicable.

D. ACQUISITION STRATEGY:
Not applicable.

FY 2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2008
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PROJECT NUMBER: 3049 PROJECT TITLE: FORCE PROTECTION

Project Number & Title	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
3049 FORCE PROTECTION	2,602	2,079	2,236	2,377	2,524	2,572	2,625

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The efforts in this project shifted focus to protection of Naval Installations starting in FY 2006. Other efforts (water-mist and volume sensor work) moved to Project 2912 in FY 2006. Advanced technologies developed, critical to protecting naval installations, will provide seamless full spectrum protection against asymmetric terrorist attack by improving the ability to: sense developing and immediate threats; shape our responses through improved situational awareness and decision making; shield personnel, mission critical facilities, infrastructure, and operating fleet assets; maintain essential functions; and sustain and restore critical services in the aftermath of an incident. Technologies developed will also seek to reduce the required manpower and skill levels devoted to the force protection mission.

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2007	FY 2008	FY 2009
EMERGING THREATS	2,602	2,079	2,236

This activity includes: Advanced technologies developed, critical to protecting naval installations, will provide seamless full spectrum protection against asymmetric terrorist attack by improving the ability to: sense developing and immediate threats; shape our responses through improved situational awareness and decision making; shield personnel, mission critical facilities, infrastructure, and operating fleet assets; maintain essential functions; and sustain and restore critical services in the aftermath of an incident. Technologies developed will also seek to reduce the required manpower and skill levels devoted to the force protection mission.

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FY 2007 Accomplishments:

- Continued development of lower cost/higher performance Force Protection sensors and automated detection algorithms, and decision support tools.
- Initiated interim demonstration of prototype Force Protection sensors.
- Initiated development of intrusion/incident response countermeasures for Force Protection.

FY 2008 Plans:

- Continue all efforts of FY 2007.
- Initiate full scale demo of swimmer defense system including sensors and response countermeasures.
- Initiate interim demonstration of force protection detection and response system with automated detection and self learning algorithms.

FY 2009 Plans:

- Continue all efforts of FY 2008.
- Initiate research to reduce force protection manpower and equipment costs through automation and predictive learning algorithms.
- Initiate threat characterization research and perception experiments for sensor performance optimization and model development and validation.

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C. OTHER PROGRAM FUNDING SUMMARY - NAVY RELATED RDT&E:
PE 0204152N E-2 Squadrons
PE 0205601N HARM Improvement
PE 0206313M Marine Corps Communications Systems
PE 0601153N Defense Research Sciences
PE 0602123N Force Protection Applied Research
PE 0602131M Marine Corps Landing Force Technology
PE 0602235N Common Picture Applied Research
PE 0602271N RF Systems Applied Research
PE 0603235N Common Picture Advanced Technology
PE 0603271N RF Systems Advanced Technology
PE 0603502N Surface and Shallow Water Mine Countermeasures
PE 0603561N Advanced Submarine System Development
PE 0603563N Ship Concept Advanced Design
PE 0603564N Ship Preliminary Design & Feasibility Studies
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

OTHER PROGRAM FUNDING SUMMARY - NON-NAVY RELATED RDT&E:
Not applicable.

D. ACQUISITION STRATEGY:
Not applicable.

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CONGRESSIONAL PLUS-UPS:

	FY 2007	FY 2008
ACCELERATED DEVELOPMENT OF MOBILE ACOUSTIC COUNTERMEASURE FOR FORCE PROTECTION FNC	971	0

FY 2007 Accomplishments: Initiated Mobile Acoustic Countermeasure efforts.

	FY 2007	FY 2008
ACCELERATING FUEL CELLS MANUFACTURABILITY AND THEIR APPLICATION IN THE ARMED FORCES	0	2,750

FY 2008 Plans: Establish a cooperative industry/academic fuel cell test, development and demonstration center, and conduct the research required to advance and demonstrate fuel cell manufacturing feasibility and readiness for field testing for a wide range of applications, initially including surface ships, unmanned underwater vehicles, ground vehicles and mobile equipment such as light carts and fork lifts, stationary and mobile power generation, unmanned aerial vehicles and ground support.

	FY 2007	FY 2008
ADVANCED LOGISTICS FUEL REFORMER FOR FUEL CELLS	0	2,400

FY 2008 Plans: Develop fuel cell technology and deploy next-generation systems, by conducting a rigorous, targeted research, development and field trial demonstration program for use with fuel cell systems and components

	FY 2007	FY 2008
ADVANCED VOLUME SENSOR SYSTEM	0	1,588

FY 2008 Plans: This effort supports the advanced volume sensor system.

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	FY 2007	FY 2008
AFFORDABLE DISTRIBUTED APERTURE IRCM FOR HELICOPTERS AND REGIONAL JETS	3,885	0

FY 2007 Accomplishments: Integrated a large format mid-wave infrared (MWIR) two-color focal plane array (FPA)-based sensor and a miniature laser beam director for Distributed Aperture Infrared Countermeasures (DAIRCM). Incorporated a laser warning sensor; developed a real-time processor capable of handling the higher data rate of the large format FPA; and produced a fiber-optic MWIR transmission line with reduced core diameter to improve the output of the beam director.

	FY 2007	FY 2008
AGILE PORT AND HIGH SPEED SHIP TECHNOLOGY	2,331	2,384

FY 2007 Accomplishments: Initiated efforts to support an agile port concept concentrating on the inland port concept and enabling ship technologies including high power waterjets.

FY 2008 Plans: This effort supports agile port and high speed ship technology.

	FY 2007	FY 2008
AVIATION GROUND ADVANCED TECHNOLOGY	2,138	0

FY 2007 Accomplishments: Continued effort that focused on research, development, test, and evaluation of the Aviation Ground Navigation System (AGNAS) full-scale prototype system configuration, including demonstrations of automated aircraft docking and towing operations at the local municipal airport.

	FY 2007	FY 2008
CENTER FOR APPLIED RESEARCH FOR AUTONOMOUS SYSTEMS	1,417	0

FY 2007 Accomplishments: Developed innovative approaches & concepts in intelligent autonomy and advanced control. These autonomous technologies developments were in the areas of dynamic control, obstacle detection and management, group behavior and planning of multiple heterogeneous vehicles, control in rough sea

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conditions, and supervisory control.

	FY 2007	FY 2008
COMPLETION OF ADVANCED SHIP SERVICE FUEL CELL POWER PLANT	971	0

FY 2007 Accomplishments: Completed factory testing and additional performance characterization for the 625 kiloWatt Molten Carbonate Fuel Cell system at the manufacturer's test site and continued development of an advanced DC/DC converter that can be used in a fuel cell system.

	FY 2007	FY 2008
CRYOGENIC POWER SYSTEM FOR UNMANNED UNDERWATER VEHICLES	1,262	994

FY 2007 Accomplishments: Initiated development, fabrication and demonstration of a multifunctional cryogenic power system consisting of a PEM (Proton Exchange Membrane) fuel cell and liquid hydrogen and oxygen storage for a 21" unmanned undersea vehicles (UUVs).

FY 2008 Plans: This effort supports the Unmanned Underwater Vehicle Cryogenic Power system.

	FY 2007	FY 2008
DAMAGE CONTROL WIRELESS COMMUNICATIONS AND EXPERIMENTATION (DCWC&E)	2,137	0

FY 2007 Accomplishments: Continued research to enhance a multi-path reconfigurable Damage Control (DC) communications capability. This project built on the FY 2005 Congressional Future Naval Capabilities-Crew Modeling and Simulation (FNC-CMS) effort by developing complementary capabilities through the addition of components ruggedized for shipboard use. This effort explored technologies and equipment to add imagery and personnel location capability to the current prototype capability and develops a prototype communications capability suitable for operational full scale testing onboard Ex-USS Shadwell at the Navy Safety and Survivability/Damage Control Laboratory in Mobile, Alabama.

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	FY 2007	FY 2008
DETECTING IMPROVISED EXPLOSIVE DEVICES (IEDS)	971	994

FY 2007 Accomplishments: Initiated development of EO/IR technology for the detection of IEDs in a stand-off mode. This effort would enhance signature detection of certain types of IEDs.

FY 2008 Plans: This effort supports detecting improvised explosive devices.

	FY 2007	FY 2008
DEVELOPMENT OF HIGH PERFORMANCE SANDWICH PANEL CONSTRUCTION	1,749	0

FY 2007 Accomplishments: Continued testing and qualification of low cost, lightweight steel sandwich structures for surface ship applications.

	FY 2007	FY 2008
DIRECT MOTOR DRIVEN WATERJET	0	1,588

FY 2008 Plans: This effort supports the direct motor driven waterjet.

	FY 2007	FY 2008
ELECTROCHEMICAL FIELD-DEPLOYABLE SYSTEM FOR POTABLE WATER GENERATION	0	2,384

FY 2008 Plans: This effort supports the electromechanical field-deployable system for potable water generation.

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	FY 2007	FY 2008
FORMABLE TEXTILE FOR COMPLEX SHAPED AEROSPACE COMPOSITES	0	1,588

FY 2008 Plans: Initiate the development of infrastructure necessary to provide a stable, consistent environment to support an aircraft manufacturing program utilizing materials which hold promise for reducing manufacturing costs of aerospace-grade, complex curved structural composite parts by enabling, via the materials, improved formability, greater utilization of automated manufacturing technologies as opposed to the current labor intensive hand lay-up methods.

	FY 2007	FY 2008
FUTURE FUEL NON-TACTICAL VEHICLE INITIATIVE	0	1,588

FY 2008 Plans: This effort supports the future fuel non-tactical vehicle initiative.

	FY 2007	FY 2008
HIGH POWER DENSITY MOTOR DRIVE	1,311	0

FY 2007 Accomplishments: Continued efforts to design, build, test and demonstrate a high performance motor drive capable of simultaneously meeting the Navy's requirement for high power density, low distortion, low acoustic noise, and high efficiency for demanding naval ship propulsion applications.

	FY 2007	FY 2008
HIGH SPEED POWER NODE SWITCHING AND CONTROL CENTER	2,331	1,588

FY 2007 Accomplishments: Expanded development of the concept of microsecond fault detection and circuit interruption, and determined its applicability to Navy shipboard electrical power systems.

FY 2008 Plans: This effort supports high speed power node switching and control center.

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	FY 2007	FY 2008
HIGH TEMPERATURE SUPERCONDUCTING (HTS) GENERATOR	2,184	0

FY 2007 Accomplishments: Continued conceptual design of 10.6 MegaWatt High Temperature Superconducting (HTS) Generator, risk assessments, and mitigation plans for seven key components for 36.5 MegaWatt Class HTS Generator technology.

	FY 2007	FY 2008
HTS AC SYNCHRONOUS NAVY PROPULSION MOTOR	2,914	0

FY 2007 Accomplishments: Construction of the propulsion motor completed by American Superconductor at the Philadelphia Naval Business District, Building 16. Completed IEEE testing of the motor and it was delivered to NAVSEA (PMS-500) for full power testing.

	FY 2007	FY 2008
INNOVATIVE METHODS FOR SHIP-BUILDING AFFORDABILITY	0	1,588

FY 2008 Plans: Support design development testing and qualification of low cost, light weight steel sandwich structures for U.S. Navy ships including CVN-78/79, DDG-1000 and LCS.

	FY 2007	FY 2008
INTEGRATED ADVANCED COMMUNICATIONS TERMINAL (IACT)	0	994

FY 2008 Plans: This effort supports development of the Integrated Advanced Communications Terminal (IACT).

	FY 2007	FY 2008
LARGE UNMANNED UNDERSEA VEHICLE (LUUV) TEST BED	1,262	0

FY 2007 Accomplishments: Continued design modifications to the existing Large Unmanned Undersea Vehicle (UUV) Test Bed that will facilitate advanced UUV systems and scaled advanced submarine propulsion systems demonstrations.

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	FY 2007	FY 2008
LASER PERIMETER AWARENESS SYSTEM	0	1,488

FY 2008 Plans: Initiate the installation and integration of the Laser Perimeter Awareness System (LPAS) with the Electronic Harbor Security System, Command, Control, Communications and Display. Conduct system testing and evaluation of the LPAS at the Naval Facility at San Diego for waterside applications to validate range and detection operations. If successful this system will provide additional coverage with its laser based sensor to detect surface swimmers, small boats, and other waterborne threats at Naval installations to protect personnel, equipment, facilities, infrastructure, and US Navy ships.

	FY 2007	FY 2008
LIGHTWEIGHT, RUGGEDIZED RECONNAISSANCE ROBOT	975	0

FY 2007 Accomplishments: Developed, in conjunction with the National Center for Defense Robotics (NCDR) technology collaborative, a working, functional prototype of a small, lightweight, multi-link manipulator arm for a lightweight, ruggedized reconnaissance robot ground vehicle. Additionally, identified, adapted, and demonstrated available advanced robotic technology in support of the Marines' route clearance and related missions.

	FY 2007	FY 2008
M65 BISMALEIMIDE CARBON FIBER PREPREG	0	2,384

FY 2008 Plans: Qualify a new controlled-flow resin technology in the manufacture of composite aircraft parts, resulting in 60% manufacturing cost savings over older methods. Supports the F-22, F-35, Long Range Strike, UAVs and other future programs.

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	FY 2007	FY 2008
MANUFACTURING AND REPAIR CELL	3,157	3,971

FY 2007 Accomplishments: Demonstrated the fabrication of new and replacement parts and components. In addition, the direct metal deposition and friction stir processing technologies were integrated into a manufacturing system and evaluated for ability to be field deployed.

FY 2008 Plans: This effort supports manufacturing and repair cell.

	FY 2007	FY 2008
MARITIME MOBILE FORCE PROTECTION PROGRAM	0	1,588

FY 2008 Plans: This effort supports the maritime mobile force protection program.

	FY 2007	FY 2008
MISSILE WARNING SENSOR	2,719	0

FY 2007 Accomplishments: Developed a large format (400 by 400 pixels) mid-wave infrared (MWIR) two-color focal plane array (FPA) to be used in a higher accuracy missile warning sensor. Developed methods to reduce the number of bad pixels that can be detrimental to missile location accuracy.

	FY 2007	FY 2008
MULTI-FUEL COMBUSTOR FOR SHIPBOARD FUEL CELLS	0	1,588

FY 2008 Plans: Naval Sea Systems Command and Naval Surface Warfare Center to evaluate a delivered scaled up Multi-Fuel Combustor capable of integration into a shipboard fuel cell system.

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	FY 2007	FY 2008
MULTIPOLAR MOTOR	1,068	0

FY 2007 Accomplishments: Continued very small scale prototypes for an innovative permanent magnet multipolar motor, and developed a detail design for a 1,000 to 5,000 horsepower prototype motor.

	FY 2007	FY 2008
PHASE II VIRENT-NASEA ANTIFREEZE HYDROGEN PROJECT	971	0

FY 2007 Accomplishments: Continued to develop fuel cell systems and reforming technologies focused on using waste ethylene glycol and other novel fuels that are part of the existing logistics chain. Continued the program that was initiated in the FY06 MULTI-FUEL PORTABLE FUEL CELL POWER PROJECT Congressional Plus-Up.

	FY 2007	FY 2008
POROUS SILICON-BASED DIRECT METHANOL FUEL CELL	1,311	0

FY 2007 Accomplishments: Continued development and demonstration of an air-independent porous silicon fuel cell.

	FY 2007	FY 2008
PURE HYDROGEN SUPPLY FROM LOGISTICS FUEL	1,164	2,384

FY 2007 Accomplishments: Continued development of pure hydrogen supply extraction system. This effort was focused on the design, construction and demonstration of a large-scale, innovative hydrogen membrane separator system that is sulfur tolerant to concentrations greater than 100 parts per million.

FY 2008 Plans: This efforts supports pure hydrogen supply from logistics fuel.

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	FY 2007	FY 2008
REMOTE CONTINUOUS ENERGETIC MATERIAL MANUFACTURING FOR PYROTECHNIC IR DECOYS	1,075	0

FY 2007 Accomplishments: Continued the development of improved twin-screw extruder processing technologies (from a safety & reliability standpoint) for remote energetic material used in pyrotechnic systems (e.g. infrared flare decoys).

	FY 2007	FY 2008
SEA FIGHTER	14,566	0

FY 2007 Accomplishments: Completed development of specifications for a ship alteration package to improve SEA FIGHTER capabilities. These modifications include necessary improvements to aviation equipment, damage control, crew facilities, communications and topside survivability improvements. A shipyard availability will occur in FY 2008 to implement these improvements.

	FY 2007	FY 2008
SECURE INFRASTRUCTURE TECHNOLOGY LABORATORY (SINTEL)	6,215	3,178

FY 2007 Accomplishments: Developed and evaluated diver and small boat technologies for Anti-Terrorism/Force Protection at the Secure Infrastructure Technology Laboratory (SINTEL).

FY 2008 Plans: This effort supports secure infrastructure technology laboratory.

	FY 2007	FY 2008
SINGLE GENERATOR OPERATIONS LITHIUM ION BATTERY	3,206	4,966

FY 2007 Accomplishments: Initiated development of lithium ion battery technology for use with shipboard fuel cell systems.

FY 2008 Plans: This effort supports single generator operations lithium ion battery.

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	FY 2007	FY 2008
SMART MICRO-SENSOR ARRAYS	971	0

FY 2007 Accomplishments: Initiated efforts to develop and demonstrate a smart micro sensor array for damage control and toxic industrial chemical detection. A portable, hand-held detector unit is under development to assist damage control personnel to detect and identify hazards.

	FY 2007	FY 2008
SOLID OXIDE FUEL CELLS (SOFCs)	971	0

FY 2007 Accomplishments: Continued to design, construct, install, and demonstrate a 100 kiloWatt planar Solid Oxide Fuel Cell cluster. The cluster will consist of four discrete and clustered 25 kiloWatt fuel cell modules that will initially run on natural gas and then on DoD logistics fuel.

	FY 2007	FY 2008
SOLID STATE DC PROTECTION SYSTEM (SSDCP)	971	397

FY 2007 Accomplishments: Initiated development of a universal solid-state circuit breaker (USSB) for medium voltage Navy power distribution systems. This effort focused on developing programmable thresholds for electrical fault trip points with increased interruption speed within a hybrid USSB that is designed to operate in Navy medium voltage applications.

FY 2008 Plans: This effort supports the Solid State DC Protection System.

	FY 2007	FY 2008
STABILIZED LASER DESIGNATION CAPABILITY	971	0

FY 2007 Accomplishments: Developed system design requirements and target tracking algorithms for an enhanced, medium altitude laser designation capability for medium altitude aircraft operations that can address moving

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targets, as well as targets in a Global Positioning System (GPS)-jammed environment.

	FY 2007	FY 2008
STRATEGIC MOBILITY 21 DEPLOYMENT TECHNOLOGY	2,719	0

FY 2007 Accomplishments: Continued projects that deal with the application of transportation technologies for Joint Force deployment and sustainment support through the development of a prototype Agile Port System (APS) that can be duplicated, adapted and integrated on a national basis and deployed intra-theater to include future Sea Basing operational requirements. Continued mobility projects for Joint Force deployment and sustainment through APS efforts.

	FY 2007	FY 2008
SUPERCONDUCTING DC HOMOPOLAR MOTOR FOR ELECTRIC DRIVE SHIPS	2,526	0

FY 2007 Accomplishments: Continued superconducting DC homopolar main propulsion motor efforts. The superconducting DC homopolar main propulsion motor is currently in the detailed design phase by General Atomics and is expected to be delivered to the Navy in FY 2011.

	FY 2007	FY 2008
TACTICAL COMPACT OPTICAL INTERROGATOR	0	1,588

FY 2008 Plans: This effort supports the tactical compact optical interrogator.

	FY 2007	FY 2008
TRANSPARENT ARMOR	486	0

FY 2007 Accomplishments: Continued efforts to establish a research and development program to explore new materials and strategies for fabrication of transparent materials with the mechanical properties needed for providing armor protection.

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	FY 2007	FY 2008
UNDERGROUND COORDINATION OF MANAGED MESH-NETWORKS	0	795

FY 2008 Plans: This effort supports the underground coordination of managed mesh-networks.

	FY 2007	FY 2008
UNMANNED SYSTEMS TECHNOLOGIES FOR EXPLOSIVE ORDNANCE DISPOSAL	975	0

FY 2007 Accomplishments: Continued developing unmanned ground system technologies for explosive ordnance disposal (EOD). Specifically, integrated low-cost, sensor and software technology on a lightweight, expendable Unmanned Aerial System (UAV), to produce an "eye-in-the-sky" capability that operates autonomously and synchronously with a unmanned ground vehicle (UGV), providing enhanced situational awareness and increased security in support of EOD operations and missions. Also integrated onto a UGV, a low-cost, colorized ranging system that generates a real-time, virtualized, three dimensional, off-robot view of the UGV maneuvering in its physical environment. This effort has the future potential to completely replace the need for live video feedback in order to tele-operate UGVs, thereby enabling the use of very low-band communications and greatly expanding the range over which they can operate.

	FY 2007	FY 2008
WAVE POWER ELECTRIC POWER GENERATING SYSTEM FOR HAWAII NAVAL BASE	971	0

FY 2007 Accomplishments: Initiated analysis of performance data for the three direct drive power conversion methods (hydraulic, rack and pinion, and permanent magnet systems).

	FY 2007	FY 2008
WIDE-AREA SENSOR FOR FORCE PROTECTION TARGETING	2,526	1,588

FY 2007 Accomplishments: Initiated wide-area sensor for force protection targeting efforts by developing an integrated EO/IR sensor prototype for demonstration.

FY 2008 Plans: This effort supports wide-area sensor for force protection targeting.

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	FY 2007	FY 2008
WIDE-BAND GAP SEMICONDUCTOR MATERIALS	5,050	1,588

FY 2007 Accomplishments: Continued development of manufacturing processes for silicon carbide semiconductor crystals capable of higher power levels and greater temperature ranges than currently employed silicon-based materials. Crystal diameter capability was successfully increased from three to four inches. Issues associated with high thermal gradients in growth systems which affect silicon carbide crystal quality, were realized and investigations initiated.

FY 2008 Plans: This effort supports development in wide-band gap semiconductor materials.

	FY 2007	FY 2008
WIRELESS CONDITION-BASED MAINTENANCE MONITORING FOR NAVAL SHIPYARD EQUIPMENT AND FACILITIES	1,603	0

FY 2007 Accomplishments: Continued development of a wireless condition-based maintenance monitoring system of naval shipyard equipment and facilities for efforts to reduce maintenance costs and operational time. The focus of these efforts were on such equipment as mobile and overhead cranes, drydock pumps, compressors and other equipment that paces ship production and repair.