Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*				R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent 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	21.129	17.979	18.092	-	18.092	18.181	18.610	19.014	19.386	Continuing	Continuing
0000: *In-House Lab Independent Res*	17.650	17.979	18.092	-	18.092	18.181	18.610	19.014	19.386	Continuing	Continuing
4027: *Naval Innovative Science and Engineering*	3.479	-	-	-	-	-	-	-	-	0.000	3.479

A. Mission Description and Budget Item Justification

This program element (PE) sustains U.S. Naval Science and Technology (S&T) superiority by providing new technological concepts for the maintenance of naval power and national security and by helping to avoid scientific surprise while exploiting scientific breakthroughs and providing options for new Future Naval Capabilities (FNCs). The Department of Navy (DON) component responds to S&T directions of the Naval S&T Strategic Plan for long term Navy and Marine Corps improvements and is in consonance with future warfighting concepts and doctrine developed at the Naval Warfare Development Command and the Marine Corps Combat Development Command. It enables technologies to significantly improve the Joint Chiefs of Staff's Future Joint Warfighting Capabilities. The In-house Laboratory Independent Research (ILIR) program also adds increased emphasis to the revitalization of the scientist and engineer workforce component at the Navy's Warfare Centers and Laboratories by attracting superior candidates and retaining our best members through the provision of exciting and meaningful work.

This PE addresses DON Basic Research which includes scientific study and experimentation directed toward increasing knowledge and understanding in national-security related aspects of physical, engineering, environmental, and life sciences; and is the core of Discovery and Invention. Basic research projects are developed, managed, and related to more advanced aspects of research in some hundred-plus technology and capability-related 'thrusts', which are consolidated in thirteen research focus areas: Power and Energy; Operational Environments; Maritime Domain Awareness; Asymmetric and Irregular Warfare; Information, Analysis and Communication; Power Projection; Assure Access and Hold at Risk; Distributed Operations; Naval Warfighter Performance and Protection; Survivability and Self-Defense; Platform Mobility; Fleet/Force Sustainment; Affordability, Maintainability and Reliability.

This portion of the DON Basic Research Program provides participating Naval Warfare Centers and Laboratories with funding for: basic research to support the execution of their assigned missions; developing and maintaining a cadre of active researchers who can distill and extend results from worldwide research and apply them to solve Naval problems; promoting hiring and development of new scientists; and encouragement of collaboration with universities, private industry, and other Navy and Department of Defense laboratories.

ILIR efforts are selected by Naval Warfare Centers/Lab Commanding Officers and Technical Directors near the start of each Fiscal Year through internal competition. Efforts typically last three years, and are generally designed to assess the promise of new lines of research. Successful efforts attract external, competitively awarded funding. Because the Warfare Centers and Labs encompass the full range of naval technology interests, the scope of ILIR topics roughly parallels that of PE 0601153N, Defense Research Science.

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy	DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601152N: *In-House Lab Independent Res*

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

B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	18.001	17.979	18.579	-	18.579
Current President's Budget	21.129	17.979	18.092	-	18.092
Total Adjustments	3.128	-	-0.487	-	-0.487
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.126	-			
• SBIR/STTR Transfer	-0.058	-			
• Program Adjustments	-	-	-0.217	-	-0.217
• Section 219 Reprogramming	3.312	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.270	-	-0.270

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent 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
0000: *In-House Lab Independent Res*	17.650	17.979	18.092	-	18.092	18.181	18.610	19.014	19.386	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project sustains U.S. Naval S&T superiority, provides new technological concepts for the maintenance of naval power and national security, and mitigates scientific surprises, while exploiting scientific breakthroughs and providing options for new Future Naval Capabilities (FNC's). It responds to S&T directions of the Naval S&T Strategic Plan for long term Navy and Marine Corps improvements. It is in consonance with future warfighting concepts and doctrine developed at the Naval Warfare Development Command (NWDC) and the Marine Corps Combat Development Command (MCCDC), and enables technologies to significantly improve the Joint Chiefs of Staff's Future Joint Warfighting Capabilities.

This portion of the DON Basic Research Program provides participating Naval Warfare Centers and Laboratories with funding for basic research to support the execution of their assigned missions, for developing and maintaining a cadre of active research scientists who can distill and extend results from worldwide research and apply them to naval problems, to promote hiring and development of new scientists, and to encourage collaboration with universities, private industry, and other Navy and Department of Defense laboratories.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: ADVANCED MATERIALS	3.405	3.485	3.526
Description: Efforts include: structural materials; functional materials; maintenance reduction, hydrodynamics; power generation; energy conservation and conversion. ***FY 2010 Accomplishments:*** - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research and development on energy flow control and redirection of anisotropic cylindrical shells. - Completed research and development effort on the nature of the Cathodic Delamination (CD) problem for the Navy and determine the effectiveness of new approaches to combating CD on Naval hardware. - Completed research in the development of an algorithm that makes use of both forward and inverse modeling techniques to determine variations in static and dynamic material properties of hyperelastic materials from experimental measurement. - Completed research on mesoscale models to include dissipative particle dynamics and automata-based modeling strategies. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Materials by Design and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Sea Basing, and National Naval Responsibility initiatives in Undersea Weaponry and Naval Engineering.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Initiated research on the use of Density Functional Theory (DFT) for intelligently designing the next advancement in chromophore (dye) structures. - Initiated research to develop new narrow and wide band gap electroactive polymer materials with tunable energy levels for high power and energy density batteries. - Initiated research to develop several novel experimental techniques to understand the phenomena of mixing in energetic material in the metal-metal oxide combustion zone. - Initiated research for Acoustic Metamaterials. - Initiated research for Absorbent Materials for Fuel Desulfurization. - Initiated research on Phase Equilibria and High-Temperature Ceramics for Zirconium Based Systems. - Initiated research on the Atomic Structure and Lattice Dynamics of Thermoelectric Materials. - Initiated research for the Fundamental Understanding of the Thermodynamic Properties of Metamaterials. - Initiated research for the Internal Behavior of Electromagnetic Properties of Metamaterials and Wideband Tunability. - Initiated research for Liquid-Crystalline Polymers for Broadband Noise Attenuation in Towed Array SONAR Systems. ***FY 2011 Plans:*** - Continue all efforts of FY 2010, less those noted as complete above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Materials by Design and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Sea Basing, and National Naval Responsibility initiatives in Undersea Weaponry and Naval Engineering. - Initiate research to develop a process to quickly and reliably fabricate large areas of Carbon Nanotubes (CNTs) without the need of costly chemical vapor deposition systems. This process will be studied and optimized and resulting CNT's will be characterized, applications could improve size, weight, and power in DoD and commercial systems. ***FY 2012 Plans:*** - Continue all efforts of FY 2011, less those noted as complete above. - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research on the use of Density Functional Theory (DFT) for intelligently designing the next advancement in chromophore (dye) structures. - Complete research to develop new narrow and wide band gap electroactive polymer materials with tunable energy levels for high power and energy density batteries. - Complete research to develop several novel experimental techniques to understand the phenomena of mixing in energetic material in the metal-metal oxide combustion zone.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	**R-1 ITEM NOMENCLATURE** PE 0601152N: *In-House Lab Independent Res*	**PROJECT** 0000: *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Complete research for Acoustic Metamaterials. - Complete research for Absorbent Materials for Fuel Desulfurization. - Complete research on Phase Equilibria and High-Temperature Ceramics for Zirconium Based Systems. - Complete research on the Atomic Structure and Lattice Dynamics of Thermoelectric Materials. - Complete research for the Fundamental Understanding of the Thermodynamic Properties of Metamaterials. - Complete research for the Internal Behavior of Electromagnetic Properties of Metamaterials and Wideband Tunability. - Complete research for Liquid-Crystalline Polymers for Broadband Noise Attenuation in Towed Array SONAR Systems. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Naval Materials by Design and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Sea Basing, and National Naval Responsibility initiatives in Undersea Weaponry and Naval Engineering.			
Title: ELECTRONICS SENSOR SCIENCES	2.493	2.562	2.596
Description: Efforts include: sensing, diagnostics, and detectors; navigation and timekeeping; nano electronics; real time targeting, Electro Optical/InfraRed (EO/IR) electronics; EO/IR electronic warfare; and EO/IR sensors for surface and subsurface surveillance. ***FY 2010 Accomplishments:*** - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research into the Space-Charge-Limited (SCL) transport of charge carriers across a potential difference. - Completed research into the twin concepts of post-selection of wave function in quantum mechanics and the Aharonov-Vaidman formula which has opened up new avenues in what can and cannot be measured in quantum mechanics. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Electric Power Sources and Multifunctional Electronics for Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Persistent Surveillance, and the National Naval Responsibility in Undersea Weaponry. - Initiated research efforts in basic understanding of electromagnetic scattering in the nano-regime. - Initiated research investigation for Millimeter Wave Spectroscopy. - Initiated research for Underwater Coherent Target Detection in Sonar Imagery in Clutter. - Initiated research on Non-Traditional Sensors for Surveillance. - Initiated research for Analog Photonic Amplification. - Initiated research in the Investigation of Acoustic Cloaking.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Initiated research for Scattered Acoustic Vector Fields in the Near Field Resonance Region. - Initiated research efforts for Magnetoelastic/Piezoelectric Layered Composite Structures. ***FY 2011 Plans:*** - Continue all efforts of FY 2010, less those noted as complete above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Electric Power Sources and Multifunctional Electronics for Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Persistent Surveillance, and the National Naval Responsibility in Undersea Weaponry. - Initiate research on an application of Green's function technique to explore exotic and unexpected nano-phenomena in the electromagnetic scattering of finite-length nanowires. This effort has broad applicability to a variety of nano devices such as, nano-antennas, nano-lasers, nano-sensors, subwavelength photonic integration, and metamaterial designs. ***FY 2012 Plans:*** - Continue all efforts of FY 2011, less those noted as complete above. - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research efforts in basic understanding of electromagnetic scattering in the nano-regime. - Complete research investigation for Millimeter Wave Spectroscopy. - Complete research for Underwater Coherent Target Detection in Sonar Imagery in Clutter. - Complete research on Non-Traditional Sensors for Surveillance. - Complete research for Analog Photonic Amplification. - Complete research in the Investigation of Acoustic Cloaking. - Complete research for Scattered Acoustic Vector Fields in the Near Field Resonance Region. - Complete research efforts for Magnetoelastic/Piezoelectric Layered Composite Structures. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Electric Power Sources and Multifunctional Electronics for Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Persistent Surveillance, and the National Naval Responsibility in Undersea Weaponry.			
Title: ENERGY SCIENCES ***Description:*** Efforts include: undersea weaponry; energetic materials and propulsion; directed energy; and TeraHertz Time-Domain Spectroscopy (THz-TDS) technology that addresses overseas contingency operations and Counter Improvised Explosive Device (C-IED) detection by detecting and spectroscopically identifying military and home-made explosives and formulations.	1.306	1.342	1.359

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research to develop Computational Fluid Dynamic (CFD) modeling techniques to support flow optimization in diving, fire fighting, Chemical, Biological, Radiological, and Nuclear (CBRN) protection, and aeronautical and aerospace life support helmets. The goal of this research is to improve CO2 transport from life support helmets to optimize performance without resorting to an oral-nasal mask. - Completed research to develop a theory to describe vibrational energy transfer between a shock wave and the local vibrations/ electrons of explosive molecules. The goal of this research is to provide a simplified theoretical expression for the rate of energy transfer into an explosive molecule, without lengthy molecular dynamics or quantum chemical calculations. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiated the research on Molecular Switching of Explosive Molecules. - Initiated the research on the Synthesis of Non-toxic High-energy Explosive Materials. - Initiated research and understanding of Modified Energy Released Weapons. - Initiated research for the Analytical Ballistic Penetration Study of the Adaptable High-Speed Underwater Munitions. - Initiated research effort for the understand of Sulfur Hexafluoride as a Oxidant for Unmanned Underwater Vehicle (UUV) Electrochemical Power Systems.			
FY 2011 Plans: - Continue all efforts of FY 2010, less those noted as complete above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiate research to investigate the dispersion and control of electromagnetic (EM) waves in the microwave (RF) region using fabricated metamaterial structures.			
FY 2012 Plans: - Continue all efforts of FY 2011, less those noted as complete above. - Complete FY 2010 initiated ILIR projects during FY 2012.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Complete the research on Molecular Switching of Explosive Molecules. - Complete the research on the Synthesis of Non-toxic High-energy Explosive Materials. - Complete research and understanding of Modified Energy Released Weapons. - Complete research for the Analytical Ballistic Penetration Study of the Adaptable High-Speed Underwater Munitions. - Complete research effort for the understand of Sulfur Hexafluoride as a Oxidant for Unmanned Underwater Vehicle (UUV) Electrochemical Power Systems. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry.			
Title: HUMAN PERFORMANCE SCIENCES	2.087	2.147	2.169
Description: Efforts include: biosensors, biomaterial, bioprocesses; marine mammals; casualty care management, undersea medicine; human factors and organizational design; manpower, personnel and advanced cockpit; and operational training and education. These efforts are coordinated with the Navy Medical Research Center (NMRC). ***FY 2010 Accomplishments:*** - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research in the area of understanding of vection in relation to contact. The goal of this research is identify the threshold for vection as a function of stimulus and understand when a pilot is susceptible to disorientation due to vection in critical environment conditions. - Completed research to examine whether or not various forms of visuospatial attention are a manifestation of a single cognitive process. - Completed research in the area of exhaled nitric oxide measurements to provide a reliable and sensitive noninvasive marker of pulmonary oxygen toxicity in humans. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiated research on Exhaled Nitric Oxide (NO) and Carbon Monoxide (CO) as Noninvasive Markers of Hyperbaric Oxidative Stress in Humans (decompression treatment, carbon monoxide poisoning, wound healing, and crush injuries for which pulmonary oxygen toxicity is a potential side effect).			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Initiated research on Characterization of Mesenchymal Stem Cell Contribution to the Formation of Heterotopic Ossifications (understanding treatment/recovery of devastating injury patterns - involving massive zones of injury that violate soft tissue). - Initiated research on the Evaluation and Training of Institution Using Individual Differences - Initiated research on the study to identify the Underlying Mechanisms Resulting from IR Exposure. - Initiated research for Advanced Adsorbent Materials for Chemical, Biological, Radiological Filtration and/or Detection. - Initiated research on Mission Defined Language and Unmanned Vehicle (UV) Capacitance Using Predictive Tools. ***FY 2011 Plans:*** - Continue all efforts of FY 2010, less those noted as complete above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiate research to characterize the naturalistic decision making processes used in Naval Aviation acquisition programs to assess cost, schedule and performance tradeoffs within and between Human Systems Integration (HSI) domains. Content analysis will be performed to identify knowledge, skills, abilities, heuristics, and biases associated with HSI decision making. ***FY 2012 Plans:*** - Continue all efforts of FY 2011, less those noted as complete above. - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research on Exhaled Nitric Oxide (NO) and Carbon Monoxide (CO) as Noninvasive Markers of Hyperbaric Oxidative Stress in Humans (decompression treatment, carbon monoxide poisoning, wound healing, and crush injuries for which pulmonary oxygen toxicity is a potential side effect). - Complete research on Characterization of Mesenchymal Stem Cell Contribution to the Formation of Heterotopic Ossifications (understanding treatment/recovery of devastating injury patterns - involving massive zones of injury that violate soft tissue). - Complete research on the Evaluation and Training of Institution Using Individual Differences - Complete research on the study to identify the Underlying Mechanisms Resulting from IR Exposure. - Complete research for Advanced Adsorbent Materials for Chemical, Biological, Radiological Filtration and/or Detection. - Complete research on Mission Defined Language and Unmanned Vehicle (UV) Capacitance Using Predictive Tools. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Naval Battlespace Awareness and			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry.			
Title: INFORMATION SCIENCES	2.111	2.172	2.195
Description: Efforts include: mathematical foundation and computational theory and tools for design communications; decision support theory; algorithm and tools, information assurance, secure and reliable infrastructure for command and control; mathematical optimization for optimal resource allocation and usage; modeling and computational propagation; seamless, robust connectivity and networking and cyber warfare. ***FY 2010 Accomplishments:*** - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research into the connection between graphs and commutative algebra, and construction of fast algorithms to compute interesting new invariants. - Completed research into recent advances in Commercial Off The Shelf (COTS) microprocessor performance that have largely been achieved via added parallelism (adding additional microprocessor "cores" on the system), rather than by the more familiar method of increasing the clock speed. - Completed research to improve the methodology of time series summarization by utilizing the framework of second generation wavelets and on-off system models, and by inventing and utilizing better pre-processing strategies, segmentation algorithms, data transforms and dissimilarity functions. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiated research on Novel Image Processing Algorithms for Matrix Completion, Automated Scene Understanding, and Biotechnology Algorithms for Genetic and Proteomic analysis. - Initiated research for the use of Neural Networks in Clustering Classification. - Initiated research on the Relationship of Quantum Random Walk and Search Efficiency. - Initiated research for Statistical Modeling and Analysis of Object Shapes in Sonar Imagery. - Initiated research on Cognitive Correlators for Cyber Operations. - Initiated research on Off-Hull Intermittent Connectivity Network Management using Computational Intelligence. - Initiated research for Vision-Capable Unmanned Vehicle (UxV) Calibration, Environment Mapping, and Obstacle Avoidance. ***FY 2011 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Continue all efforts of FY 2010, less those noted as complete above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiate research to develop a theory of Systems-of-Systems (SoS) network engineering and analysis based on the theory of time series of attributed graphs to understand how such systems can be mathematically formulated, simulated, analyzed, and tested. ***FY 2012 Plans:*** Continue all efforts of FY 2011, less those noted as complete above. - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research on Novel Image Processing Algorithms for Matrix Completion, Automated Scene Understanding, and Biotechnology Algorithms for Genetic and Proteomic analysis. - Complete research for the use of Neural Networks in Clustering Classification. - Complete research on the Relationship of Quantum Random Walk and Search Efficiency. - Complete research for Statistical Modeling and Analysis of Object Shapes in Sonar Imagery. - Complete research on Cognitive Correlators for Cyber Operations. - Complete research on Off-Hull Intermittent Connectivity Network Management using Computational Intelligence. - Complete research for Vision-Capable Unmanned Vehicle (UxV) Calibration, Environment Mapping, and Obstacle Avoidance. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry.			
Title: NAVAL PLATFORM DESIGN SCIENCES ***Description:*** Efforts include: novel hull forms, materials, structures and signatures; and virtual shaping concepts for structures and platforms. ***FY 2010 Accomplishments:*** - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research on breaking wave loads utilizing the computational Reynolds Average Navier Strokes (RANS) codes. The research will investigate four general phases: creating consistent, repeatable breaking waves; creating these waves so that they	1.438	1.481	1.498

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
break on the surface to analyze impact forces; validating those impact forces with existing and additional experimental data; and exploring the scaling effects of the impact forces. - Completed research on a virtual shaping concept for structures and platforms. - Completed research to develop the next generation prediction tools based on RANS such that arbitrary complex geometries including non-circular body can be handled and the reliance on empiricism can be minimized. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiated research on Hydrodynamic Self-cleaning and Ship Performance use Flow Generated Forces. - Initiated research on New Approach to Dynamic Similarity for Surface Ship Scale Modeling. - Initiated research on Internal Actuation for Marine Sensor Platforms. - Initiated research on High Accuracy Inertial Measurement Unit from an Array of Low Cost Sensors. - Initiated research on the Applications of Hydrofoils with Leading Edge Protuberances. ***FY 2011 Plans:*** - Continue all efforts of FY 2010, less those noted as completed above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiate research to characterize the biaxial fatigue behavior of carrier-based aircraft in a corrosive environment, identify the basic mechanism of environment assisted biaxial fatigue cracking, develop an accurate model for corrosion fatigue crack growth under biaxial loading, and demonstrate and validate the model in the application to aircraft structure. ***FY 2012 Plans:*** - Continue all efforts of FY 2011, less those noted as completed above. - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research on Hydrodynamic Self-cleaning and Ship Performance use Flow Generated Forces. - Complete research on New Approach to Dynamic Similarity for Surface Ship Scale Modeling. - Complete research on Internal Actuation for Marine Sensor Platforms. - Complete research on High Accuracy Inertial Measurement Unit from an Array of Low Cost Sensors. - Complete research on the Applications of Hydrofoils with Leading Edge Protuberances.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry.			
Title: OCEAN/SPACE SCIENCES	4.810	4.790	4.749
Description: Efforts include: Littoral Geosciences, Optics, and biology; Marine Mammals; Ocean Acoustics; and autonomous systems. ***FY 2010 Accomplishments:*** - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Continued Naval Research Enterprise Intern Program (NREIP) to support undergraduate and graduate students performing Navy-related research at Naval Warfare Centers under the supervision and mentorship of DON Scientists, thus exposing them to interesting and challenging work done at the centers. NREIP is a continuing Navy education program. - Completed research into the development of a pentacene based neutron detector. - Completed research into the phenomenon of Core-Valence Luminescence (CVL) in scintillators that have the potential for radiation discrimination. - Completed research into the relative performance of Probabilistic Multi-Hypothesis Tracker (PMHT) and Joint Probabilistic Data Association (JPDA) and methods for integrating the best aspects of both into a single multi-target tracking and data fusion algorithm. - Completed research and development into a new scalable Computational Fluid Dynamics (CFD) tool to simulate the propulsion and maneuvering hydrodynamics of a biominetic Autonomous Underwater Vehicles (AUV) employing multiple flapping foils as the primary propulsor and control surfaces. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Battlespace Awareness, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility initiatives in Ocean Acoustics and Undersea Weaponry. - Initiated research on Free-Surface Interface Capturing Algorithm for CFD in the Understanding/Modeling of Autonomous Undersea Systems. - Initiated research for Coherent Terrain Navigation. - Initiated research on Multipath Signal Processing Cancellation Techniques for Mine Hunting. - Initiated research for Optical Integration Algorithm for Global Positioning System (GPS).			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Initiated research for Flight Behavior and Surveillance for Unmanned Underwater Systems for Anti-Submarine Warfare (ASW) Mission. - Initiated research for Full Spectrum Propagation Prediction. ***FY 2011 Plans:*** - Continue all efforts of FY 2010, less those noted as completed above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility initiatives in Ocean Acoustics and Undersea Weaponry. - Initiate research to assess the effects of Mid-Frequency Active (MFA) sonar on the movement of fish species in a natural environment to compare the behavior and movement of fish prior to exposure to sonar, during exposure, and for a significant amount of time post-exposure to provide valuable data on fish behavior, movement, and survival following exposure to high-intensity tactical MFA sonar. ***FY 2012 Plans:*** - Continue all efforts of FY 2011, less those noted as completed above. - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research on Free-Surface Interface Capturing Algorithm for CFD in the Understanding/Modeling of Autonomous Undersea Systems. - Complete research for Coherent Terrain Navigation. - Complete research on Multipath Signal Processing Cancellation Techniques for Mine Hunting. - Complete research for Optical Integration Algorithm for Global Positioning System (GPS). - Complete research for Flight Behavior and Surveillance for Unmanned Underwater Systems for Anti-Submarine Warfare (ASW) Mission. - Complete research for Full Spectrum Propagation Prediction. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Naval Battlespace Awareness, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility initiatives in Ocean Acoustics and Undersea Weaponry.			
Accomplishments/Planned Programs Subtotals	17.650	17.979	18.092

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent Res*	PROJECT 0000: *In-House Lab Independent Res*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The ILIR initiative seeks to improve the quality of defense research conducted predominantly through the Naval Warfare Centers/Laboratories. It also supports the development of technical intellect and education of engineers and scientists in disciplines critical to national defense needs through the development of new knowledge in a military laboratory environment. Initial research focus is often conducted in an unfettered environment since it is basic research, but many projects focus on applying recently developed theoretical knowledge to real world military problems with the intention of developing new capabilities and improving the performance of existing systems. Individual project metrics then become more tailored to the needs of specific applied research and advanced development programs. The National Research Council of the National Academies of Science and Engineering's Congressionally directed "Assessment of Department of Defense Basic Research" concluded that the DoD is managing its basic research program effectively.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 1: *Basic Research*	R-1 ITEM NOMENCLATURE PE 0601152N: *In-House Lab Independent 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*	3.479	-	-	-	-	-	-	-	-	0.000	3.479

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	3.479	-	-
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	3.479	-	-

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.