Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602123N: *Force Protection Applied Res*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	154.170	107.448	156.901	-	156.901	156.391	146.367	146.023	133.105	Continuing	Continuing
0000: *Force Protection Applied Res*	88.359	107.448	156.901	-	156.901	156.391	146.367	146.023	133.105	Continuing	Continuing
4027: *Naval Innovative Science and Engineering*	9.748	-	-	-	-	-	-	-	-	0.000	9.748
9999: *Congressional Adds*	56.063	-	-	-	-	-	-	-	-	0.000	56.063

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 (Feb 2009). 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 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, Cross Pillar Enablers and Enterprise and Platform Enablers (EPE).

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 ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	146.045	107.448	111.156	-	111.156
Current President's Budget	154.170	107.448	156.901	-	156.901
Total Adjustments	8.125	-	45.745	-	45.745
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.028	-			
• SBIR/STTR Transfer	-1.550	-			
• Program Adjustments	-	-	46.714	-	46.714
• Section 219 Reprogramming	8.724	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.969	-	-0.969
• Congressional General Reductions Adjustments	-0.021	-	-	-	-
• Congressional Add Adjustments	1.000	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Project: 9999: *Congressional Adds*		
Congressional Add: *Advanced Battery System for Military Avionics Power Systems*	1.593	-
Congressional Add: *Advanced Composite Manufacturing for Composite High-Speed Boat Design*	1.593	-
Congressional Add: *Advanced Energetics Initiative*	3.983	-
Congressional Add: *Advanced Simulation Tools for Composite Aircraft Structures*	1.593	-
Congressional Add: *Alternative Energy Research*	18.423	-
Congressional Add: *Power Generation Carbon Comp Thin Films*	1.593	-
Congressional Add: *Center for Autonomous Solar Power*	3.983	-
Congressional Add: *Energetic Nano-Materials Agent Defeat Initiative*	1.593	-
Congressional Add: *Fuel Efficient, High Specific Power Free Piston Engine for USSVs*	1.593	-
Congressional Add: *Harbor Shield - Homeland Defense Port Security Initiative*	1.593	-
Congressional Add: *Integration of Electro-Kinetic Weapons Into Next Generation Navy Ships*	3.983	-

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Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Congressional Add: *Lithium Ion Storage Advancement for Aircraft Applications*	1.992	-
Congressional Add: *Magnetic Refrigeration Technology for Naval Applications*	3.983	-
Congressional Add: *Multi-Mission Unmanned Surface Vessel*	1.992	-
Congressional Add: *Non Traditional Ballistic Fiber and Fabric Weaving for Force Protection*	1.992	-
Congressional Add: *Hybrid Power Systems*	1.992	-
Congressional Add: *Proton Exchange Membrane Fuel Cell for Underwater Vehicles*	1.593	-
Congressional Add: *Joint Heavy-Lift Rotocraft Research*	0.996	-
Congressional Add Subtotals for Project: 9999	56.063	-
Congressional Add Totals for all Projects	56.063	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: *Force Protection Applied Res*	88.359	107.448	156.901	-	156.901	156.391	146.367	146.023	133.105	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. It supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. The goal is to provide the ability to win or avoid engagements with other platforms or weapons and, in the event of engagement, to resist and control damage while preserving operational capability. Within the Naval Transformational Roadmap, this investment directly supports the Theater Air and Missile Defense transformational capability required by Sea Shield and the Ship to Objective Maneuver key transformational capability by virtue of improvements in platform offensive performance, stealth, and self defense. This effort supports the FNC in the areas of Sea Shield, Cross Pillar Enablers, and Enterprise and Platform Enablers (EPE).

This project reflects the alignment of Future Naval Capability (FNC) program investments for the following Enabling Capabilities (ECs): Anti-Ship Missile Defense Technologies, Sea Based Missile Defense of Ships & Littoral Installations, Advanced Threat Aircraft Countermeasures, Helicopter Low-Level Operation, Four Torpedo Salvo Defense, Shipboard Force Protection in Port and Restricted Waters - Detection and Classification, Underwater Total Ship Survivability, Compact Power Conversion Technologies and Affordable Submarine Propulsion and Control Actuation.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: ADVANCED ENERGETICS	2.242	2.120	0.201
Description: 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. FY 2011 to FY 2012 funding decrease is due to the conclusion and transition of Advanced Energetics efforts in the areas of enhanced performance formulations, insensitive explosives, detonation merging techniques, and reactive materials. Remaining funding will be used to complete transition efforts and to develop next generation concepts as described below. ***FY 2010 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. - Continued Advanced Energetics research in development and evaluation of advanced explosive/			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
propellant/reactive ingredients and formulations for next generation higher performing systems. - Continued Advanced Energetics research in development of advanced directed hydro-reactive material warhead concepts to enhance performance of undersea warheads. - 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. - Continued Advanced Energetics research in advanced multiphase blast concepts employing dense metalized explosives to enhance performance of air and underwater blast warheads. - Continued 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- Continued 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 application specific target interaction, lethality modeling and ordnance specific experiments and demonstrations to Electromagnetic Rail Gun, PE 0603114N. - Continued 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. - Continued development and evaluation of energetic ingredients and formulations for next generation higher performance applications. Conclude scale-up development and testing. ***FY 2011 Plans:*** - Continue all efforts of FY 2010. ***FY 2012 Plans:*** -Complete or terminate efforts associated with Energetics Applied Research due to cessation of funding in FY12.			
Title: AIRCRAFT TECHNOLOGY ***Description:*** The Aircraft Technology activity develops technologies for enhanced capability of naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, scaleable naval air vehicle technologies, such as - autonomous air vehicle command and control, helicopter and tiltrotor rotor drive systems, aerodynamics, propulsion systems, materials, structures	13.134	14.086	42.264

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012

and flight controls for future and legacy air vehicles. This activity directly supports the Naval Aviation Enterprise Science and Technology Objectives and the Naval Science and Technology Strategic Plan, principally in the Platform Mobility, Survivability and Self-defense, Affordability/Maintainability/Reliability and Power Projection Focus Areas.

FY 2011 and FY 2012 funding increase is due to two programs beginning in FY12: Variable Cycle Advanced Technology (VCAT) and Autonomous Aerial Cargo/Utility System (AACUS). VCAT will identify and mature critical, relevant variable/adaptive cycle propulsion system technologies for the next generation carrier-based TACAIR/ISR systems. AACUS will develop advanced autonomous capabilities to enable sea based resupply of distributed forces and casualty evacuation, in response to Navy/Marine Corps needs in Operation Iraqi Freedom/Operation Enduring Freedom/Counter Insurgency Operations (OIF/OEF/COIN).

FY 2010 Accomplishments:
- Continued development of survivability/reduced observables technology. Metrics are classified.
- Continued development of flight control, intelligent autonomy, command & control, and multi-vehicle cooperation technologies for Unmanned Air Vehicle (UAV).
- Continued development of a Computational Fluid Dynamics (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.
- Continued vertical lift technology investments.
- Continued research in fixed wing aircraft/vertical lift/rotorcraft technology areas such as aeromechanics, propulsion, active rotor control for enhanced ship board operations, structural concepts compatible with shipboard operations, autonomous operations in the shipboard and austere environment, and innovative vehicle concepts for naval application.
- Initiated research in vertical lift aircraft /rotorcraft technology areas such as aeromechanics, propulsion, active rotor control for enhanced ship board operations, structural concepts compatible with shipboard operations, autonomous operations in the shipboard and austere environment, and innovative vehicle concepts for naval application.

FY 2011 Plans:
- Continue all efforts of FY 2010.

FY 2012 Plans:
- Continue all efforts of FY 2011.
- Initiate the Variable Cycle Advanced Technology (VCAT) Program. Critical technology development efforts will begin with major engine manufacturers and weapon system contractors to develop and mature to TRL 4/5 the highest priority, long-lead,

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
propulsion system technologies, including variable/adaptive cycle engine components, for next generation carrier-based TACAIR/ ISR systems. - Initiate Autonomous Aerial Cargo/Utility System (AACUS) advanced autonomous capability technologies for sea based resupply of distributed forces and casualty evacuation. - Initiate maturation of Science of Autonomy basic research into applied research to reduce manning for unmanned system operations in shipboard and expeditionary operations, enable safe and sustainable unmanned air system operations in challenging environmental/weather conditions, and provide robust cooperation between unmanned systems that can adapt to changes in the battlespace and environment.			
Title: FLEET FORCE PROTECTION AND DEFENSE AGAINST UNDERSEA THREATS	10.934	11.723	13.362
Description: 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 electro-optical (EO), infrared (IR), radio frequency (RF), electro-magnetic (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 activity is to develop a torpedo defense capability to fill Sea Shield Warfighting Capability Gap/Enabling Capability: Platform Defense against Undersea Threats, including Four Torpedo Salvo Defense. This provides a capability to prevent any of the torpedoes, in up to four-torpedo salvos fired at high value units, from hitting those units. 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; and Shipboard Force Protection in Port and Restricted Waters - Detection and Classification. This activity supports the development of technologies that aid the helicopter pilot when operating in degraded visual cue environments (brown-out). ***FY 2010 Accomplishments:***			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Sensors & Associated Processing - Continued efforts in biomimetic sonar systems for operation in air and aquatic environments based on bat echolocation neurophysiology and information processing algorithms. - Continued efforts in biomimetic signal processing: panoramic periscope for submarines and temporal pattern recognition for Systems for Security Breaching Noise Detection. - Continued efforts in bioinspired quiet, efficient and maneuverable self-propelled line array using high-lift propulsors based on insect biomechanics. - Continued studies to develop catalytic activity profile of bioactive coatings against chemical agents. Designed and initiated fabrication of coatings to degrade both, chemical and biological agents. - Continued 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). - Continued 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 import and transiting restricted waters. - Continued the Countermeasures for Advanced Imaging Infrared (IIR) Guided Missiles FNC effort by initiating IIR threat model development. - Continued the Countermeasures for Millimeter Wave Guided Missiles FNC effort by initiating requirements analysis. - Continued the Multifunction Capabilities for Missile Warning Sensors FNC effort by commencing data collection and analysis. - Continued efforts to design microfabricated system for 3-color fluorescence measurements using integrated waveguides. - Continued effort to develop new, highly selective, preferential oxidation catalysts for the generation of power from the reformate gas purification process. - Continued effort to develop aspheric gradient index optics. - Continued the Helicopter Laser-Based Landing Aids FNC effort by commencing experimentation, data collection and analysis. Brown-out testing was successfully completed at Yuma Proving Grounds in April. - Completed the design and fabrication of self-reporting coatings for system failure detection. Underwater Platform Self-Defense - Continued development of low-cost, light weight swimmer detection and localization technologies.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Continued 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 2011 Plans:*** Sensors & Associated Processing - Continue all efforts of FY 2010 unless completed above. - Continue the Helicopter Laser-Based Landing Aids FNC effort by development of a ladar capable of sensing through degraded visual cue environments (brown-out) and providing a display format that is usable to the pilot. - Complete FNC EC Shipboard Force Protection in Port and Restricted Waters - Detection and Classification. This project 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 in port and transiting restricted waters. Underwater Platform Self-Defense - Continue all efforts of FY 2010. - Complete development of optimized microfluidic components suitable for explosive, chemical, and biological sensing applications, and initiate the development of models required to apply existing automated design tools to components with more complex physics and more general geometries. In support of FNC (Force Projection Applied Research), perform the following efforts: - Initiate the development and application of emerging technologies that support delivery of Navy approved FNC enabling capabilities structured to close operational capability gaps in force projection. - Initiate the packaging of emerging force projection technologies into deliverable FNC products and ECs that can be integrated into acquisition programs within a five year period. - Initiate the development of force projection technologies that support naval requirements identified within the Sea Shield and Sea Strike naval capability pillars as well as those applicable to specific naval platforms and those that apply across the naval enterprise. ***FY 2012 Plans:*** Sensors & Associated Processing - Continue all efforts of FY 2011, less those noted as completed above. - Complete the Multifunction Capabilities for Missile Warning Sensors FNC effort. - Complete the Helicopter Laser-Based Landing Aids FNC effort by development of a ladar capable of sensing through degraded visual cue environments (brown-out) and providing a display format that is usable to the pilot.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Underwater Platform Self-Defense - Continue all efforts of FY 2011, less those noted as completed above.			
Title: MISSILE DEFENSE (MD)	9.960	9.898	13.222
Description: This activity describes Missile Defense S&T projects of the Sea Shield FNC program, and non-FNC-related Navy research. - Naval Interceptor Improvements (NII) technology upgrades for STANDARD Missile (SM) future fleet air defense missile. Metrics are 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 for an Automated Battle Management Aid (ABMA) that recommends hard kill weapons, soft kill countermeasures, and emission control measures to reduce the probability of being hit or to optimally engage threats with self-defense weapons. Metric is improved probability of negation (Pneg) against advanced ballistic & cruise missile anti-ship threats that may be susceptible to decoys and jamming. - Positive Control of Naval Weapons (PCNW) - additional technology upgrades for SM to enable forward relay, remote launch & potentially forward pass engagements. Metrics are classified. - Midcourse and Terminal Algorithms (MTA) for prototype state-of-the art weapon system algorithms for STANDARD Missile (SM) engagements vs modern anti-ship missile threats. Specific metrics are classified. - Enhanced Lethality Guidance Algorithms (ELGA) to increase Navy shipboard missile probability of kill versus an expanded threat set including ASBMs and advanced ASCMs. Metrics for this project are classified. - Enhanced Maneuverability Missile Airframe (EMMA) technology for Navy shipboard missile systems to intercept highly agile maneuvering ASCMs and ASBMs. Metrics for this project are classified. - Integrated Active & Electronic Defense (IAED) technology basis for response combinations of active and electronic weapons & systems to optimize Pneg against ASBMs and ASCMs, including potential interactions. Metrics are classified. - Radar Resource Manager (RRM) algorithms and software for weapon control system capability to provide dynamic platform and force-level radar management and coordination of radar resources for integrated air and missile defense (IAMD). Metrics will be classified. - Non-FNC-related investigation of effects of charged particle layers on UHF to S-Band radars used to track space vehicles and initiate development of advanced electromagnetic decoy launchers and payloads. FY 2011 to FY 2012 funding increase reflects initiation of the RRM project. ***FY 2010 Accomplishments:***			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Continued development of advanced electromagnetic decoy launchers and payloads. - Initiated ELGA and EMMA project efforts. ***FY 2011 Plans:*** - Complete EDWC, NII and PCNW development efforts. - Continue all efforts of FY 2010 less those noted as completed above. - Initiate IAED project effort. ***FY 2012 Plans:*** - Continue all efforts of FY 2011. - Initiate RRM project effort.			
Title: STOPPAGE OF LARGE SURFACE VESSELS AT SEA ***Description:*** 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 non-cooperative large, greater than 20 meters or 300 gross tons, vessels at sea 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. FY 2010 to FY 2011 funding increase is due to large-scale demonstrations of various stages of the systems. FY 2011 to FY 2012 funding decrease is due to completion of large-scale demonstrations. ***FY 2010 Accomplishments:*** - Continued analysis and modeling of hydrodynamic forces generated between a large vessel and much smaller intercept craft or Unmanned Surface Vehicle (USV). - Completed prototype development and fabrication for a large-scale propeller entanglement device. - Completed design and fabrication of device and emplacement system to externally inhibit seawater cooling flow to ship propulsion equipment. - Completed the evaluation of technologies capable of remotely exploiting the electronic vulnerabilities identified within critical propulsion and steering systems. - Completed the design and evaluation of a large-scale large vessel momentum reduction device and delivery system. - Completed tactical system engineering and defined the operational parameters for a large vessel momentum reduction device.	6.312	14.870	4.877

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Completed large-scale demonstration of propeller entanglement device. - Completed testing of common large vessel exhaust system components to assess the risk to structural integrity of the exhaust system under elevated pressures associated with blocking exhaust outlets. - Initiated a study to evaluate the required performance parameters of a vehicle capable of emplacing a package to externally inhibit seawater cooling flow to ship propulsion equipment. - Initiated development of a submergible autonomous delivery and deployment capability for a device emplacement package to externally inhibit seawater cooling flow to ship propulsion equipment. - Initiated fabrication of a large-scale demonstration system for a large vessel momentum reduction device. ***FY 2011 Plans:*** - Continue all efforts of FY 2010, less those noted as completed above. - Complete a study to evaluate the required performance parameters of a vehicle capable of emplacing a package to externally inhibit seawater cooling flow to ship propulsion equipment. - Complete development of a submergible autonomous delivery and deployment capability for a device emplacement package to externally inhibit seawater cooling flow to ship propulsion equipment. - Complete fabrication of a large-scale demonstration system for a large vessel momentum reduction device. - Complete analysis and modeling of hydrodynamic forces generated between a large vessel and much smaller intercept craft or Unmanned Surface Vehicle (USV). - Complete demonstration of a large-scale system for a large vessel momentum reduction device. - Initiate large-scale demonstrations of submergible autonomous device components to externally inhibit seawater cooling flow to ship propulsion equipment. ***FY 2012 Plans:*** - Complete large-scale demonstrations of submergible autonomous device components to externally inhibit seawater cooling flow to ship propulsion equipment.			
Title: SURFACE SHIP & SUBMARINE HULL MECHANIC & ELECTRICAL (HM&E) ***Description:*** : Efforts include: signature reduction, hull life assurance, hydromechanics, distributed control for automated survivability (includes damage control), and advanced naval 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	45.777	54.751	82.975

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012

self-healing capability. Advanced naval 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. Advanced Naval Power efforts include: Compact Power Conversion Technologies that reduce the cost of high power conversion equipment required to enable more-electric and all-electric ships. This activity also supports the Overseas Contingency Operations (OCO) Counter IED - Extramural activity which supports applied research for force protection of Naval platforms. Technologies are being developed that focus on prediction, prevention, detection, neutralization, and mitigation of improvised explosive devices in the maritime/littoral environment.

FY 2010 to FY 2011 funding increase is due to the start up and initiation of modeling of hydroacoustics of turbulence propulsor interaction; the effort on exploitation of polymers for the deflection of dissipation of shock wave impact on ship and submarine hull structures; transition of small scale hardware-in-the-loop demonstrator to the academic community for challenge problem formulation and demonstrations of developed model based reasoning control algorithms on full scale hardware test beds. FY 2011 to FY 2012 funding increase is due to expansion of the Counter-Improvised Explosive Devices (C-IED) program, initiation of FNCs in support of Enterprise and Platform Enablers (EPE) and Expeditionary Maneuver Warfare (EMW) pillars, UUV Power and Energy efforts and development of damage control technologies.

FY 2010 Accomplishments:
Survivable Platforms - Reduced Signatures
- Continued advanced numerical acoustic codes (and gridding methods for those codes) for submarines.
- 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 IR and radar detectability prediction capability.
- Continued surface ship super-conductive degaussing with laboratory demonstration loop for Electromagnetic (EM) field accuracy measurements and control methods.
- Continued testing on Advanced Electric Ship Demonstrator (AESD) to assess energy propagation and acoustic radiation mechanisms and to develop mitigation concepts for surface ships.
- Continued IR assessment of two advanced treatments.
- Continued first of a series of IR validation experiments and critical sensitivity analysis.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602123N: *Force Protection Applied Res*	PROJECT 0000: *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Continued Improved Corrosion Related Magnetic (CRM) Field Prediction Model to design compensation systems to reduce ship's CRM signature. - Continued assessment of ship biostatic Radar Cross Section (RCS). - Continued 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. - Continued experimental effort to characterize electric drive motor signature mechanisms and verify modeling and simulation approaches for signature prediction. - Continued development of modeling methods and noise control concepts for modular/reconfigurable submarine architectures. - Continued investigation into hull treatment concepts for acoustic signature/vibration control for surface ships. - Continued development of advanced RF metamaterials for platform signature control. - Continued development of LPI technologies for surface ship emissions including communication, navigation, electronic warfare, and combat systems. - Continued development of modeling methods and noise control concepts for modular/reconfigurable submarine architectures. - Continued investigation into hull treatment concepts for acoustic signature/vibration control for surface ships. - Continued development of advanced RF metamaterials for platform signature control. - Continued development of LPI technologies for surface ship emissions including communication, navigation, electronic warfare, and combat systems. - Continued development of signature modeling approaches for electric actuation and alternate electric drive system architectures. - Continued development of Low probability Intercept (LPI) technologies for surface ship emissions including communication, navigation, electronic warfare, and combat systems. 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, providing 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. - Continued composite and composite-metal hull performance characterization and testing including structural loading, thermal stress and signatures. - Continued effort on an advanced class of polymers as a follow-on to current ERC for application against advanced threats, Overseas Contingency Operations (OCO). - Continued Payload Implosion and Platform Damage Avoidance efforts.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Continued development of reliability-based recoverability methods for assessing damaged ship structures. - Continued development of advanced analytical, numerical and experimental methods in support of platform signature reduction. 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 research into advanced HM&E system reconfiguration approaches, including agent-based control systems and algorithms, and model-based reasoning. - Continued Second Generation distributed systems model development. - Continued demonstration of real-time modeling of multiple distributed systems - utilizing small scale demonstrator. - Continued demonstration of Genetic Algorithm(s) for determining optimal distributed system control strategy. - Continued development of a hardware in-the-loop small scale demonstrator for fluid/thermal/electrical distributed systems. - Continued development of Survivability Analysis Algorithms Operable on a Total Ship Modeling Environment. 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 development design tools for integrated antenna and composite topside. - Continued circulation control analysis for three-dimensional flow effects. - Continued aperstructures microwave communication system. - Continued concept for Ultra High Frequency (UHF)/Very High Frequency (VHF) aperstructures opportunistic array (Advanced Hull-form Inshore Demonstrator - AHFID). - Continued development of methods for determining reliability and vulnerability of aluminum ship structures. 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 development of two-phase flow waterjet concept, Detached Eddy Simulation (DES) method for crashback prediction and numerical prediction method(s) of waterjet cavitation.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602123N: *Force Protection Applied Res*	PROJECT 0000: *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Continued modeling of turbulent flow interaction with propeller Leading Edge (LE) and Trailing Edge (TE) and modeling and simulation of rough-wall boundary layer noise. - Continued development of podded propulsor design/analysis tools. - Continued prediction and validation of damaged stability and capsize. - Continued non-body-of-revolution tool development for advanced submarine configurations. - Continued the multi-platform interaction analysis and tool development. Advanced Naval 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 studies of alternative cooling systems for future shipboard radar systems. - Continued development of structural macroscopic 3-dimensional battery. - Continued development of pulsed power technologies to include pulsed alternators and capacitors. - Continued electromechanical actuator noise source characterization activities. - Continued torque measurements on reduced scale models in support of electromechanical actuators. - Continued control surface actuator project focused on the technologies needed to define the design space for control surface actuators supporting submarines. - Continued development of automated HVAC system architectures for future Naval platforms. - Continued development of common universal stator design to accommodate varying rotor topologies to improve affordability of motor design and development. - Continued ship service fuel cell development. - Continued development of shipboard waste heat driven chiller systems.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602123N: *Force Protection Applied Res*	PROJECT 0000: *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Continued 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. - Continued analytical model and reduced scale component development of power conversion technologies for multi-function motor drives, bi-directional power conversion modules, and power management controllers focusing on closing technology gaps associated with Alternative Integrated Power System (IPS) Architectures. - Continued preliminary designs of control surface actuator systems. - Continued studies of advanced heating, ventilation, and air-conditioning architectures, including studies of alternative (non-vapor-compression) refrigeration systems and concepts for waste heat reuse, to enhance ship cooling and provide thermal energy storage. - Continued research into the development of fuel chemistries, materials, and energy conversion technologies for optimal performance in Naval power systems. - Initiated Electrically Actuated Submarine Control Surfaces FNC to develop electric actuation for submarine control surfaces. Surface Ship & Submarine HM&E Applied Research - Continued development of heterojunction power switching devices. - Continued the computational design, synthesis and evaluation of new, high capacity, high-rate anode materials for Li-ion batteries. - Completed development of heterojunction power switching devices. - Completed the computational design, synthesis and evaluation of new, high capacity, high-rate anode materials for Li-ion batteries.			
FY 2011 Plans: Survivable Platforms - Reduced Signatures - Continue all efforts of FY 2010. - Initiate advanced EM modeling tools development and validation. - Initiate next generation deckhouse integration technology development. - Initiate modeling of hydroacoustics of turbulence-propulsor interaction. Survivable Platforms - Hull Life Assurance - Continue all efforts of FY 2010. - Initiate effort on exploitation of polymers for the deflection and dissipation of shock wave impact on ship and submarine hull structures.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Survivable Platforms - Distributed Intelligence for Automated Survivability - Continue all efforts of FY 2010. - Complete initial demonstration of real-time modeling of multiple distributed systems - utilizing the small scale demonstrator. - Complete development of a hardware in-the-loop small scale demonstrator for fluid/thermal/electrical distributed systems. - Complete Second Generation distributed systems model development. - Initiate the transition of the small scale hardware-in-the-loop demonstrator to the academic community for challenge problem formulation. - Initiate demonstration of the developed model based reasoning control algorithms on full scale hardware test beds. Advanced Platforms - Advanced Platform Concepts and Designs - Continue all efforts of FY 2010. Advanced Platforms - Hydromechanics - Continue all efforts of FY 2010. - Complete optimization for waterjet-hull interaction. - Complete tip-vortex cavitation inception and scaling modeling. - Complete modeling of shock performance on composite propeller. - Initiate modeling of performance of composite propellers in extreme maneuvers. Advanced Naval Power Systems - Continue all efforts of FY 2010. - Complete detailed design and breadboard demonstration of control surface actuator systems. - Complete electromechanical actuator noise source characterization activities. - Complete torque measurements on reduced scale models in support of electromechanical actuators. - Initiate fabrication of scaled control surface actuator systems under the Future Naval Capabilities (FNC) program. - Initiate fuel cell propulsion for unmanned systems. - Initiate energy programs in support of SECNAV Energy Goals including biofuels and ship energy efficiencies. Surface Ship & Submarine HM&E Applied Research - Continue all efforts of FY 2010, less those noted as completed above. ***FY 2012 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Survivable Platforms - Reduced Signatures - Continue all efforts of FY 2011. Survivable Platforms - Hull Life Assurance - Continue all efforts of FY 2011. - Initiate effort on DDG51 hull modification for flight IV using hybrid hull concept to increase efficiency and provide BMD capability, larger Radar loads and additional power requirements. Survivable Platforms - Distributed Intelligence for Automated Survivability - Continue all efforts of FY 2011, less those noted as completed above. - Initiate development of simulations for optimal distribution of control objectives amongst computational resources. - Initiate development of simulations for the decomposition of control objectives for distributed solutions. - Initiate development of simulations for complexity and control for multiple, heterogeneous, interdependent, HM&E systems. - Initiate development of simulations for Information Theory and Information Entropy for control of HM&E systems. Advanced Platforms - Advanced Platform Concepts and Designs - Continue all efforts of FY 2011. Advanced Platforms - Hydromechanics - Continue all efforts of FY 2011, less those noted as completed above. - Complete non-body-of-revolution tool development for advanced submarine configurations. Advanced Naval Power Systems - Continue all efforts of FY 2011, less those noted as completed above. - Initiate development and demonstration of technology options for UUV energy systems. - Initiate efforts in support of Renewable-Sustainable Expeditionary Power FNC. - Initiate efforts in support of Long Endurance Undersea Vehicle Propulsion FNC. Surface Ship & Submarine HM&E Applied Research - Continue all efforts of FY 2011. - Continue efforts to expand the Counter-Improvised Explosive Devices (C-IED) enhancement to support urgent operational needs.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Initiate development of autonomous system to navigate through ship interior to locate and apply advanced damage control technologies.			
Accomplishments/Planned Programs Subtotals	88.359	107.448	156.901

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• 0603123N: *FORCE PROTECTION ADVANCED TECHNOLOGY*	32.668	44.995	40.818	0.000	40.818	36.487	24.714	6.843	0.000	0.000	186.525

D. Acquisition Strategy

Not Applicable.

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 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.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602123N: *Force Protection Applied Res*	PROJECT 4027: *Naval Innovative Science and Engineering*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: *Naval Innovative Science and Engineering*	9.748	-	-	-	-	-	-	-	-	0.000	9.748

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Naval Innovative Science and Engineering	9.748	-	-
Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act. ***FY 2010 Accomplishments:*** Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for: 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories.			
Accomplishments/Planned Programs Subtotals	9.748	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602123N: *Force Protection Applied Res*	PROJECT 9999: *Congressional Adds*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: *Congressional Adds*	56.063	-	-	-	-	-	-	-	-	0.000	56.063

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011
Congressional Add: Advanced Battery System for Military Avionics Power Systems ***FY 2010 Accomplishments:*** This effort provided for the study of safety and performance characteristics of lithium batteries in military avionics at the systems level in order to assess the use of advanced lithium battery technology for military aircraft.	1.593	-
Congressional Add: Advanced Composite Manufacturing for Composite High-Speed Boat Design ***FY 2010 Accomplishments:*** This effort established a basic set of criteria for the design and specification of advanced composite high speed boats. When used, these criteria will allow engineers to better utilize advanced composites in high-speed boat design, resulting in lighter, more efficient, and more reliable high-speed craft.	1.593	-
Congressional Add: Advanced Energetics Initiative ***FY 2010 Accomplishments:*** This effort provided for research into; energetic processes, conventional energetic materials to enhance blast from novel formulations and reactive casings, modulation of propellant reactions, and pursuit of novel smart and multifunctional materials that traditionally have non-energetic function to make them energetic.	3.983	-
Congressional Add: Advanced Simulation Tools for Composite Aircraft Structures ***FY 2010 Accomplishments:*** This effort developed and validated advanced computational tools and guidelines for the simulation of the structural and strength responses of airframe components made of fiber-reinforced composites.	1.593	-
Congressional Add: Alternative Energy Research ***FY 2010 Accomplishments:*** This effort provided for alternative energy research, specifically for participation in the 2010 International Methane Hydrate Expedition in the Arctic Ocean, to develop a thorough understanding of the properties and potential energy applications of oceanic methane hydrates through this joint international	18.423	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011
program in order to develop improved models for the creation and disassociation of natural gas hydrates and to quantify the impact of these processes on the geophysical and geotechnical properties of marine sediments.		
Congressional Add: Power Generation Carbon Comp Thin Films ***FY 2010 Accomplishments:*** This effort funded research leading to development of a wide variety of new nanomaterials (polymers/epoxy/resin and fillers) that will broaden capabilities in key areas of energy generation and storage. The potential use of organic nanomaterials in the proposed concentrator cells will result in lightweight plastic solar cells, new controlled high performance blades for harnessing wind energy and lightweight high efficiency batteries with high storage capabilities.	1.593	-
Congressional Add: Center for Autonomous Solar Power ***FY 2010 Accomplishments:*** This effort provided for research and development of large area, flexible, light weight solar cells to meet scientific challenges in reducing the cost of solar power and enhancing energy efficiency. Solar cells were integrated with novel high energy density supercapacitors for a complete collection and storage capability.	3.983	-
Congressional Add: Energetic Nano-Materials Agent Defeat Initiative ***FY 2010 Accomplishments:*** This effort provided applied research to develop technology to disable chemical and biological (CB) agent munitions stockpiles while minimizing dispersion of CB agents and increasing efficiency of CB agent defeat during a short time event.	1.593	-
Congressional Add: Fuel Efficient, High Specific Power Free Piston Engine for USSVs ***FY 2010 Accomplishments:*** This effort provided applied research to develop a free-piston engine. Operation at varying load and speed was studied to explore power, output range and capability, focusing on engine cooling system design and verification of operation in compression ignition mode with a heavy fuel.	1.593	-
Congressional Add: Harbor Shield - Homeland Defense Port Security Initiative ***FY 2010 Accomplishments:*** This effort provided applied research for design and manufacture of underwater components for a prototype ship hull scanning sonar system, mounting fixtures, cabling, and interfaces.	1.593	-
Congressional Add: Integration of Electro-Kinetic Weapons Into Next Generation Navy Ships ***FY 2010 Accomplishments:*** This effort investigated the energy delivery technologies for electro-kinetic weapons systems and the integration and interface issues of theses weapons.	3.983	-
Congressional Add: Lithium Ion Storage Advancement for Aircraft Applications	1.992	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011
FY 2010 Accomplishments: This effort supported lithium ion storage advancement for aircraft applications research.		
Congressional Add: Magnetic Refrigeration Technology for Naval Applications ***FY 2010 Accomplishments:*** This effort studied the feasibility of materials and assisted in the development of a transition strategy for magnetic refrigeration technology for naval application. New amorphous magnetic alloys were designed, characterized, and optimized for use in magnetic refrigeration applications. Enhanced (Fe,Co,Mn)-based amorphous magnetocaloric materials were synthesized by rapid solidification processing and their structural and magnetic properties were characterized. The newly developed alloys will provide better magnetic entropy change and higher refrigeration capacity than conventional amorphous magnetocaloric effect materials near room temperature.	3.983	-
Congressional Add: Multi-Mission Unmanned Surface Vessel ***FY 2010 Accomplishments:*** This effort enabled testing and evaluation of the use and effectiveness of a large Unmanned Surface Vessel (USV) with multiple capabilities including surface warfare, persistent electronic surveillance for dull, dirty, dangerous missions typical of unmanned vessels. The first large, stealthy, attack USV with a combat suite was integrated into the US Navy enterprise network (FORCEnet), reducing risk to personnel conducting high risk, covert, intelligence/surveillance operations.	1.992	-
Congressional Add: Non Traditional Ballistic Fiber and Fabric Weaving for Force Protection ***FY 2010 Accomplishments:*** This effort evaluated non traditional weave designs of Aramid (ballistic) fiber coupled with new applications of microwave plasma treatments to enhance the strength of the fiber. The new technology may result in enhanced mobility, ease of medical access, reduced weight, increased ballistic protection, cost savings and weight reduction compared to current ballistic materials.	1.992	-
Congressional Add: Hybrid Power Systems ***FY 2010 Accomplishments:*** This effort investigated aluminum/seawater combustion systems using a balanced program that addresses technologies that can be inserted in UUV power plants in the near-, mid- and long-term time frames.	1.992	-
Congressional Add: Proton Exchange Membrane Fuel Cell for Underwater Vehicles	1.593	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011
FY 2010 Accomplishments: This effort provided for development of a proton exchange membrane fuel cell for underwater vehicles that assisted with the development of a hybrid fuel cell/lithium ion battery power system that combines the advantages of each to create an ideal solution for mobile power applications.		
Congressional Add: Joint Heavy-Lift Rotocraft Research ***FY 2010 Accomplishments:*** This effort developed a comprehensive aeromechanics research program to support the development of efficient heavy-lift rotorcraft concepts. The work involved innovative rotor designs, variable rotor speed capability, swashplateless flight and active vibration control, lightweight airframe with body armor, condition-based maintenance of advanced flight control system, acoustic prediction with high-fidelity computational tools, and flight controls of mission adaptive rotors. This research program provided risk reduction guidance and design solutions as well as strategic directions for the next-generation of heavy-lift V/STOL systems.	0.996	-
Congressional Adds Subtotals	56.063	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.