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 0602236N: *Warfighter Sustainment 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	121.588	113.724	101.205	-	101.205	94.994	90.172	93.558	91.348	Continuing	Continuing
0000: *Warfighter Sustainment Applied Res*	99.740	113.724	101.205	-	101.205	94.994	90.172	93.558	91.348	Continuing	Continuing
4027: *Naval Innovative Science and Engineering*	5.591	-	-	-	-	-	-	-	-	0.000	5.591
9999: *Congressional Adds*	16.257	-	-	-	-	-	-	-	-	0.000	16.257

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 supports the Future Naval Capabilities (FNCs) of Littoral Combat/Power Projection, Capable Manpower, Force Health Protection Future Capability, Seabasing and Enterprise and Platform Enablers (EPE) FNC; and innovation-based efforts that will provide technology options for future Navy and Marine Corps capabilities. Efforts focus on manpower and personnel; naval systems training; littoral combat and power projection capabilities; advanced naval materials; medical technologies; environmental quality; biocentric technologies; high speed sealift; cost reduction technologies; and seabasing technologies. Within the Naval Transformation Roadmap, this investment supports eight transformational capabilities within the "Sea Strike", "Sea Shield", and "Sea Basing" operational concepts; the critical human system, "Sea Warrior"; and Naval business efficiencies within "Sea Enterprise."

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	118.783	113.724	97.518	-	97.518
Current President's Budget	121.588	113.724	101.205	-	101.205
Total Adjustments	2.805	-	3.687	-	3.687
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	0.437	-			
• SBIR/STTR Transfer	-2.786	-			
• Program Adjustments	-	-	4.092	-	4.092
• Section 219 Reprogramming	5.161	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.405	-	-0.405
• Congressional General Reductions Adjustments	-0.007	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Project: 9999: *Congressional Adds*		
Congressional Add: *Advanced Composite Maritime Manufacturing*	1.593	-
Congressional Add: *Assistive Technologies for Injured Service Members*	0.797	-
Congressional Add: *Biosensors for Defense Applications*	0.797	-
Congressional Add: *Composite Materials Enhancements through Polymer Science R&D*	5.099	-
Congressional Add: *Managing and Extending DoD Asset Lifecycles*	1.593	-
Congressional Add: *Nanotechnology for Anti-Reverse Engineering*	2.390	-
Congressional Add: *Productization of Anti-fouling and Fouling Release Coating Systems*	2.788	-
Congressional Add: *ENV SAFE DECON AGENTS*	1.200	-
Congressional Add Subtotals for Project: 9999	16.257	-
Congressional Add Totals for all Projects	16.257	-

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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: *Warfighter Sustainment Applied Res*	99.740	113.724	101.205	-	101.205	94.994	90.172	93.558	91.348	Continuing	Continuing

A. Mission Description and Budget Item Justification

This PE supports the FNC's of Littoral Combat/Power Projection, Capable Manpower, Force Health Protection Future Capability, Enterprise and Platform Enablers (EPE) FNC; and innovation-based efforts that will provide technology options for future Navy and Marine Corps capabilities. Efforts focus on manpower and personnel; Naval systems training and education; human systems integration; littoral combat and power projection capabilities; advanced naval materials; medical technologies; environmental quality; biocentric technologies; high speed sealift; cost reduction technologies; and Sea Basing technologies. Within the Naval Transformation Roadmap, this investment supports eight transformational capabilities within the "Sea Strike", "Sea Shield", and "Sea Basing" operational concepts; the critical human system, "Sea Warrior"; and Naval business efficiencies within "Sea Enterprise."

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: ADVANCED NAVAL MATERIALS	16.247	23.876	24.191

Description: Advanced Naval Materials efforts include: developing advanced, high-performance materials; processes to reduce weight and cost; and enhanced sonar transducers.

FY 2010 and FY 2011 funding increase is due to Energy initiative.
FY 2011 and FY 2012 funding increase is to support FNC EPE-FY11-01 Flight Deck Thermal Management.

FY 2010 Accomplishments:
- Continued multi-laser-processing technique development for the fabrication of ultra hard materials for wear resistance applications.
- Continued development of advanced, cost-efficient joining of titanium for >25% weight reduction of large seaborne structures.
- Continued development of advanced composites and polymers with fire resistance for ship structures.
- Continued development of nanotube reinforced composite materials for next generation air and naval platforms.
- Continued development of acceptance testing methodologies for advanced transducer single-crystal high-strain materials and definition of standardized materials properties and composition ranges.
- Continued development of compositional tuning of single-crystal, high-strain transducer materials, for

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
specialized naval system applications. - Continued development of cavitation resistant ship rudder coatings based on the FY 2004 shipboard coating study. - Continued marine titanium alloy design and processing development, exploiting anticipated cost reductions for high performance, reduced maintenance naval applications. - Continued development of continuous single wall carbon nanotube composite materials for next generation air and naval platforms. - Continued stainless steel carburization study to enhance corrosion performance. - Continued development of surface preparation methods and characterization of corrosion performance for future naval ship materials. - Continued evaluation of low temperature carburized materials for marine application. - Continued development of coating performance and knowledge database for Naval use. - Continued development of mechanistic model for stress corrosion cracking in Nickel Aluminum Bronze (NAB). - Continued friction stir welding development for control of residual stresses and elimination of distortion in naval steels. - Continued development of innovative sonar transducers based on high-strain, high-coupling piezoelectric single crystals. - Continued development of integrated structural composites with blast resistance, manufacturing technologies, and low-cost organic resins with improved fire resistance. - Continued development of novel processing technologies for increasing the fatigue strength and corrosion resistance of weldments for ship structures with reduced weight and maintenance requirements. - Continued development of materials processing methods for single crystal piezoelectrics to make strong, robust sonar transducers. - Continued development of models and characterization methods for dynamic loading (water slamming and blast loading) in polymer composite materials. - Continued acoustic damping coatings for ship tank application. - Continued development of portable, real-time, Non-Destructive Examination (NDE)/Non-Destructive Inspection (NDI) technology for heat damage detection in composite materials. - Continued development of fiber-optic Bragg grating sensor and demodulation technology system for structural health monitoring of ships and submarines. - Continued development of new 3D mechanical characterization technique for polymer composites			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
based on dissipative energy density principles. - Continued development of continuous based monitoring techniques of new synthetic fuels and lubricants based on electromagnetic signature analysis. - Continued development and application of distributed fiber optic Bragg gratings for structural health monitoring of ships and aircrafts. - Continued development of novel growth methods to specialized single crystal transducer materials tuned to requirements of specialized naval systems. - Continued assessment of the degree of sensitization potential of marine grade Al alloys. - Continued investigation of criteria for stable pitting of stainless steel. - Continued development of surface assessment technologies to measure surface profile and chlorine. - Continued evaluation of advanced material coating for erosion control on helicopter main rotor blade leading edges. - Completed ballistic test program to assess dependence of penetration velocity on coating thickness and substrate properties. - Completed modeling and process development of single-melt cold hearth casting of naval titanium alloys including Ti 5-1-1-1 for enhanced mechanical properties and formability. - Completed development of a revolutionary new thermal spray technology for repair and refurbishment of worn and/or corroded components on ships, aircraft and combat vehicles. - Initiated development of seamless joining technologies for large, complex shaped conventional ceramic windows from small, inexpensive components using electrophoretic deposition of ceramic nanoparticles. - Initiated development of intelligent corrosion sensor systems for intergranular corrosion cracking. - Initiated studies on fuel cell corrosion. - Initiated development of superhydrophobic surface modification technology. - Initiated studies on mitigation of pitting corrosion and stress corrosion cracking in marine aluminum alloys.			
FY 2011 Plans: - Continue all efforts of FY 2010, less those noted as completed above. - Complete development of new 3D mechanical characterization technique for polymer composites based on dissipative energy density principles. - Complete development of compositional tuning of single-crystal, high-strain transducer materials, for specialized naval system applications.			

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 quantitative coating quality assurance tools. - Initiate development of surface tolerant coating removal methods. - Initiate development of processing technologies to fabricate piezoelectric single crystals into complex transducer assemblies. - Initiate development of thermal management system(s) to arrest excessive heat fluxes and loads on amphibious ship by advanced Naval/USMC aircraft. - Initiate development of MEMS based sensor nodes, with energy harvesting and wireless communication capabilities, for system health management and prognosis. -Initiate development of high-strength, high-hardness tool materials for friction-stir welding applications. -Initiate development of the rational engineering design of Al-alloys for naval applications. ***FY 2012 Plans:*** - Continue all efforts of FY 2011, less those noted as completed above. - Complete friction stir welding development for control of residual stresses and elimination of distortion in naval steels.			
Title: BIOCENTRIC TECHNOLOGIES ***Description:*** Biocentric technologies provide novel solutions for naval needs based upon the applications of bio-inspiredsensors, materials, processes and systems. Topic areas include, but are not limited to development of biologically-based signal processing for medical, surveillance and security applications; bioinspired robotics; synthetic biology to produce high-value naval materials or to develop sentinel organisms, and marine mammal diagnostics to support the Navy's Fleet Marine Mammal Systems. ***FY 2010 Accomplishments:*** - Continued development of innovative naval biosensors, biomaterials, and bioprocess technology - Continued efforts on naval biosensor to detect brain structures and blood vessels through skull bones. - Continued engineering development and optimization of sea-floor sediment energy harvesting system for sustainable and autonomous powering of underwater sensor networks and AUV's - Continued marine mammal diagnostics efforts, including the characterization of the dolphin fore-stomach microbial community, identification of probiotic immunostimulating species and immunobioassays for stress and infection detection. - Continued efforts on advanced biomimetic sensing and neural control for human-robot interaction to enable effective collaboration of warfighters and autonomous systems. -Continued integration of biomimetic sonar with bioinspired autonomous undersea vehicles (with high-lift propulsors) to achieve closed loop control.	5.011	5.800	5.298

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Continued efforts in bioinspired quiet, and maneuverable self-propelled line array using high-lift propulsors based on animal wing and fin biomechanics. - Continued effort to develop living fluidic networks. - Completed research on microbial synthesis of phloroglucinol, an energetic material precursor. - Completed effort to develop and demonstrate methods for determining multiple microbial genetic sequences which will have profound implications for detection of environmental pathogens and marine sensory systems using microorganisms. - Completed development of a microfabricated analytical system for trace detection of illicit materials including explosives, and other hazardous chemicals. - Initiated development of a second set of molecular diagnostic tests for recently discovered viral, bacterial, and fungal pathogens of marine mammals ***FY 2011 Plans:*** - Continue all efforts of FY 2010, less those noted as completed above. - Complete research for detection or mitigation of microbes or compounds of naval relevance in various settings. - Initiate long duration, realistic field tests, and modeling studies of autonomous microbial fuel cell power systems for underwater sensor networks. - Initiate efforts for bio-inspired massively parallel vision systems. - Initiate effort to evaluate breath analysis for non-invasive diagnostics in marine mammal medicine. ***FY 2012 Plans:*** - Continue all efforts of FY 2011, less those noted as completed above. - Initiate animal studies of autonomous in vivo devices for detection of biomarkers and drug delivery - Initiate studies to evaluate candidate probiotics in Atlantic bottlenose dolphins.			
Title: COST REDUCTION TECHNOLOGIES ***Description:*** Cost Reduction Technology efforts include: developing ultrareliable materials and sensors to reduce cost by enabling condition-based and zero maintenance capabilities; and airframe and ship corrosion efforts for advanced cost effective prevention and life cycle management technologies. This activity includes the Navy's share of the Versatile, Affordable, Advanced Turbine Engine (VAATE) program for materials. Investments under this activity were previously reported under Advanced Naval Materials and were broken out to provide improved clarification of the overall investment scope. FY 2010 to FY 2011 funding increase is to support FNC EPE-FY10-03. FY 2011 to FY 2012 funding increase is due the Corrosion Mitigation Technologies and Design Integration and Rotor - Hot Spot Sensors and Integration FNC new start efforts.	8.186	11.620	14.054

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: - Continued development of ceramic matrix composite turbine blades for gas turbine engines. - Continued development of cavitation resistant ship rudder coatings. - Continued development of durable alloys and materials for shipboard and aircraft gas turbine engines and spallation-resistant thermal barrier coatings for shipboard/aircraft marine gas turbine hot sections. - Continued development of advanced materials and processes for high temperature marine turbine disks and combustors. - Continued development of oxidation and vanadium/sulfate-resistant high temperature coatings for shipboard/aircraft gas turbine engines. - Continued development of calcium magnesium aluminum-silicate (CMAS)-resistant coatings for ceramic matrix composites. - Continued development of high temperature foil bearing coatings for aircraft engine weight reduction. - Continued development of high temperature organic matrix composites. - Continued development of low-platinum and platinum-free aluminide coatings that are phase compatible with turbine blade alloys and exhibit low oxidation rates. - Continued efforts to assess manufacturing issues and reliability of ceramic matrix composites for turbine engines. - Continued development of materials processing for future gas turbine molybdenum-based alloys. - Continued efforts to conduct warfighter sustainment applied research, including technology management of investments supporting the naval enterprise and naval capability pillars. - Continued efforts to perform technology analyses to support the development and validation of FNC technology performance metrics for enabling capabilities structured to close naval capability gaps. - Continued efforts to assess technology options for the development of applied FNC technologies packaged into deliverable science and technology products. - Continued applied research and development of improved coatings for (1) non-skid surfaces, (2) ship rudders, (3) high performance ship topsides, and (4) high performance airfield pavements. - Continued analytical model and reduced scale component development of shipboard compact 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 Architectures. - Continued applied research in determining lifting of hot section materials exposed to alternative synthetic fuels and petroleum-synthetic fuel blends. - Continued applied research development of Calcium Magnesium Aluminum-Silicate (CMAS)-resistant			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
coatings for molybdenum-base alloys. - Continued life prediction research for modeling of hot section gas turbine materials, including blades, in mixed naval environments. - Continued development of an Adaptive Expert System to automatically and rapidly analyze aircrew performance (1M+ flight hours annually) to detect human factors related mishap leading indicators using a new technique with anomaly detection and corroboration. - Completed integrated development of durable thermal barrier coating system with various bond coats for naval aircraft gas turbine hot section. - Initiated durable environmental barrier coatings for 2700F ceramic-matrix composites. - Initiated research on Nb-Cr-Si alloys for improved corrosion resistance at high temperatures. - Initiated, developed and applied emerging technologies that support delivery of Navy. approved FNC enabling capabilities structured to close operational capability gaps in warfighter sustainment. - Initiated package emerging warfighter sustainment technologies into deliverable FNC products and ECs that can be integrated into acquisition programs within a five year period. - Initiated and developed mature warfighter sustainment technologies that support naval requirements identified within the Naval Power 21 capability pillars. - Initiated development of novel seawater pretreatment strategies to optimize performance of prefiltration membranes (microfiltration or ultrafiltration membranes or filters). - Initiated further development of novel high flux and chlorine resistant reverse osmosis membranes. ***FY 2011 Plans:*** - Continue all efforts of FY 2010 less those noted as completed above. - Complete development of high temperature foil bearing coatings for aircraft engine weight reduction. - Complete integrated development of durable thermal barrier coating system with various bond coats for naval aircraft gas turbine hot section. - Initiate research and development of ceramic matrix composite vanes for Naval aircraft. - Initiate applied research on radiation barrier coatings. - Initiate development of 1500F capable disk coatings. - Initiate development of advanced ASGS (Active Shaft Grounding System) with integrated shaft current sensing and extremely low frequency electromagnetic (ELFE) control. - Initiate development of novel ICCP (Impressed Current Cathodic Protection) anodes, reference cells and sensors with high Mean Time Between Failure(MTBF).			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Initiate development of dual-use ICCP and novel sensor technology for CBM and closed-loop deamping to extend hull/ballast coating longevity and reduce recalibration frequency. - Initiate applied research in modeling and simulation to identify key corrosion drivers and target problem areas for material modification and improved barrier dielectrics. - Intitiate development of spatial corrosion recognition and diagnostic models for hull, ballast tanks and propulsor condition. - Initiate/complete systems analysis efforts to identify and prioritize critical, relevant variable/adaptive cycle propulsion system technologies and development plans/approaches. The outcome of these analyses will provide essential information supporting initiation of the Variable Cycle Advanced Technology (VCAT) Program in FY 2012 (see PE 0602123N). -Initiate development of durable lift fan alloy. ***FY 2012 Plans:*** - Continue all efforts of FY 2011 less those noted as completed above. - Complete applied research development of Calcium Magnesium Aluminum-Silicate (CMAS)-resistant coatings for molybdenum-base alloys. - Complete research on Nb-Cr-Si alloys for improved corrosion resistance at high temperatures. - Complete applied research on radiation barrier coatings - Initiate applied research in wireless energy harvesting sensors, architecture, and diagnostics for rotorcraft structural health management. - Initiate development of sprayable acoustic damping systems for submarines to significantly reduce weight and costly maintenance procedures and increase operational readiness. - Initiate development of low temperature carbon supersaturation (LTCSS) technology to incorporate improved corrosion resistance and surface hardness to materials in erosion-corrosion environments. - Initiate development of algorithms to incorporate into design module for corrosion prevention to predict the occurrence of corrosion and provide alternative solutions for use in component and system design.			
Title: ENVIRONMENTAL QUALITY ***Description:*** Environmental Quality technologies enable sustained world-wide Navy operations in compliance with all local, state, regional, national and international laws, regulations and agreements, and support the Navy Transformational Roadmap in the areas of Sea Basing, Sea Strike and Sea Warrior. Compliant operations enable training evolutions and exercises that are critical for maintaining readiness. ***FY 2010 Accomplishments:*** - Continued development of advanced environmentally sound technologies for shipboard waste treatment and pollution abatement systems.	2.984	3.139	3.155

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Continued development and modifications to shipboard oily waste treatment systems to accommodate processing of synthetic lubricants. - Continued field evaluation of prototype robotic Hull BUG to identify gaps needed to refine and advance the technology. - Continued development of new, advanced, environmentally benign AF/Anti-Corrosive (AC) coating systems for Navy platforms - Completed pilot scale system development of miniature gasification process for treatment of shipboard solid waste. - Completed far-term noise and air pollution emissions abatement technology for unrestricted operations. - Completed multiple aqueous metal ion sensor to incorporate copper sensor developed in the Strategic Environmental Research and Development Program (SERDP) program for planned combined transition to the Environmental Security Technology Certification Program (ESTCP). - Initiated efforts on ballast tank and system design optimization that minimize fuel discharges from compensated systems, minimize sedimentation in clean ballast and compensated ballast tanks, and maximize exchange of organisms during ballast tank exchanges. - Initiated efforts on solids separation/removal from shipboard liquid waste streams. ***FY 2011 Plans:*** - Continue all efforts of FY 2010 less those noted as completed above. - Continue development and modifications to shipboard oily waste treatment systems to accommodate processing of synthetic lubricants. - Complete field evaluation of prototype robotic Hull BUG and transition to FNC program. - Initiate efforts on improved handheld, waterborne, underwater hull cleaning technologies. - Initiate studies on oil emulsion issues and development of novel bilge water treatment systems on existing and new ships. ***FY 2012 Plans:*** - Continue all efforts of FY 2011, less those noted as completed above.			
Title: HUMAN SYSTEMS DESIGN ***Description:*** This activity supports the warfighter by designing affordable user-centered systems that are efficient, easy to use, and provide required mission capabilities at lowest lifecycle costs. Such systems will be optimally designed for the right number and types of personnel, requiring minimum training while providing high skills retention.	1.993	3.197	4.021

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Congressional, DoD, and Navy policies and instructions require the Navy and Marine Corps to have a comprehensive plan for Human Systems Design (HSD) in the acquisition process to optimize total system performance, minimize total ownership costs, and ensure the system is built to accommodate the characteristics of the user population that will operate, maintain, and support the systems. The increase in funding from FY 2011 to FY 2012 reflects the planned initiation of a new project and the planned funding profile of the other projects in this activity. ***FY 2010 Accomplishments:*** - Continued research into technologies and strategies for significantly improving on-board training and performance measurement for improving submarine command team decision making and overall submarine team performance and resilience. - Continued research into operational constructs, processes, methods, and software specifications to merge the full spectrum of Human Systems Engineering into the Navy's standards based, open-architecture, Integrated Product Data Environment. - Continued research to develop and demonstrate automation and human interface technologies to support collaborative decision-making in which multiple unmanned system operators manage groups of vehicles with optimal manning. - Completed HSI interface display research to improve ships personnel's ability to efficiently and effectively detect, recognize, and identify noisy targets in ambiguous and uncertain dynamic environments. - Initiated research into mission performance optimization encompassing task centered design and advanced human performance modeling for achieving the requisite manning, both in numbers and capabilities, for the complex ships and systems of the future fleet. - Initiated research into improving the capability to fuse imaging, electronic warfare, inorganic and acoustic sensor inputs into integrated, fused, and intuitive displays that enhance the presentation and command understanding of uncertain information. ***FY 2011 Plans:*** - Continue all efforts of FY 2010 less those noted as completed above. - Complete research into technologies and strategies for significantly improving on-board training and performance measurement for improving submarine command team decision making and overall submarine team performance and resilience. - Complete research to develop and demonstrate automation and human interface technologies to support collaborative decision-making in which multiple unmanned system operators manage groups of vehicles with optimal manning. - Initiate research into the impact of incorporating environmental stressors (fatigue, motion, vibration and extreme temperatures) into systems engineering tools for the development for complex Navy systems. ***FY 2012 Plans:*** - Continue all efforts of FY 2011.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Complete research into operational constructs, processes, methods, and software specifications to merge the full spectrum of Human Systems Engineering into the Navy's standards based, open-architecture, Integrated Product Data Environment. - Complete research into mission performance optimization encompassing task centered design and advanced human performance modeling for achieving the requisite manning, both in numbers and capabilities, for the complex ships and systems of the future fleet.			
Title: LITTORAL COMBAT / POWER PROJECTION	12.405	11.593	12.615
Description: This activity provides for technologies that enhance the ability of the Navy-Marine Corps team to assure access and sustained operations in the Littorals. The FNC Program considers all the critical functions of warfighting: command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR); fires; strike; maneuver; sustainment; and fleet/force protection. This activity includes technical assessments and trade studies for FNC Enabling Capabilities that transition high priority technologies to the Navy and Marine Corps in support of the Sea Strike, Sea Shield, Sea Basing, and ForceNet Naval Power 21 pillars as well as Enterprise and Platform Enabling Science and Technology requirements. The decrease from FY2010 to FY 2011 is due to the realignment of FNC efforts to other PE's. The increase from FY2011 to FY2012 is due to increase in the Modular Photonics Mast Housing and Compact Low Light Level SWIR Video Camera FNC efforts. ***FY 2010 Accomplishments:*** - Continued efforts to assess technology options for the development of applied FNC technologies packaged into deliverable S&T products. - Initiated development of technologies to reduce the load of warfighters by 1) reducing the weight of and improving the capability of the day/night weapon sight, 2) eliminating battery incompatibility, and 3) providing GUI-based software for tradeoff analyses based on Military Operational Posture. (Concurrent funding provided by PE 0603236N) - Initiated research to develop technology to reduce fabrication and life cycle costs of SSN/SSGN next generation photonics mast and to improve SSN surface situational awareness through faster image acquisition rates, improve range performance under adverse weather conditions and improve autonomous detection and classification. (Concurrent funding provided by PE 0603236N) ***FY 2011 Plans:*** - Continue all efforts of FY 2010 less those noted as completed above.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Realign development of technologies to reduce the load of warfighters by 1) reducing the weight of and improving the capability of the day/night weapon sight, 2) eliminating battery incompatibility, and 3) providing GUI-based software for tradeoff analyses bases on Military Operational Posture to PEs 0602131M, 0603236N and 0603640M. - Continue efforts to assess technology options for the development of applied research for FNC technologies, to include preparation of detailed technology specifications and performance metrics, packaged into deliverable S&T products for enabling capabilities structured to close naval capability gaps. ***FY 2012 Plans:*** - Continue all efforts of FY 2011 less those noted as completed above.			
Title: MANPOWER/PERSONNEL ***Description:*** These technologies enhance the Navy's ability to select, assign, and manage its people by responding to a variety of requirements, including: managing the force efficiently and maintaining readiness with fewer people and smaller budgets; providing warfighting capabilities optimized for low-intensity conflict and littoral warfare; and operating and maintaining increasingly sophisticated weapons systems while managing individual workload and supporting optimal manning. This activity further supports the warfighter by providing enhanced capabilities by designing affordable user-centered systems that are efficient, easy to use, and provide required mission capabilities at lowest lifecycle costs. Such systems will be optimally designed for the right number and types of personnel, requiring minimum training while providing high skills retention. The reduction in funding from FY 2011 to FY 2012 reflects realignment of projects by the program sponsor; OPNAV N1. ***FY 2010 Accomplishments:*** - Continued research into decision support tools to better enable meeting the goals of the Navy's evolving strategies for personnel and manpower management and especially to evaluate manpower alternatives. - Continued research into intelligent agents to empower total force members to make training and assignment choices that enhance their careers and meet personal goals. - Continued research into agent-based simulations for enhancing the effectiveness of behaviorally-based predictive models.	2.569	2.391	2.194

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
- Initiated research into supporting technologies for a prototype decision support system to enable community management program analysts to better forecast and assess the effects of active duty enlisted and officer behavior resulting from both proposed and current policy decisions. ***FY 2011 Plans:*** N/A ***FY 2012 Plans:*** N/A			
Title: MEDICAL TECHNOLOGIES ***Description:*** This program supports the development of field medical equipment, diagnostic capabilities and treatments; technologies to improve warfighter safety and to enhance personnel performance under adverse conditions; and systems to prevent occupational injury and disease in hazardous, deployment environments. Navy investment in these areas is essential because Navy/USMC mission needs are not adequately addressed by the civilian sector or other Federal agencies. For example, civilian emergency medicine does not address casualty stabilization during long transit times to definitive care. The National Institutes of Health (NIH) focuses on the basic science of disease processes and not applied research related to development. Programs are coordinated with other Services through the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee, and Joint Technical Coordinating Group (JTCG) process, to prevent duplication of effort. This project funds the Force Health Protection FNC that will provide technology options for future Navy and Marine Corps capabilities and supports the "Sea Warrior" component of the Naval Transformation Roadmap, medical logistics aspects of "Sea Basing" and expeditionary force medical support associated with "Sea Strike". ***FY 2010 Accomplishments:*** - Continued program to develop enhanced First Responder capabilities. - Continued program to develop enhanced Forward Resuscitative Surgical capabilities. - Continued program to develop enhanced En Route Care capabilities. - Continued efforts to mitigate the effects of environmental and other threats to health. - Continued program, with Army, in regenerative medicine (Armed Forces Institute for Regenerative Medicine (AFIRM)). - Continued efforts to reduce operational injuries. - Continued efforts to reverse NIHL.	17.259	18.092	19.483

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
- Continued studies on decompression sickness (DCS) and arterial gas embolism (AGE), to include novel approaches to the prevention, detection and treatment of DCS/AGE, particularly by nonrecompressive methods. - Continued efforts to develop prophylactic agents preventing hyperbaric oxygen toxicity. Prolonged exposure to hyperbaric oxygen can be toxic to lungs, nervous system and eyes. - Continued efforts to assess the impact of thermal (i.e., heat and cold) stress on operational performance. Underwater thermal extremes can affect diver performance and alter risk of incurring decompression sickness. - Continued studies related to optimization of diver performance. Operational performance in the undersea environment can be hampered by a variety of environmental stressors. - Continued studies related to optimization of submariner health and performance. Submarine crewmembers are exposed to a variety of unique stressors including prolonged deployments, effects of altered diurnal rhythms, non-standard breathing gases, lack of sunlight, etc that can impact health and performance. - Continued studies related to biomedical effects of underwater sound. Military divers must operate safely and effectively in potentially complex underwater sound fields. - Continued efforts for "stress inoculation" to mitigate the impact of exposure to stressful combat environments prior to deployment - Continued efforts to develop advanced technologies to support Rapid Blood Treatment. (Previously identified as First Responder in FY09 in this activity) - Continued efforts to develop advanced technologies to support Warfighter Restoration. (previously identified as FRSS/ERSS in FY09 in this activity). - Continued efforts to develop advanced technologies to support Warfighter Restoration. (Previously identified as En Route Care in FY09 in this activity). - Continued efforts to model accelerated head and neck injuries; operational injuries. - Completed safety studies and analysis of compartmental shipboard heat exposure levels; environmental threats to health. - Initiated research to reduce noise at the source, i.e. jet engine quieting and flight deck noise reduction. - Initiated research to study the incidence and susceptibility of Noise Induced Hearing Loss (NIHL) and tinnitus, and to evaluate mitigation strategies. - Initiated research in medical prevention and treatment of NIHL and tinnitus (ringing in the ears). - Initiated research to improve personal protective equipment technology.			

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
- Initiated research to develop a Human Injury and Treatment (HIT) model for predicting outcomes of personnel exposure to shipboard damage. - Initiated and develop mature force health protection technologies that support naval requirements identified within the Navy and Marine Corps. ***FY 2011 Plans:*** - Continue all efforts of FY 2010 less those noted as completed above. - Initiate development of multifunctional blood substitute program. - Initiate program in hypothermics. ***FY 2012 Plans:*** - Continue all efforts of FY 2011. - Initiate Jet Noise Reduction Project, Noise Induced Hearing Loss Program, to utilize analytical modeling and simulation tools anchored by experiment to develop and assess solutions enabling mitigation of jet induced noise from high performance tactical aircraft. (NIHL Transitions from PE 0603729N in FY 2012) - Initiate development of the Automated Critical Care System (ACCS). - Initate program in hypothermics.			
Title: SEA BASING TECHNOLOGIES ***Description:*** This activity includes development and advancement of technologies to support Seabasing. Areas include: advanced hull forms, propulsion, and materials to support high speed, shallow draft, and beachable connectors; innovative connector interface and transfer technologies; advanced wave and position sensors and autonomous controls to support vessel to vessel interfaces; and autonomous conveyance systems to support automated and integrated warehousing. The decrease in funding from FY 2011 to FY 2012 is due to the completion of T-CRAFT scale technology demonstration articles. ***FY 2010 Accomplishments:*** - Continued Sense and Respond Logistics (S&RL) research in: battlefield fuel management; decision support systems for S&RL; emergent intelligence/intelligent agents for S&RL; and advanced sensors/ processes for S&RL. - Continued efforts for the development of technologies supporting automated shipboard assembly of air-delivered weapons - Continued multiple INP contracts for preliminary designs in the area of a T-CRAFT and a Rapidly	21.388	24.127	7.243

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
Deployable Seabasing Stable Transfer Platform. - Continued the construction of a scaled model of a Rapidly Deployable Stable Transfer Platform demonstrator. - Continued a second evaluation of potential Seabasing INP efforts. - Initiated the down-selection of Sense and Respond Logistics Information Architecture prototype development. - Completed the down-selection of T-CRAFT designs for prototype and component development. - Completed T-CRAFT model testing and evaluation. - Initiated contract design and develop shipyard building plans for T-CRAFT prototype and component construction. - Initiated procurement of components and material to support T-CRAFT prototype construction. - Initiated development of agent based decision support and logistics planning algorithms. ***FY 2011 Plans:*** - Continue all efforts of FY 2010, less those noted as completed above. - Complete T-CRAFT scale technology demonstration articles. - Initiate development of a detailed technology demonstration plan. - Initiate T-CRAFT technology demonstration component construction. - Initiate the modeling and simulation of first article prototypes of Sense and Respond demonstration systems; Logistics Common Operating Picture, Decision Support Tools, Prognostics Embedded Health Management, Macro Fuel Quantity Management, Portable Fuel Quality Analysis. - Initiate development of the Connectors and the Sea Base Enabling Capability including Environmental Ship Motion Forecasting and Advanced Mooring System Technologies. ***FY 2012 Plans:*** - Continue all efforts of FY 2011, less those noted as completed above. - Complete testing and integration of Sense & Response Logistics Common Operating Picture. - Initiate model testing of Advanced Mooring System and planning of at-sea demonstration.			
Title: TRAINING TECHNOLOGIES ***Description:*** Training technologies enhance the Navy's ability to train effectively and affordably in classroom settings, in simulated environments, while deployed, and to operate effectively in the complex, highstress, information-rich and ambiguous environments of modern warfare such as asymmetric warfare. Technology development responds to a variety of requirements, including providing more affordable	11.698	9.889	8.951

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 0602236N: *Warfighter Sustainment Applied Res*	PROJECT 0000: *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
approaches to training and skill maintenance. Improved training efficiency and cost-effectiveness is achieved by applying operations research, modeling and simulation, and instructional, cognitive, and computer sciences to the development, delivery, evaluation, and execution of training. ***FY 2010 Accomplishments:*** - Continued development of optimized strategies for performance aiding and training - Continued development of virtual technologies for warfare training application. - Continued research and assessment of advanced gaming technology for enhanced training. - Continued research into game based training to more effectively enable better warfighter understanding of languages and cultures to enhance their regional expertise. - Continued creation and conduct of experiments to validate automated performance assessment and after action reviews. - Continued a systematic program of applied research addressing unanswered questions regarding effective instructional strategies in artificially intelligent tutoring. - Continued research on software tools to facilitate building natural language tutorial dialogs for artificially intelligent tutoring. - Continued task to develop multi-agent based architectures for modeling human behavior, improve techniques for human cognitive and behavioral modeling, and create highly realistic simulated teammates. - Continued field studies and user tests evaluating new features and job aiding tools. - Initiated research to create computational models of human behavior in selected non-Western environments that reflect the dominant cultural, social, ethnic, and economic determinants of behaviors, attitudes, and beliefs of individuals, groups, and organizations operating in these environments, and exploit these models to forecast responses to our actions and those of others attempting to exert influence in these environments. - Initiated research into computational neuron-models in the design of training systems - Initiated the integration of cognitive and neuron-computational models of human learning. - Initiated research into intelligent tutoring systems for adaptive competency in submarine bridge team and surface ship combat information center trainers. ***FY 2011 Plans:*** - Continue all efforts of FY 2010 except those noted as complete above. - Complete development of optimized strategies for performance aiding and training - Complete development of virtual technologies for warfare training application. - Complete research and assessment of advanced gaming technology for enhanced training. - Complete creation and conduct of experiments to validate automated performance assessment and after action reviews.			

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 research to identify the perceptual cues in the urban and dense infrastructure and environment that may improve warfighter performance. ***FY 2012 Plans:*** - Continue all efforts of FY 2011 except those noted as complete above. - Complete research into game based training to more effectively enable better warfighter understanding of languages and cultures to enhance their regional expertise. - Initiate development of simulation technologies to deliver safe, effective, and balanced live-virtual-constructive training to achieve meaningful training and readiness levels without the costs involved with only using live assets. - Initiate research to determine the improvement in recruit classification provided by the addition of measures of fluid intelligence and working memory - Initiate research to understand the structural relations among the latent variables of short-term memory, working memory, executive attentional control, and fluid intelligence - Initiate research on techniques to improve warfighter adaptability and resilience.			
Accomplishments/Planned Programs Subtotals	99.740	113.724	101.205

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
• 0603236N: *WARFIGHTER SUSTAINMENT ADVANCED TECHNOLOGY*	38.414	50.625	56.311	0.000	56.311	63.410	43.106	35.585	17.278	0.000	304.729
• 0603729N: *WARFIGHTER PROTECTION ADVANCED TECHNOLOGY*	8.603	12.463	12.471	0.000	12.471	13.580	12.359	5.083	2.493	0.000	67.052

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

As discussed in Section A, there are a significant number of varied efforts within this PE. For the most part these efforts support the FNC program. As such, each is monitored at two levels. At the lowest level each is measured against both technical and financial milestones on a monthly basis. Annually each FNC and its projects are reviewed in depth for technical and transition performance by the Chief of Naval Research against goals which have been approved by the Navy.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
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The FNC managers conduct routine site visits to performing organizations to assess programmatic and technical progress and most projects conduct an annual or biannual review by an independent board of visitors who assess the level and quality of the Science and Technology (S&T) basis for the project.

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 0602236N: *Warfighter Sustainment 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*	5.591	-	-	-	-	-	-	-	-	0.000	5.591

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	5.591	-	-
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	5.591	-	-

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 0602236N: *Warfighter Sustainment 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*	16.257	-	-	-	-	-	-	-	-	0.000	16.257

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 Composite Maritime Manufacturing ***FY 2010 Accomplishments:*** This effort addressed characterization and modeling, process innovation and tooling, design and testing of advance composites integrated into a virtual simulation environment with a focus on Prepreg Tape Placement process and Autoclave Prepreg processing.	1.593	-
Congressional Add: Assistive Technologies for Injured Service Members ***FY 2010 Accomplishments:*** This effort advanced noninvasive technologies to compensate for sensory (vision, balance) and mobility deficits.	0.797	-
Congressional Add: Biosensors for Defense Applications ***FY 2010 Accomplishments:*** This effort investigated emerging environmental factors in inflammatory and cellular stress responses. The objective of this effort was to measure and characterize the inflammatory and cell stress response of relevant cell systems to key emergent environmental chemical conditions with the goal of defining relevant mechanisms.	0.797	-
Congressional Add: Composite Materials Enhancements through Polymer Science R&D ***FY 2010 Accomplishments:*** This effort investigated composite matrix technology for lighter weight, stronger, stiffer, higher toughness materials providing for more accurate property predictions, and accurate service life prediction.	5.099	-
Congressional Add: Managing and Extending DoD Asset Lifecycles ***FY 2010 Accomplishments:*** This effort developed technologies to; extend the useful life of facilities and equipment, yield a reduction in maintenance manpower, and contribute to DoD's knowledge base to improve mission capability rates while decreasing life cycle costs by providing an examination and evaluation of corrosion-resistant hybrid coatings for facilities and aircraft as well as investigation and development of concepts for decentralized netcentric decision support tools.	1.593	-
Congressional Add: Nanotechnology for Anti-Reverse Engineering	2.390	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011
FY 2010 Accomplishments: This effort provided cost effective active and passive Inner Volume protections linked to firmware and software Anti-Tamper (AT). The AT tools and techniques at each layer provide innovative features and characteristics that will add value to the DoD's AT toolbox of techniques .		
Congressional Add: Productization of Anti-fouling and Fouling Release Coating Systems ***FY 2010 Accomplishments:*** This effort provided for development of a new class of environmentally friendly antifouling coatings for use on U. S. Navy vessels, which may result in reduced maintenance and achieving 12 years between dry-docking of vessels.	2.788	-
Congressional Add: ENV SAFE DECON AGENTS ***FY 2010 Accomplishments:*** This effort support the development and test environmentally safe decontaminating agents for bio-defense, biomedical, and environmental use.	1.200	-
Congressional Adds Subtotals	16.257	-

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.