Exhibit R-2, PB 2010 Navy RDT&E Budget Item Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 1319 - Research, Development, Test & Evaluation, Navy/BA 1 - Basic Research					R-1 ITEM NOMENCLATURE PE 0601152N IN-HOUSE LABORATORY INDEPENDENT RESEARCH (ILIR)					
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	16.390	17.207	18.076						Continuing	Continuing
0000: IN-HOUSE LABORATORY INDEPENDENT RESEARCH (ILIR)	16.390	17.207	18.076						Continuing	Continuing

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.

The vision of the DON S&T strategy is "to inspire and guide innovation that will provide technology-based options for future Navy and Marine Corps Capabilities", where "Innovation is a process that couples Discovery and Invention with Exploitation and Delivery". 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 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.

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ILIR efforts are selected by Naval Warfare Centers/Lab COs and TDs 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.

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 2008	FY 2009	FY 2010	FY 2011
Previous President's Budget	16.403	17.298	18.285	
Current BES/President's Budget	16.390	17.207	18.076	
Total Adjustments	-0.013	-0.091	-0.209	
Congressional Program Reductions		-0.047		
Congressional Rescissions				
Total Congressional Increases				
Total Reprogrammings	0.010			
SBIR/STTR Transfer	-0.023			
Program Adjustments			-0.219	
Rate/Misc Adjustments		-0.044	0.010	

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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APPROPRIATION/BUDGET ACTIVITY 1319 - Research, Development, Test & Evaluation, Navy/BA 1 - Basic Research				R-1 ITEM NOMENCLATURE PE 0601152N IN-HOUSE LABORATORY INDEPENDENT RESEARCH (ILIR)					PROJECT NUMBER 0000
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
0000: IN-HOUSE LABORATORY INDEPENDENT RESEARCH (ILIR)	16.390	17.207	18.076						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. 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 Program ($ in Millions)	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
ADVANCED MATERIALS	3.117	3.301	3.557	
Efforts include: Structural materials; functional materials; maintenance reduction, hydrodynamics; power generation; energy conservation and conversion.				
FY 2008 Accomplishments: - Continued research to investigate a radical new technique for producing structures that have reconfigurable embedded functionality based on chemistry and nanotechnology. The research centers on the creation of “MicroConduit Network” (MCN) which is a series of interconnected micron-size channels designed to permeate thought the structure and occupy the smallest volume fraction, to preserve the strength and stiffness of the structure.				

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continued research to quantify the Small Angle X-ray Scattering (SAXS) and tensile mechanical tests the structural transition to the mechanical mechanism for protective response to different polyurea chemistries. Continue to characterize the response limits in terms of strain and high strain rates (10E-1s – 10E4/s) to ensure specific impact loading levels in the protective range of the polyurea coatings. - Continued research in the field of fuel cell membranes, chemical analysis and biological transport requires the understanding of the conduction and electrical mechanisms through porous membranes. The research has revealed unusual and enhanced conduction properties in pores with widths that are less than 1um; exceeding the diameter by which the current theory predicts. The research will exploit the enhanced current where there exists the potential for order-of-magnitude improvements in sensors, computation and communications. - Continued research from a previously sponsored ILIR project that produced the scientific foundation of a new technology for the expitaxial deposition of lattice-mismatched films on substrates of silicon (Si) and gallium arsenide (GaAs). The technology features the formation of an atomic layer or template that serves as the interface between the film and substrate. It was discovered that the layer formation happens when there is a chemical reaction between the substrate and the impinging molecules. This research will focus on the hypothesis that instead of fusion, the impinging molecules come in sequence with a narrow distribution of velocities than an ideal gas with lower overall entropy. - Completed research to seek a substrate to maximize the Surface Enhanced Raman Spectroscopy (SERS) effect. The SERS effect has been shown to be dependent on nanostructure size and distance between neighbors. SERS has been studied using roughened surfaces, nanocolloids, deposited films, electrode tips, metal islands, and a few other variations. The research sought to deposit Self-Assembled Monolayer's (SAMs) of conducting organic molecules on a gold surface and attach gold nanoparticles to the SAMs. The distance between nanoparticles was optimized to create SERS "hot spots" by varying the concentration and length of the molecules. - Completed research to identify a method of protecting underwater structures from bio-fouling without using toxins. Utilizing conductive polymers (piezoelectric), plastic films technology, nano-release mechanisms and non-chromate metal finishing indicated that the technology is mature enough to mimic natural non-toxic antifouling methods on artificial structures with added benefit of electric fields and piezoelectric movement.				

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
- Completed research on microstructure development of cast titanium Ti-5111 that determined critical features to control the strength and fracture toughness of the alloy. Strategic heat treatments were conducted, and two optimum heat treatment conditions were developed that show fracture toughness values greater than the wrought product while still maintaining good strength and ductility. An understanding of how the fracture toughness and ultimate strength of the material varies with types of grains, grain size and orientation was developed. This is particularly important for thin-walled pressure hulls where the grains of poorer quality can span the thickness of the hull and lead to lower strength structures than expected. - Initiated research and development on energy flow control and redirection of anisotropic cylindrical shells. This research is to reduce and redirect vibrational energy propagation through cylindrical structures by utilizing new anisotropic materials that are now available. - Initiated research and development effort to reinvestigate the nature of Cathodic Delamination (CD) problem and determine the effectiveness of new approaches to combating the old scourge of CD on naval hardware. - Initiated research in the development of an algorithm that makes us of both forward and inverse modeling techniques to determine variations in both static and dynamic material properties of hyper elastic materials from experimental measurement. The research seeks to develop a technique that combines modeling and experimental measurements to quantify spatial variations in materials response both static and dynamic loads. - Initiated research on mesoscale models to include dissipative particle dynamics and automata based modeling strategies. *FY 2009 Plans:* - Continue all efforts of FY 2008, less those noted as completed above. - Complete research to investigate a radical new technique for producing structures that have reconfigurable embedded functionality based on chemistry and nanotechnology. The research centers on the creation of MCN which is a series of interconnected micron-size channels designed to permeate thought the structure and occupy the smallest volume fraction, to preserve the strength and stiffness of the structure.					

Exhibit R-2a, PB 2010 Navy RDT&E Project Justification		DATE: May 2009			
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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
- Complete research to quantify the SAXS and tensile mechanical tests the structural transition to the mechanical mechanism for protective response to different polyurea chemistries. Continue to characterize the response limits in terms of strain and high strain rates (10E-1s – 10E4/s) to ensure specific impact loading levels in the protective range of the polyurea coatings. The strain rate material response for both elastic and plastic incorporated into the constitutive equation for modeling and hydrocode simulation for further calculations of the geometries and layer thickness. - Complete the research in the field of fuel cell membranes, chemical analysis and biological transport requires the understanding of the conduction and electrical mechanisms through porous membranes. The research revealed unusual and enhanced conduction properties in pores with widths less than 1um; exceeding the diameter by which the current theory predicts. The research will exploit the enhanced current where there exists the potential for order-of-magnitude improvements in sensors, computation and communications. - Complete research from a previously sponsored ILIR project that produced the scientific foundation of a new technology for the expitaxial deposition of lattice-mismatched films on substrates of silicon (Si) and GaAs. The technology features the formation of an atomic layer or template that serves as the interface between the film and substrate. It was discovered that the layer formation happens when there is a chemical reaction between the substrate and the impinging molecules. This research will focus on the hypothesis that instead of fusion, the impinging molecules come in sequence with a narrow distribution of velocities than ideal gas with lower entropy. - 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. FY 2009 projects are currently going through a rigorous selection process at the naval warfare centers. Projects selected for FY 2009 will focus on supporting Naval Materials by Design and Intelligent Naval Sensors, Innovation naval Prototypes Initiatives in Electromagnetic Gun and See Basing, and National Naval Responsibility Initiatives in Undersea Weaponry and Naval Engineering. *FY 2010 Plans:* - Continue all efforts of FY 2009, less those noted as completed above. - Complete research and development on energy flow control and redirection of anisotropic cylindrical shells					

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
- Complete research and development effort on the nature of CD problem in the navy and determine the effectiveness of new approaches to combating the old scourge on naval hardware. - Complete the research in the development of an algorithm that makes us of both forward and inverse modeling techniques to determine variations in both static and dynamic material properties of hyper elastic materials from experimental measurement. The research seeks to develop a technique that combines modeling and experimental measurements to quantify spatial variations in materials response both static and dynamic loads. - Complete research on mesoscale models to include dissipative particle dynamics and automata based modeling strategies. - 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 2010 will focus on supporting Naval Materials by Design and Intelligent Naval Sensors, Innovation naval Prototypes Initiatives in Electromagnetic Gun and See Basing, and National Naval Responsibility Initiatives in Undersea Weaponry and Naval Engineering.					
ELECTRONICS SENSOR SCIENCES 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 2008 Accomplishments:* - Continued research on new approaches, to miniaturization and the integration of optical components into compact functions systems capable of generating, localizing, detecting, amplifying, and processing light signals. The research will focus on novel coupling and beam splitting methods utilizing metallic tip and multilayer stock. The Y-Splitter is the basic components in many optical devices, such as coupling efficiency and splitting ratio. The beam splitting effect can be employed to construct a nanoplasmonic Y-splitter. Investigation into the method of beam coupling and splitting in the subwavelength scale. Nanoscale optics is expected to form the basis for future nanolithography and optical sensors, diagnostics in single- molecular level through surface plasmon enhanced ramon scattering.		2.434	2.464	2.618	

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continued research using mid-IR solid state laser to photo-acoustically generate large dimension, short-lived underwater filaments. Filament dimensions on the order of 10 mm in diameter and 10 cm long with durations ranging from 100 microseconds to a few milliseconds are expected as a result of using an existing laser system. The investigation could produce large dimension filaments and accompanying transient shock waves in a controlled manner could potentially revolutionize air/surface-to-underwater communications, and development of additional naval applications to support other situational awareness efforts. - Completed the research to numerically model the reduction of semiconductor laser phase noise and line width through optical injection locking and verify model developed. - Completed research on the extension of Negative Index Materials (NIM) wavelengths into the visible region. Near-field Scanning Optical Microscopy (NSOM) lithography was used in the fabrication or nanophotonic component structures. The component structure of primary interest was a layered parallel nanowire pair array separated by dielectric. Investigation incorporated material parameters derived from the Drude model. - Initiated investigation into the Space-Charge-Limited (SCL) transport of charge carriers across a potential difference. The related publications on theoretical, experimental and numerical investigations have undergone excess growth in the number of disciplines for which SCL related flows are found to be applicable. Currently SCL is playing in a classical role in the discharge and bounded of plasma devices. SCL is found to have a strong impact on ion diodes in connection with inertial fusion, diodes with cold cathode emission, field-emitter-arrays in the vacuum electronic field's semiconductor diodes and on the capabilities of photocathode guns. This research is to investigate the limitations of SCL transport and certain extension that have recently been proposed. The extensions can lead to enhancements in the amount charge and able to transport in 1-D, 2-D, and 3-D geometries. - Initiated an investigation into twin concepts of post-selection of wave function in a quantum mechanics and Aharonov-Vaidman formula that has opened up new avenues in the theory of what can and can not be measured in quantum mechanics. Each theory and experiment confirmation has proven new, previously unexpected effect in quantum mechanics and identifies a possible new area of technology. Research to translate the aspects of quantum mechanical work into a classical weak signatures (Observables) setting to determine if the effects can occur in electromagnetic and other wave theories. This research will have an enormous potential in provide new way to enhance signals that otherwise				

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
would not be detectable, new types of signatures to be looked for in the traditional signal (radar) waveform returns, new phenomena – weak energy. Investigate these phenomena in the classical signals that are regularly used in naval applications such as radar, sonar and electro-optics. *FY 2009 Plans:* - Continue all efforts of FY 2008, less those noted as completed above. - Complete research on new approaches, to miniaturization and integration of optical components into compact functions systems capable of generating, localizing, detecting, amplifying, and processing light signals. The research will focus on novel coupling and beam splitting methods utilizing metallic tip and multilayer stock. The Y-Splitter is the basic component in many optical devices. The beam splitting effect can be employed to construct a nanoplasmonic Y-splitter. Nanoscale optics is expected to form the basis for future nanolithography and optical sensors, and diagnostics in the single-molecular level through surface plasmon enhanced ramon scattering. - Complete research using mid-IR solid state laser to photo-acoustically generate large dimension, short-lived underwater filaments. Filament dimensions on the order of 10 mm in diameter and 10 cm long with durations ranging from 100 microseconds to a few milliseconds are expected as a result of using an existing laser system. The investigation could produce large dimension filaments and accompanying transient shock waves in a controlled manner could potentially revolutionize air/surface-to-underwater communications, and development of additional naval applications to support other situational awareness efforts. - 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. FY 2009 projects are currently going through a rigorous selection process at the naval warfare centers. Projects selected for FY 2009 will focus on supporting Electric Power Sources and Multifunctional Electronics for Intelligent Naval Sensors, Innovative Naval Prototypes Initiatives in Electromagnetic Gun and Persistent Surveillance, and the National Naval Responsibility in Undersea Weaponry. *FY 2010 Plans:* - Continue all efforts of FY 2009, less those noted as completed above.					

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
- Complete the investigation into the SCL transport of charge carriers across a potential difference. The related publications on theoretical, experimental and numerical investigations have undergone excess growth in the number of disciplines for which SCL related flows are found to be applicable. Currently SCL is playing in a classical role in the discharge and bounded of plasma devices. SCL is found to have a strong impact on ion diodes in connection with inertial fusion, diodes with cold cathode emission, field-emitter-arrays in the vacuum electronic fields' semiconductor diodes and on the capabilities of photocathode guns. This research is to investigate the limitations of SCL transport and certain extension that have recently been proposed. The extensions can lead to enhancements in the amount charge and able to transport in 1-D, 2-D, and 3-D geometries. - Complete the investigation into the twin concepts of post-selection of wave function in a quantum mechanics and Aharonov-Vaidman formula that has opened up new avenues in the theory of what can and can not be measured in quantum mechanics. Each theory and experiment confirmation has proven new, previously unexpected effect in quantum mechanics and identifies a possible new area of technology. Research to translate the aspects of quantum mechanical work into a classical weak signatures (Observables) setting to determine if the effects can occur in electromagnetic and other wave theories. This research will have an enormous potential in provide new way to enhance signals that otherwise would not be detectable, new types of signatures to be looked for in the traditional signal (radar) waveform returns, new phenomena – weak energy. Investigate these phenomena in the classical signals that are regularly used in naval applications such as radar, sonar and electro-optics. - 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 2010 will focus on supporting Electric Power Sources and Multifunctional Electronics for Intelligent Naval Sensors, Innovative Naval Prototypes Initiatives in Electromagnetic Gun and Persistent Surveillance, and the National Naval Responsibility in Undersea Weaponry.				
ENERGY SCIENCES Efforts include: undersea weaponry; energetic materials and propulsion; directed energy; and THZ-TDS technology that addresses the global war on terror and Counter Improvised Explosive Device (C-IED) (detect) tenet lane by detecting and spectroscopically identifying military and home-made explosives and formulations		1.283	1.275	1.372	

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
FY 2008 Accomplishments: - Continued research on the physical properties of explosively driven, guided shock waves. An explosively driven, guided shock wave is a shock wave produced in a guide tube that was initiated by an explosive at one end of the tube. The goal of this project is explore the properties guided shock wave to include: the pressure, temperature, and velocity of the gas through which the guided shock wave travels. - Continued research in the TeraHertz Time-Domain Spectroscopy (THz-TDS) technology which addressed the Global War On Terror (GWOT) and the C-IED (detect) tenet lane by detecting and spectroscopically identifying military and home-made explosives and formulations. The continued focus of this research is to establish peak assignments of explosives in the THz regime by comparing solid-state quantum chemistry calculations that is to be measured. Results of this study will provide the fundamental THz reflection and absorption spectra of explosives found in IEDs. - Completed research on the development of a capability to monitor detonation and subsequent combustion processes with temporal, spatial and chemical sensitivity. The measurement provided in this program focused on absorption spectroscopy and related schemes aimed at concentrations of metal particles and oxides. - Completed research into the capability of detonation and subsequent combustion processes with temporal, spatial and chemistry sensitive energetic materials. This effort focused on absorption spectroscopy and related schemes aimed at concentration of metal particles and oxides. Small scale laser ablation and composite explosive experiments were used to create highly turbulent environments where optical methods can be developed. - Initiated research to develop 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. - Initiated research in the development of a theory that will describe vibrational energy transfer between the 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. The approach combines both				

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
macroscopic thermodynamic properties and ultra fast spectroscopy data to study the initial nanosecond as the shock passes through the material. *FY 2009 Plans:* - Continue all efforts of FY 2008, less those noted as completed above. - Complete research on the physical properties of explosively driven, guided shock waves. An explosively driven, guided shock wave is a shock wave produced in a guide tube that was initiated by an explosive at one end of the tube. The goal of this project is explore the properties guided shock wave to include: the pressure, temperature, and velocity of the gas through which the guided shock wave travels. - Complete research in the THz-TDS technology which addressed the GWOT and the C-IED (detect) tenet lane by detecting and spectroscopically identifying military and home-made explosives and formulations. The continued focus of this research is to establish peak assignments of explosives in the THz regime by comparing solid-state quantum chemistry calculations that is to be measured. Results of this study will provide the fundamental THz reflection and absorption spectra of explosives found in IEDs. - 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. FY 2009 projects are currently going through a rigorous selection process at the naval warfare centers. Projects selected for FY 2009 will focus on supporting Naval Battlespace Awareness and Intelligent naval Sensors, Innovative Naval Prototypes Initiative in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. *FY 2010 Plans:* - Continue all efforts of FY 2008, less those noted as completed above. - Complete research to develop CFD modeling techniques to support flow optimization in diving, fire fighting, 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. - Complete research in the development of a theory that will describe vibrational energy transfer between the 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,				

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
without lengthy molecular dynamics or quantum chemical calculations. The approach combines both macroscopic thermodynamic properties and ultra fast spectroscopy data to study the initial nanosecond as the shock passes through the material. - 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 2010 will focus on supporting Naval Battlespace Awareness and Intelligent naval Sensors, Innovative Naval Prototypes Initiative in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry.					
HUMAN PERFORMANCE SCIENCES 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 2008 Accomplishments:* - Continued research to elucidate the pathogenic mechanism, looking for common and different underlying mechanisms of injury, in hyperbaric oxygen and Blast OverPressure (BOP) induced injury by specific induction of heme oxygenase-1 or specific suppression of inducible nitric oxide synthesis in lungs. - Continued research to determine if inhaled heavy metals contribute to the pathogenesis of neurodegeneration. The research focused on the olfactory and trigeminal sensory nerves in the nasal mucosa. The hypothesis is that retrograde axonal transport of inhaled heavy metals from sensory nerves in the upper airway to the central nervous system results in significant neurotoxicity. - Continued research in the proliferation and differentiation of adult/stem progenitor cells to mature, terminally differentiated cells of skin, muscle, bone, nerve, heart, tendon, liver, and pancreas in a multi-step process. There is continual evidence that some tissue regenerative cells, particularly found in bone marrow migrate within the body and can contribute to healing at multiple sites in multiple lineages. Bone		2.019	1.998	2.192	

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
marrow derived hematopoietic stem cells, mesenchymal stem cells, endothelial progenitor cells and skeletal muscle-derived stems can contribute to the regeneration of a variety of tissues in vivo. - Completed research to modify the test fixture to add a yaw capability, quantitatively determine the limits of human cervical spine tolerance to a parachute opening shock as a function of pitch and yaw to be representative of a true ejection environment. - Completed research experiments designed to prove the theory that adding spark arc conditions during the electro spin process that has tremendous impact on the chemistry of polymer formation and accurately describes the electro spinning phenomena. Understanding the fundamental science of electro spinning phenomena allows for intelligent approach – system engineering to the design of new formulation of nanotechnology based materials for military importance. - Completed the investigation of the degree to which periodic structures such as thin film holograms or photonic crystals are turned by ultra fast laser pulses. - Completed research to develop and demonstrate chemical and biological sensors based on the use of miniature array of Micro-Electro- Mechanical Systems (MEMS) based on the Frabry-Perot Interferometers (FPIs). The goals of the research effort is to yield very small, inexpensive arrayable devices capable of rapidly detecting a variety of Biological Warfare Agents (BWA) with low levels of false positives. - Initiated research in the area of understanding of vection (illusion of self-motion) 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 in critical environment (visual induced illusion of self-motion) conditions. - Initiated research to examine whether or not various forms of visuospatial attention are a manifestation of a single cognitive process. The intent of this research is to understand the basic principles of visuospatial attention would allow engineers to define upper and lower boundaries for attentional ability and design display systems to consider these aspects of operator performance. - Initiated research into exhaled nitric oxide measurement to provide a reliable and sensitive noninvasive marker of pulmonary oxygen toxicity in humans. The research seeks to measure normal day to day individual variability in pulmonary function and exhaled nitric oxidant and contrast these measurements with pulmonary function, exhaled nitric oxide and pulmonary oxygen toxicity symptoms.				

Exhibit R-2a, PB 2010 Navy RDT&E Project Justification		DATE: May 2009
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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
FY 2009 Plans: - Continue all efforts of FY 2008, less those noted as completed above. - Complete research to elucidate the pathogenic mechanism, looking for common and different underlying mechanisms of injury, in hyperbaric oxygen and BOP induced injury by specific induction of heme oxygenase-1 or specific suppression of inducible nitric oxide synthesis in lungs. - Complete research to determine if inhaled heavy metals contribute to the pathogenesis of neurodegeneration. The research focused on the olfactory and trigeminal sensory nerves in the nasal mucosa. The hypothesis is that retrograde axonal transport of inhaled heavy metals from sensory nerves in the upper airway to the central nervous system results in significant neurotoxicity. - Complete research in the proliferation and differentiation of adult/stem progenitor cells to mature, terminally differentiated cells of skin, muscle, bone, nerve, heart, tendon, liver, and pancreas in a multi-step process. There is continual evidence that some tissue regenerative cells, particularly found in bone marrow migrate within the body and can contribute to healing at multiple sites in multiple lineages. Bone marrow derived hematopoietic stem cells, mesenchymal stem cells, endothelial progenitor cells and skeletal muscle-derived stems can contribute to the regeneration of a variety of tissues in vivo. - 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. FY 2009 projects are currently going through a rigorous selection process at the naval warfare centers. Projects selected for FY 2009 will focus on supporting Naval Battlespace Awareness and Intelligent naval Sensors, Innovative Naval Prototypes Initiative in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. *FY 2010 Plans:* - Continue all efforts of FY 2009, less those noted as completed above. - Complete research in the area of understanding of vection (illusion of self-motion) 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 in critical environment (visually induced illusion of self-motion) conditions. - Complete researches to examine various forms of visuospatial attention are a manifestation of a single cognitive process. The goal of this research is to understand the basic principles of visuospatial attention				

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
would allow engineers to define upper and lower boundaries for attentional ability and design display systems to consider these aspects of operator performance. - Complete the research in the area of exhaled nitric oxide measurements that provided a reliable and sensitive noninvasive marker of pulmonary oxygen toxicity in humans. The research seeks to measure normal day to day individual variability in pulmonary function and exhaled nitric oxidant and contrast these measurements with pulmonary function, exhaled nitric oxide and pulmonary oxygen toxicity symptoms. - 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 2010 will focus on supporting Naval Battlespace Awareness and Intelligent naval Sensors, Innovative Naval Prototypes Initiative in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry.					
INFORMATION SCIENCES		2.015	2.060	2.217	
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 2008 Accomplishments:* - Continued research to harness the power of clustering algorithms in association with other analytical techniques to detect changes in a system. Changes can be temporal, tracking a system over time or introduced in a system with outside influence. The research focused development of algorithms to compare different clustered data. Continued research to find and measure changes in data using data clustering as an underlying representation of the data. Experimental evaluation will be preformed utilizing our program to measure changes in the real data such as maritime domain data and synthetic data. - Continued research will focus on the development of nonlinear dynamics based criteria to distinguish structural damage from the general dynamic characteristic changes which will include environmental effects. The goal is to finalize the phased array interrogation/sensing, signal extraction and nonlinear					

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B. Accomplishments/Planned Program ($ in Millions)		FY 2008	FY 2009	FY 2010	FY 2011

dynamic analysis scheme is effective, which is automatic to provide real-time health monitoring and diagnostic technology with potential for a variety of applications.
- Completed the research in the area of generic types of streaming data with graphs. Streaming data is data that have a temporal relationship and arrived at such a rate (large volume) as to preclude past data from being revisited. Algorithms for streaming data make only one pass through the data and required use of data structures that enable information to be gained even though there is only limited memory and storage. Research issue on streaming data is import in today's world is collected faster than the data can be analyzed.
- Completed research in the detection change and structures in the time series of graphs and networks. The purpose of this research was to detect and model significant changes in the graph, trends and anomalies in the time series of graphs. Investigated methods that are both informed applications and mathematical scientific issues. The project sought to determine applicability of social network analysis to networks of interest.
- Initiated an investigation into the connection between graphs and commutative algebra, and construct fast algorithms to computer interesting new invariants on graph. This research project will link graph theory, commutative algebra, geometry and topology to provide new way to analyze data and information.
- Initiated research into recent advances in Commercial Off The Shelf (COTS) microprocessor performance that have largely be achieved via added parallelism (adding additional microprocessor "cores" on the system), rather than by the more familiar method of increasing the clock speed. Research into developing software to perform well on these parallel architectures is difficult and expensive. The problem has been made more difficult by the vastly different programming techniques required by the two leading COTS parallel architectures (IBM "Cell BE" vs Intel/AMD x86). Initiate an investigation into a technique to automatically supply specialize Navy algorithm to these radically different architectures, and use a stochastic search to optimize the performance of the algorithm to each targeted architecture.
- Initiated 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.

FY 2009 Plans:
- Continue all efforts of FY 2008, less those noted as completed above.

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Complete research to harness the power of clustering algorithms in association with other analytical techniques to detect changes in a system. Changes can be temporal, tracking a system over time or introduced in a system with outside influence. The research focused development of algorithms to compare different clustered data. Continued research to find and measure changes in data using data clustering as an underlying representation of the data. Experimental evaluation will be preformed utilizing our program to measure changes in the real data such as maritime domain data and synthetic data. - Complete research will focus on the development of nonlinear dynamics based criteria to distinguish structural damage from the general dynamic characteristic changes which will include environmental effects. The goal is to finalize the phased array interrogation/sensing, signal extraction and nonlinear dynamic analysis scheme is effective, which is automatic to provide real-time health monitoring and diagnostic technology with potential for a variety of applications. - 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. FY 2009 projects are currently going through a rigorous selection process at the naval warfare centers. Projects selected for FY 2009 will focus on supporting Naval Battlespace Awareness and Intelligent naval Sensors, Innovative Naval Prototypes Initiative in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. *FY 2010 Plans:* - Continue all efforts of FY 2009, less those noted as completed above. - Complete an investigation into the connection between graphs and commutative algebra, and construct fast algorithms to computer interesting new invariants on graph. This research project will link graph theory, commutative algebra, geometry and topology to provide new way to analyze data and information. - Complete research into recent advances in COTS microprocessor performance that have largely be achieved via added parallelism (adding additional microprocessor “cores” on the system), rather than by the more familiar method of increasing the clock speed. Research into developing software to perform well on these parallel architectures is difficult and expensive. The problem has been made more difficult by the vastly different programming techniques required by the two leading COTS parallel architectures (IBM “Cell BE” vs Intel/AMD x86). Initiate an investigation into a technique to automatically				

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
supply specialize Navy algorithm to these radically different architectures, and use a stochastic search to optimize the performance of the algorithm to each targeted architecture. - Complete 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. - 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 2010 will focus on supporting Naval Battlespace Awareness and Intelligent naval Sensors, Innovative Naval Prototypes Initiative in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry.					
NAVAL PLATFORM DESIGN SCIENCES Efforts include: novel hull forms, materials, structures and signatures; and virtual shaping concepts for structures and platforms *FY 2008 Accomplishments:* - Continued research in the increasing sophistication of sensor systems that have made mid- and high-frequency acoustic signature identification possible. New ship classes are given tight acoustic budgets, driving the exploration of new and novel concepts in hull form, materials and propulsion and development of structural and acoustic analysis tools to evaluate the vulnerability. The focus of this research project is to develop a method for efficiently addressing a class of mid-frequency vibration problems highly relevant to naval vessels. The goal is to capture directly the mid-frequency physics rather than apply a hybrid approach. - Continued research in the ThermoElectric (TE) devices used for waste heat recovery and its conversion to electrical energy. Conversion efficiencies of the TE devices are related to a dimensionless merit of figure referred to as ZT. Devices have low efficiencies to due to a low value of ZT. The goal of this research is to provide an improved understanding of the materials physical and chemical properties, that lead to an increase in the value of ZT and subsequently an increase in conversion efficiency. An		1.233	1.407	1.510	

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
increase in value of ZT can be accomplished by reducing the lattice thermal conductivity and increasing the Seebeck coefficient and electrical conductive of TE materials. - Continued research to increase the energy density and lower the self-discharge rate of energy storage systems by identifying the physicochemical properties of the electrode/electrolyte interface associated with capacitance. Continued focus on novel carbons and lithium electrolytic salts (as opposed to tetraethylammonium tetrafluoroborate used in current capacitors) and non-aqueous, asymmetric hybrid supercapacitors. - Completed research to understand the influence of various metallurgical factors on the strengthening or softening mechanisms of Iron-based friction stir welds. The goal was to develop a predictive tool that is interchangeably correlate process parameters to mechanical property requirements for any material and thickness. - Completed research into a passive millimeter wave phenomenology in a maritime environment so that accurate signature models can be developed. Millimeter waves are defined as electromagnetic waves having wavelengths of 1 to 10 millimeters. - Completed research on the complex physical phenomena of aerodynamic heating on three-dimensional hypersonic bodies generated by the waverider concept. - Initiated research in the area of experimental breaking wave loads by bringing the analysis into the computational realm using the Reynolds Average Navier Strokes (RANS) codes. The research will investigate four general phases: creating consistent, repeatable breaking waves; creating these waves so that they 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. The goal of the research is to gain a much clearer understanding of the functional physics of breaking waves and the loads that are created, but to replicate these characteristics in a computational environment. The result of the computational capability will provide guidance for the future fleet designs and understand hydro loads on structural ship design. - Initiated research on a virtual shaping concept for structures and platforms. Virtual shaping is implemented by introducing a phase shift gradient in the reflective wave along a structural surface, which will cause the reflection of an incoming plane wave to be in a non-specular direction, minimizing the chance of detection by the emitter. The virtual shaping concept could be implemented by surface treatments, appliqués containing micropatch arrays, constructed to simulate the effects of shaping when				

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
applied to the ship structure. This goal of this research are to reduced the need for tumblehome design for stealthiness, reduced surface area of topside structures and retrofitting of existing ships to reduce their radar cross section - Initiated 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. The goal of this research is to be accurate and fast enough to do real time analysis and support submarine design and be able to accommodate submarine Submerged Operating Envelope (SOE). *FY 2009 Plans:* - Continue all efforts of FY 2008, less those noted as completed above. - Complete research on the increasing sophistication of sensor systems that have made mid- and high-frequency acoustic signature identification possible. New ship classes are given tight acoustic budgets, driving the exploration of new and novel concepts in hull form, materials and propulsion and development of structural and acoustic analysis tools to evaluate the vulnerability. The focus of this research project is to develop a method for efficiently addressing a class of mid-frequency vibration problems highly relevant to naval vessels. The goal is to capture directly the mid-frequency physics rather than apply a hybrid approach. - Complete research in the TE devices used for waste heat recovery and its conversion to electrical energy. Conversion efficiencies of the TE devices are related to a dimensionless merit of figure referred to as ZT. Devices have low efficiencies to due to a low value of ZT. The goal of this research is to provide an improved understanding of the materials physical and chemical properties, that lead to an increase in the value of ZT and subsequently an increase in conversion efficiency. An increase in value of ZT can be accomplished by reducing the lattice thermal conductivity and increasing the Seebeck coefficient and electrical conductive of TE materials. - Complete research to increase the energy density and lower the self-discharge rate of energy storage systems by identifying the physicochemical properties of the electrode/electrolyte interface associated with capacitance. Continued focus on novel carbons and lithium electrolytic salts (as opposed to tetraethylammonium tetrafluoroborate used in current capacitors) and non-aqueous, asymmetric hybrid supercapacitors.					

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**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. FY 2009 projects are currently going through a rigorous selection process at the naval warfare centers. Projects selected for FY 2009 will focus on supporting Naval Battlespace Awareness and Intelligent naval Sensors, Innovative Naval Prototypes Initiative in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. *FY 2010 Plans:* - Continue all efforts of FY 2009, less those noted as completed above. - Complete research on breaking wave loads utilizing the computational RANS codes. The research will investigate four general phases: creating consistent, repeatable breaking waves; creating these waves so that they 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. The goal of the research is to gain a much clearer understanding of the functional physics of breaking waves and the loads that are created, but to replicate these characteristics in a computational environment. The result of the computational capability will provide guidance for the future fleet designs and understand hydro loads on structural ship design. - Complete research on a virtual shaping concept for structures and platforms. Virtual shaping is implemented by introducing a phase shift gradient in the reflective wave along a structural surface, which will cause the reflection of an incoming plane wave to be in a non-specular direction, minimizing the chance of detection by the emitter. The virtual shaping concept could be implemented by surface treatments, appliqués containing micropatch arrays, constructed to simulate the effects of shaping when applied to the ship structure. This goal of this research are to reduced the need for tumblehome design for stealthiness, reduced surface area of topside structures and retrofitting of existing ships to reduce their radar cross section - Complete 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. The goal of this research is to be accurate and fast enough to do real time analysis and support submarine design and be able to accommodate submarine SOE.					

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**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 2010 will focus on supporting Naval Battlespace Awareness and Intelligent naval Sensors, Innovative Naval Prototypes Initiative in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry.					
OCEAN/SPACE SCIENCES Efforts include: Littoral Geosciences, Optics, and biology; Marine Mammals; Ocean Acoustics; and autonomous systems. *FY 2008 Accomplishments:* - Continued research and development of test algorithms for acoustics marine mammal (Beaked Whales) bioacoustics and spatial/temporal habitat characterization in the Tongue of the Ocean, Bahamas. Density estimation algorithms were developed and three methods were investigated: group localization, time-difference-of-arrival histograms, and click counting. Counting beaked whale vocalization termed clicks was shown to be a promising technique to measure the beaked whale population density on the Atlantic Undersea Test and Evaluation Center (AUTEC) Range. Beaked whales appear to be the most susceptible to active sonar. Research is continuing to determine whether this technique can be used on ranges in other environments. - 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. - Continued research to determine whether chaos based communications can be applied to typical range tracking scenarios. Chaos based spread-spectrum communications to underwater telemetry have been explored, simulated and demonstrated for low-Doppler littoral environments. Initial analysis of in-water experiments including determining the suitability of chaotic sequences for detection and time-stamping when tracking was performed.		4.289	4.702	4.610	

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Completed the analytical solution to the vector wave equation in prolate Spheroidal which developed a lossy material. The results of this research will enable rapid and complete prediction of sonar array performance for submarines. - Completed the research to develop methods to automatically segment and characterize data using Bayesian networks. Developed hierarchical texture segmentation algorithms based on tree-structured Bayesian networks (TSBN) and Dynamic Tree (DT) graphical image models. - Completed the application of level sets to the problem of acoustic propagation in shallow water regimes, providing robust theoretical and numerical foundation for accurate range dependent acoustic modeling. This effort will provide greater flexibility and improved accuracy in the simulation of propagation in the littoral environment. - Initiated research in the development of a pentacene based neutron detector. This effort will seek to explore processing parameters for preparing thick pentacene-based films at purities suitable for neutron detection and develop a fundamental understanding of electronic structure interaction of pentacene with organo-boron-containing film components. - Initiated investigation of the phenomenon of Core-Valence Luminescence (CVL) in scintillators that have the potential of radiation discrimination. CVL is the emission resulting from radiative transitions between the valance and first core band under gamma excitation. The effort will explore unique spectral properties which can be exploited to discriminate between different types of nuclear radiation. - Initiated research into the relative performance of promising technologies (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. This effort will seek to integrate an Interacting Multiple Model (IMM) algorithm into the PMHT algorithm, with a Multi-Dimensional Assignment (MDA). - Initiated research and development into a new scaleable Computational Fluid Dynamics (CFD) tool to simulate the propulsion and maneuvering hydrodynamics of biominetic Autonomous Underwater Vehicles (AUV) employing multiple flapping foils as the primary propulsor and control surfaces. This research effort is to demonstrate that CFD can be an effective tool for evaluating biominetic AUV designs and development of control strategies for optimizing the hydrodynamic performance of biomimetic designs and minimizing undesirable effects such as unwanted vehicle motions that can degrade sensor performance.				

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
FY 2009 Plans: - Continue all efforts of FY 2008, less those noted as completed above. - Complete the beaked whale algorithms for density data is to be analyzed for spatial, seasonal and diurnal trends, and the relationships to oceanographic features. Detection and localization archive files from a number of marine mammal monitoring on Navy ranges at the Atlantic Undersea Test and Evaluation Center, Bahamas. The results of the algorithms are required to meet proposed mitigation measures for both at sea operations and long term monitoring of the Navy's undersea acoustic ranges. - Complete the chaos based spread-spectrum communications to underwater telemetry have been explored, simulated and demonstrated for low-doppler littoral environments. - 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. FY 2009 projects are currently going through a rigorous selection process at the naval warfare centers. Projects selected for FY 2009 will focus on supporting Naval Battlespace Awareness, Innovation Naval Prototypes Initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility Initiatives in Ocean Acoustics and Undersea Weaponry. *FY 2010 Plans:* - Continue all efforts of FY 2009, less those noted as completed above. - Complete research in the development of a pentacene based neutron detector. This effort will seek to explore processing parameters for preparing thick pentacene-based films at purities suitable for neutron detection and develop a fundamental understanding of electronic structure interaction of pentacene with organo-boron-containing film components. - Complete investigation of the phenomenon of CVL in scintillators that have the potential of radiation discrimination. CVL is the emission resulting from radiative transitions between the valance and first core band under gamma excitation. The effort will explore unique spectral properties which can be exploited to discriminate between different types of nuclear radiation. - Complete research into the relative performance of promising technologies (PMHT and JPDA) and methods for integrating the best aspects of both into a single multi-target tracking and data fusion algorithm. This effort will seek to integrate an IMM algorithm into the PMHT algorithm, with a MDA.				

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Complete research and development into a new scaleable CFD tool to simulate the propulsion and maneuvering hydrodynamics of biominetic AUV employing multiple flapping foils as the primary propulsor and control surfaces. This research effort is to demonstrate that CFD can be an effective tool for evaluating biominetic AUV designs and development of control strategies for optimizing the hydrodynamic performance of biomimetic designs and minimizing undesirable effects such as unwanted vehicle motions that can degrade sensor performance. - 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 2010 will focus on supporting Naval Battlespace Awareness, Innovation Naval Prototypes Initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility Initiatives in Ocean Acoustics and Undersea Weaponry.				

C. Other Program Funding Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
PE 0601101A/In-House Laboratory Independent Research									Continuing	Continuing
PE 0601102F/Defense Research Sciences									Continuing	Continuing
PE 0601153N/Defense Research Sciences									Continuing	Continuing

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

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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.

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