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**Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy** **DATE:** February 2011

<b>APPROPRIATION/BUDGET ACTIVITY</b>				<b>R-1 ITEM NOMENCLATURE</b>							
1319: <i>Research, Development, Test &amp; Evaluation, Navy</i> BA 2: <i>Applied Research</i>				PE 0602747N: <i>Undersea Warfare Applied Res</i>							
<b>COST (\$ in Millions)</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	<b>FY 2013</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	64.000	69.186	108.666	-	108.666	113.155	115.662	122.343	125.097	Continuing	Continuing
0000: <i>Undersea Warfare Applied Res</i>	53.465	69.186	108.666	-	108.666	113.155	115.662	122.343	125.097	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	0.975	-	-	-	-	-	-	-	-	0.000	0.975
9999: <i>Congressional Adds</i>	9.560	-	-	-	-	-	-	-	-	0.000	9.560

**A. Mission Description and Budget Item Justification**

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE funds applied research efforts in undersea target detection, classification, localization, tracking, and neutralization. Technologies being developed within this PE are aimed at enabling Sea Shield, one of the core operational concepts detailed in the Naval Transformational Roadmap. Associated efforts focus on new Anti-Submarine Warfare (ASW) operational concepts that promise to improve wide-area surveillance, detection, localization, tracking, and attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments. Related efforts are aimed at leveraging technologies that will protect the country's current capital investment in surveillance, submarine, surface ship, and air ASW assets. Research focused on understanding the impacts on marine mammals of manmade underwater sound is also conducted in the Program Element.

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

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<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>
Previous President's Budget	65.003	69.186	89.728	-	89.728
Current President's Budget	64.000	69.186	108.666	-	108.666
Total Adjustments	-1.003	-	18.938	-	18.938
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.301	-			
• SBIR/STTR Transfer	-1.178	-			
• Program Adjustments	-	-	19.385	-	19.385
• Section 219 Reprogramming	0.485	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.447	-	-0.447
• Congressional General Reductions Adjustments	-0.009	-	-	-	-

**Congressional Add Details (\$ in Millions, and Includes General Reductions)**

**Project: 9999: Congressional Adds**

Congressional Add: *Advanced High Energy Density Surveillance Power Module*

Congressional Add: *Autonomous UUV Delivery and Communication System Integration*

Congressional Add: *Galfenol Energy Harvesting*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	<b>FY 2010</b>	<b>FY 2011</b>
	3.187	-
	3.585	-
	2.788	-
Congressional Add Subtotals for Project: 9999	9.560	-
Congressional Add Totals for all Projects	9.560	-

**Change Summary Explanation**

Technical: Not applicable.

Schedule: Not applicable.

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<b>COST (\$ in Millions)</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	<b>FY 2013</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
0000: <i>Undersea Warfare Applied Res</i>	53.465	69.186	108.666	-	108.666	113.155	115.662	122.343	125.097	Continuing	Continuing

**A. Mission Description and Budget Item Justification**

This PE funds applied research efforts in undersea target detection, classification, localization, tracking, and neutralization. Technologies being developed within this project are aimed at enabling Sea Shield which is one of the core operational concepts detailed in the Naval Transformational Roadmap. Associated efforts focus on new ASW operational concepts that promise to improve wide-area surveillance, detection, localization, tracking, and attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments. Related efforts are aimed at leveraging technologies that will protect the country's current capital investment in surveillance, submarine, surface ship, and air ASW assets.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012</b>
<p><b>Title:</b> ANTI-SUBMARINE WARFARE (ASW) DISTRIBUTED SEARCH</p> <p><b>Description:</b> ASW Distributed Search focuses on the development of technologies for the non-covert tactical search for undersea targets ranging from hours to weeks using automated sensor systems deployed around operating areas including along key transit routes to protect naval/maritime forces, around temporarily fixed sea base regions and naval force operating areas, or around fixed defensive regions and areas of interest such as key US/Allied ports. "Non-covert" implies availability of airborne assets for sensor deployment (although other means may also be used), and the ability to employ active sonar along with passive and non-acoustic methods. "Search" is conducted in concentrated areas, typically exploiting cues received from surveillance systems. The submarine target must be detected beyond its weapons release range. The objective is to develop rapidly deployable systems employing automated detection and classification capabilities for use in both shallow and deep water operating environments. Distributed Search supports the ASW protected passage Maritime Shield operational constructs. Related efforts include the development of distributed systems employing optimization as well as active acoustic sensing and processing techniques, navy-unique transduction and underwater networking technology. Efforts also include the development of Unmanned Undersea Vehicle-based and affordable off-board deployable sensing systems employing persistent detection concepts and components. These efforts provide an extended reach of organic platform-based systems through the use of new sensor concepts, improved materials for advanced sensors, optimized deployment, employment, and automated operation of distributed sensor fields. The cornerstone of Distributed Search is the development of rapidly deployable, long-endurance active sensors with automated processing suitable for use in a wide variety of operational environments.</p> <p>Increase from FY 2010 to FY 2011 is due to the new EC SHD-FY10-02 High Fidelity Active Sonar Training (HIFAST).</p> <p><b>FY 2010 Accomplishments:</b> Wide Area ASW Surveillance activity:</p>	11.776	14.592	16.571

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2010</b>	<b>FY 2011</b>
<ul style="list-style-type: none"> <li>- Continued development of signal processing algorithms aimed at reducing clutter-generated false alerts.</li> <li>- Continued development/improvement of multi-static signal processing techniques for systems employing coherent sound sources.</li> <li>- Continued development of "intelligent" algorithms aimed at optimizing distributed multistatic sources/receivers.</li> <li>- Continued a collaborative follow-on Joint Research Project for Next Generation Autonomous Sensing (NGAS).</li> <li>- Initiated research and development of feature-based tracking techniques to improve multi-sensor tracking of quiet submarines in littoral and deep-ocean environments.</li> <li>- Initiated research into the characterization and classification of deep-ocean clutter sources to improve active sonar system performance in Convergence Zone (CZ) and other deep-ocean propagation conditions.</li> <li>- Initiated development of Non-Traditional Transduction Methods (NTTM) which fundamentally departs from conventional ASW transduction techniques.</li> <li>- Initiated development of Non-Acoustic Fiber Optic Sensors (NA-FOS) for ASW applications.</li> <li>- Initiated research aimed at adaptive design and synthesis of networked distributed sensors.</li> <li>- Initiated effort to demonstrate the effectiveness of structural acoustic-based classifier techniques to detect, localize and identify.</li> <li>- Completed research effort to accomplish array shape estimation using fiber-optic interferometric methods.</li> </ul> <p>The following efforts contribute to the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area:</p> <ul style="list-style-type: none"> <li>- Continued an applied research effort to improve distributed system processing techniques and capabilities.</li> <li>- Initiated development of high fidelity computer-based simulation training with linked architecture that supports ASW training from the operator-level to the ASW Commander-level applicable to both surface and air platforms.</li> </ul> <ul style="list-style-type: none"> <li>- Continued development of signal processing improvements for coherent tactical active sonar systems aimed at improving Detection, Classification, and Localization of small, slow moving submarines in shallow water.</li> <li>- Continued development of improved techniques to distinguish submarine echoes from those produced by ocean bottom features.</li> <li>- Continued design and development of underwater projectors using structural magnetostrictive materials.</li> <li>- Continued dipole projector array design and development.</li> <li>- Continued compact low frequency projector developments.</li> <li>- Continued single crystal and hybrid projector design and development.</li> </ul> <p><b>FY 2011 Plans:</b></p> <ul style="list-style-type: none"> <li>- Continue all efforts of FY 2010, less those noted as completed above.</li> </ul>			

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012</b>
<p>- Complete dipole projector array design and development.</p> <p>The following efforts contribute to the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area:</p> <ul style="list-style-type: none"> <li>- Continue all efforts of FY 2010.</li> <li>- Complete an applied research effort to improve distributed system processing techniques and capabilities. Technologies will transition to Air ASW Systems, NAVAIR PMA.</li> </ul> <p><b>FY 2012 Plans:</b></p> <ul style="list-style-type: none"> <li>- Continue all efforts of FY 2011, less those noted as completed above.</li> </ul>				
<p><b>Title:</b> ANTI-SUBMARINE WARFARE (ASW) PERFORMANCE ASSESSMENT</p> <p><b>Description:</b> The goal of this work is to integrate ocean and atmospheric environmental characteristics with sensor performance predictions in order to develop algorithms and Tactical Decision Aids (TDAs) that will accurately predict overall sensor performance in a given environment in near real-time for both present and future situations. The results of these research efforts in conjunction with embedded state-of-the-art command and operator-level training will facilitate the optimum employment of ASW sensor systems, thus increasing their effectiveness and potentially decreasing the number of sensors used to provide coverage in a given area. This work will provide operational commanders with sensor performance predictions which allow them to accurately judge the performance of those sensors, as well as information with which to deploy them for the greatest operational effect. It will also provide information as to how the performance evolves over time due to effects such as the deformation of sensor locations by currents, sound velocity profile changes, geologic magnetic interference changes, or changes to the optical properties of the water, etc. The effort includes performance predictions for fields of sensors as well as individual sensors themselves and applies to both acoustic and nonacoustic sensors.</p> <p>Work includes development of ASW sensor and system performance models, and realistic simulations and measures of effectiveness that incorporate and exploit critical environmental knowledge. It includes efforts to couple ocean dynamics and acoustics, characterize ambient noise in the littorals, measure and model acoustic and optical propagation and scattering in complex environments, develop algorithms to extract environmental information from through-the-sensor measurements and quantification and prediction of uncertainty. This information is combined with the operating characteristics of particular sensors (or groups of sensors) to provide predictions of sensor performance in the environment at that particular time and in the future. The predictions will also include assessments of the prediction uncertainty due to environmental measurement and sensor performance uncertainties.</p>		4.047	3.052	2.258

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012</b>
<p>This work aligns principally with the Assure Access and Hold at Risk S&amp;T Focus Area in the Naval S&amp;T Strategic Plan and contributes measurably to the Operational Environments S&amp;T Focus Area strategic objectives.</p> <p>Decrease in funding for fiscal years 2010, 2011 and 2012 is due to phasing down funding for FNC SHD-FY09-01 (Operation of ASW Active Distributed Systems).</p> <p><b>FY 2010 Accomplishments:</b> Wide Area ASW Surveillance activity: - Naval Research Laboratory effort in Wide Area-Performance Assessment (NRL/WA-PA): Completed development of models that accurately characterize short and long range forward scattering from the ocean boundaries for surveillance through tactical sonar frequencies.</p> <p>The following efforts contribute to the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area: - Continued an applied research effort to improve distributed system processing techniques and capabilities. - Continued research effort aimed at the ideal placement of acoustic sources and drifting sensor systems using in-situ environmental information and models. - Continued research effort focusing on distributed system in-situational environmental characterization and system monitoring. - Continued research effort aimed at the ideal placement and control of acoustic sources and drifting sensors systems. - Continued research effort to determine the placement of and follow-on control and pattern keeping of mobile sources and distributed sensor systems. - Initiated development of algorithms to extract environmental information from through-the-sensor measurements.</p> <p><b>FY 2011 Plans:</b> The following efforts contribute to the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area: - Continue all efforts of FY 2010.</p> <p><b>FY 2012 Plans:</b> - Continue all efforts of FY 2011.</p>				
<b>Title:</b> ANTI-SUBMARINE WARFARE (ASW) PRECISION LOCALIZATION		3.381	3.694	3.710
<b>Description:</b> Precision Localization focuses on the development and demonstration of technologies which use information from surveillance or search systems to determine an area of uncertainty (AOU) relative to target range, bearing, and depth adequate				

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012</b>
<p>to handoff to an attack system. Precision Localization employs non-acoustic techniques such as magnetic and optical sensing to highly localize submerged threats. The objective is to increase magnetic sensor range and robustness, enable deployment on Unmanned Air Vehicles (UAVs), and increase optical sensing search rates. Efforts include the development of non-traditional tracking and advanced magnetic and electric field sensors and processing. These technologies will provide a decreased AOU size thus enabling the effective use of smaller, more versatile torpedoes as well as increased performance gain in detection, targeting, tracking/trailing, and homing via target acquisition and covert prosecution.</p> <p><b>FY 2010 Accomplishments:</b> Wide Area ASW Surveillance activity:</p> <ul style="list-style-type: none"> <li>- Continued development of a non-traditional tracking system for deployment on undersea vehicles.</li> <li>- Continued testing of a non-traditional tracking system.</li> <li>- Continued development of alternative active optical sources and sensor devices for Non-Acoustic ASW systems.</li> <li>- Continued an effort to extend the technology base for blue laser sources for Undersea Warfare applications including underwater communications.</li> <li>- Continued an effort to extend the technology base for high performance electro-optic detectors suitable for Undersea Warfare applications including underwater communications.</li> <li>- Continued an effort to extend the technology base for high performance electro-optic filters suitable for Undersea Warfare applications including underwater communications.</li> <li>- Continued an effort to develop consistent and comprehensive modeling and simulation tools for photonic Undersea Warfare and underwater communications components and systems.</li> <li>- Continued an effort to develop optical signal processing and hybrid computing technology appropriate for Undersea Warfare and underwater communications systems.</li> <li>- Completed development of spin-dependent tunneling and coupled magnetostrictive/piezoelectric passive magnetometer device technologies.</li> <li>- Completed development of models that accurately characterize short and long range forward scattering from the ocean boundaries for surveillance through tactical sonar frequencies.</li> <li>- Initiated development of ASW sensor technologies capable of being deployed by a gun or missile launcher.</li> </ul> <p><b>FY 2011 Plans:</b> - Continue all efforts of FY 2010, less those noted as completed above.</p> <p><b>FY 2012 Plans:</b> - Continue all efforts of FY 2011.</p>				
<b>Title:</b> ANTI-SUBMARINE WARFARE (ASW) SURVEILLANCE		15.841	26.232	63.985

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2010</b>	<b>FY 2011</b>
<p><b>Description:</b> ASW Surveillance focuses on dramatically improving detection, classification, and localization capabilities in large ocean areas relative to the capabilities of legacy ASW surveillance systems. The related technologies support the conduct of covert wide-area surveillance ranging from one day to six months. The objectives are to develop and demonstrate technologies that provide clandestine indications and warnings in far forward and contested operating areas and in complex operational environments against all submarine threats including new threats with unknown target signatures and tactics. Covertiness implies use of non-observable platforms and/or deployed automated sensors employing passive sonar or other non-detectable methods. The surveillance process includes initial detection and classification. Efforts include the development of Unmanned Undersea Vehicle-based and affordable off-board deployable sensing systems employing a wide variety of surveillance concepts and components. These efforts focus on alternative detection phenomena, vector/tensor sensors, automated acoustic processing, more compact and longer lasting power sources, and high bandwidth acoustic communications links.</p> <p>FY 2010 to FY 2011 funding increase is due to new FNC (SHD-FY10-05 Affordable Vector Sensor Towed Array and Signal Processing) starting in FY 2011. FY 2012 funding increase is due to the initiation of a new INP for Large Displacement Unmanned Undersea Vehicles (LD-UUV).</p> <p><b>FY 2010 Accomplishments:</b> Wide Area ASW Surveillance activity: - Naval Research Laboratory effort in Wide Area-Surveillance (NRL/WA-SV): Continued development of new acoustic and magnetic sensors for autonomous, networked underwater threat monitoring over large spatial scales. - Completed design of a "Sea Star" undersea local area network to link peripheral sensors to a centralized node through high-bandwidth, short-haul acoustic communications. - NRL/WA-SV: Completed fiber optic technology development to support the next generation of submarine hull arrays including new transducers, optical multiplexing, and optical components. - Initiated development of Non-Acoustic Underwater Communications. - Initiated development of Advanced Imaging Methods (AIM) to provide expanded spatial, temporal and spectral imaging options. - Initiated an effort to research improved seawater electrodes for Underwater Electric Potential (UEP) sensing in ASW applications. - Initiated research the goal of which is to form underwater magnetic sensors into a virtual gradiometric array via non-cabled communications.</p> <p>The following Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area: - Continued development of technologies to provide rapid localization of threat submarines for On-Demand Detection, Classification and Localization (On-Demand DCL).</p>			

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2010</b>	<b>FY 2011</b>
<p>- Initiated development of a vector sensor towed array and associated signal processing with performance nominally equivalent to a "thin-line" (TB-29) twin-line towed array to be compatible with the existing TB-29 array handling system.</p> <p>Battlegroup ASW Defense activity:</p> <ul style="list-style-type: none"> <li>- Continued development of an acoustic/magnetic hybrid sensor.</li> <li>- Continued development of low cost, compact, combined acoustic sensor.</li> <li>- Continued electroactive polymer smart sensor development.</li> <li>- Continued research to improve detection of quiet diesel-electric submarines using passive sonar arrays in deep ocean environments.</li> <li>- Completed development of target classification algorithms that adapt to local shipping noise conditions, thereby reducing false alarm probability.</li> <li>- Completed development of environmentally adaptive target detection and classification algorithms for deep water operating environments.</li> <li>- Initiated research to predict performance of automated passive sonar detection and classification algorithms in shallow and deep ocean environments.</li> <li>- Initiated biomimetic and nano sensor development.</li> <li>- Initiated 'hockey puck' transducer/amplifier module development.</li> <li>- Initiated broadband, directional, high power array development.</li> <li>- Continue development of new acoustic and magnetic sensors for autonomous, networked underwater threat monitoring over large spatial scales.</li> <li>- Complete fiber optic technology development to support the next generation of submarine hull arrays including new transducers, optical multiplexing, and optical components.</li> </ul> <p><b>FY 2011 Plans:</b></p> <ul style="list-style-type: none"> <li>- Continue all efforts of FY 2010, less those noted as completed above.</li> <li>- NRL/WA-SV: Complete development of new acoustic and magnetic sensors for autonomous, networked underwater threat monitoring over large spatial scales.</li> </ul> <p>The following efforts contribute to the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area:</p> <ul style="list-style-type: none"> <li>- Continue all efforts of FY 2010, less those noted as completed above.</li> <li>- Complete development of new acoustic and magnetic sensors for autonomous, networked underwater threat monitoring</li> </ul>			

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>				
				<b>FY 2010</b>
				<b>FY 2011</b>
				<b>FY 2012</b>
<p>over large spatial scales.</p> <p><b>FY 2012 Plans:</b></p> <ul style="list-style-type: none"> <li>- Continue all efforts of 2011, less those noted as completed above.</li> <li>- Initiate development of a long endurance air independent energy source for Large UUVs.</li> <li>- Initiate development of Autonomy for operation of UUV in the littorals.</li> <li>- Initiate development of core UUV technologies to extend the reliability and endurance of UUV operating in the littorals.</li> <li>- Initiate at sea testing of prototype LD-UUV technologies.</li> <li>- Initiate Consortium for Robotics and Unmanned Systems Research (CRUSER) in support of the LD UUV program.</li> </ul>				
<p><b>Title:</b> MARINE MAMMALS</p> <p><b>Description:</b> The goal of this activity is to support: (1) marine mammal research related to understanding impacts of underwater sound (especially sonar) on marine mammal behavior, hearing, physiology, distributions and ecology; (2) development and testing of new technologies for the detection of marine mammals at sea; (3) research on the bio-acoustic properties, use of sound for detection of, and effects of sound on fish and lesser marine organisms; and (4) research on optically important biota in the coastal ocean in support of Naval Mine, Undersea, and Special Warfare (including oceanic bioluminescence and the development and testing of bioluminescence sensors).</p> <p>The marine mammals research conducted in this Program Element (P.E.) represents part of a total effort executed in coordination with complementary research performed in PE 0602435N.</p> <p>This Activity has been created specifically to address the work associated with determining and mitigating the effects on the behavior of marine mammals of manmade sound transmitted underwater.</p> <p><b>FY 2010 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>- Continued multi-investigator, coordinated field research to test responses of marine mammals (especially beaked whales) to controlled sound exposures.</li> <li>- Continued development of new technologies for detection and localization of marine mammals, including (but not restricted to) gliders equipped with passive acoustic sensors, radar and thermal imagery.</li> <li>- Continued research examining hearing sensitivity of marine mammals (including temporary and permanent threshold shifts).</li> <li>- Continued research efforts examining distributions and abundances of marine mammals relative to prey fields and basic oceanographic parameters.</li> <li>- Continued development of and evaluate models that predict time- and space-dependent sound fields produced by anthropogenic noise sources and mammal responses to the noise.</li> </ul>				4.790
				5.205
				5.236

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<b>APPROPRIATION/BUDGET ACTIVITY</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602747N: <i>Undersea Warfare Applied Res</i>	<b>PROJECT</b> 0000: <i>Undersea Warfare Applied Res</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012</b>
<ul style="list-style-type: none"> <li>- Continued development and testing of multi-frequency acoustic technologies for detection, identification and enumeration of fish.</li> <li>- Continued research to examine sensitivity of fish to anthropogenic sound.</li> <li>- Continued research leading to better predictability of bioluminescent and pigment-bearing planktonic organisms.</li> <li>- Initiated research on effects of chronic physiological stress related to acoustic exposure of marine mammals in the wild.</li> </ul> <p><b>FY 2011 Plans:</b></p> <ul style="list-style-type: none"> <li>- Continue all FY 2010 efforts.</li> <li>- Initiate research on the population level consequences of acoustic disturbance to marine mammals.</li> </ul> <p><b>FY 2012 Plans:</b></p> <ul style="list-style-type: none"> <li>- Continue all efforts of FY 2011.</li> </ul>				
<p><b>Title:</b> UNDERSEA WEAPONRY</p> <p><b>Description:</b> Undersea Weaponry focuses on the development of enabling technologies to counter threat submarines and surface vessels by increasing Probability of Kill and platform survivability. Weapon technology focus areas include: Explosives and Warheads, Guidance and Control (G&amp;C), Multidisciplinary Systems Design &amp; Optimization (MSDO) (comprising Simulation Based Design, Silencing, and Propulsion), Power Sources, Supercavitation, and Counter Weapons/Counter Measures.</p> <p>The ultimate goal of this activity is to provide revolutionary capabilities needed to fill Sea Shield and Sea Strike Warfighter Capability Gaps, to accommodate unique payload limitations through the development of modular and reduced sized undersea weapons based on common technology enablers (where possible), and to provide improved platform pre-engagement positioning and fire-control solutions for effective weapon-to-target engagement, and provide countermeasures and counterweapons against current and next-generation undersea weapons.</p> <p>FY 2010 to FY 2011 funding increase is due to new FNC (SHD-FY11-01 Torpedo Common Hybrid Fuzing System) starting in FY 2011. FY 2011 to FY 2012 funding increase is due to increased funding to support stealth technologies in accordance with Ohio Replacement mission.</p> <p><b>FY 2010 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>- Completed evaluation of alternative undersea warhead fuzing concept developed under the advanced undersea warhead fuzing initiative.</li> <li>- Completed weaponization study for unmanned surface vehicle.</li> <li>- Completed assessment of the kinetic energy warhead concept potential to provide enhanced undersea warhead performance.</li> <li>- Completed transition of the Torpedo Intelligent Controller to NAVSEA/PMS 404.</li> </ul>		13.630	16.411	16.906

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2012 Navy		<b>DATE:</b> February 2011		
<b>APPROPRIATION/BUDGET ACTIVITY</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602747N: <i>Undersea Warfare Applied Res</i>	<b>PROJECT</b> 0000: <i>Undersea Warfare Applied Res</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012</b>
<p>The following efforts support the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area:</p> <ul style="list-style-type: none"> <li>- Continued development of a reduced size/weight Compact Rapid Attack Weapon (CRAW) for air deployment. This effort will include sensor, guidance and control, warhead, propulsion, and air frame integration tasks.</li> <li>- Continued the development of algorithms for CRAW to search, home and terminally home in deep and shallow water against targets both without and with countermeasures.</li> <li>- Continued the development of a CRAW warhead that will achieve required performance against submarine targets, and demonstrate feasibility of achieving final goal.</li> <li>- Completed development of enhanced performance concept for torpedo warheads using focused energy technologies for Light Weight Torpedo (LWT) Improvement and CRAW applications.</li> </ul> <p><b>FY 2011 Plans:</b></p> <ul style="list-style-type: none"> <li>- Complete assessment of the kinetic energy warhead concept potential to provide enhanced undersea warhead performance.</li> <li>- Complete a proof-of-concept demonstration of optical fuzing components developed under the advanced undersea warhead fuzing initiative.</li> <li>- Complete development of the supercavitating 6.75-inch vehicle with vehicle control devices.</li> <li>- Complete assessment of the long pulse concept potential to provide enhanced undersea warhead performance with smaller volumetric requirements.</li> <li>- Initiate design of advance undersea weapon testbed vehicles.</li> <li>- Initiate CONOPs and tactical-level analysis and employment for advanced undersea weapons.</li> </ul> <p>The following efforts support the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area:</p> <ul style="list-style-type: none"> <li>- Continue all efforts of FY 2010, less those noted as completed above.</li> </ul> <p><b>FY 2012 Plans:</b></p> <ul style="list-style-type: none"> <li>- Continue all efforts of FY2011, less those noted as completed.</li> <li>- Complete design of advance undersea weapon testbed vehicles.</li> <li>- Initiate design/formulation of advanced warheads.</li> <li>- Initiate design/formulation and early-stage testing of propulsion system components for advanced undersea platforms.</li> <li>- Initiate construction of advance undersea weapon testbed vehicles.</li> <li>- Initiate efforts to provide relevant stealth technologies in accordance with Ohio Replacement mission and threat analysis.</li> <li>- Initiate efforts to provide technologies for the next generation Ohio Class submarine.</li> </ul>				
<b>Accomplishments/Planned Programs Subtotals</b>		53.465	69.186	108.666

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2012 Navy		<b>DATE:</b> February 2011
<b>APPROPRIATION/BUDGET ACTIVITY</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602747N: <i>Undersea Warfare Applied Res</i>	<b>PROJECT</b> 0000: <i>Undersea Warfare Applied Res</i>

**C. Other Program Funding Summary (\$ in Millions)**

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• 0603747N: <i>UNDERSEA WARFARE ADVANCED TECHNOLOGY</i>	20.065	22.995	22.609	0.000	22.609	17.051	21.949	21.113	10.501	0.000	136.283

**D. Acquisition Strategy**

Not applicable.

**E. Performance Metrics**

The overall metrics of applied research in undersea warfare are to develop technologies aimed at improving target detection, classification, localization, tracking, increasing attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments, countering enemy torpedoes, providing the ability to conduct long-range engagements, increasing weapons load-out, providing multi-platform connectivity, increasing endurance/survivability, and reducing size and power requirements.

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**Exhibit R-2A, RDT&E Project Justification:** PB 2012 Navy **DATE:** February 2011

<b>APPROPRIATION/BUDGET ACTIVITY</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy</i> BA 2: <i>Applied Research</i>				<b>R-1 ITEM NOMENCLATURE</b> PE 0602747N: <i>Undersea Warfare Applied Res</i>				<b>PROJECT</b> 4027: <i>Naval Innovative Science and Engineering</i>			
<b>COST (\$ in Millions)</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	<b>FY 2013</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
4027: <i>Naval Innovative Science and Engineering</i>	0.975	-	-	-	-	-	-	-	-	0.000	0.975

**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)**

	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012</b>
<b>Title:</b> Naval Innovative Science and Engineering	0.975	-	-
<b>Description:</b> Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.			
<b>FY 2010 Accomplishments:</b> 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:			
<ol style="list-style-type: none"> <li>1. Innovative basic and applied research that is conducted at the laboratory and supports military missions;</li> <li>2. Development programs that support the transition of technologies developed by the defense laboratory into operational use;</li> <li>3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and</li> <li>4. The revitalization and recapitalization of the laboratories.</li> </ol>			
<b>Accomplishments/Planned Programs Subtotals</b>	0.975	-	-

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**D. Acquisition Strategy**

Not applicable.

**E. Performance Metrics**

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.

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**Exhibit R-2A, RDT&E Project Justification:** PB 2012 Navy **DATE:** February 2011

<b>APPROPRIATION/BUDGET ACTIVITY</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy</i> BA 2: <i>Applied Research</i>				<b>R-1 ITEM NOMENCLATURE</b> PE 0602747N: <i>Undersea Warfare Applied Res</i>				<b>PROJECT</b> 9999: <i>Congressional Adds</i>			
<b>COST (\$ in Millions)</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	<b>FY 2013</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
9999: <i>Congressional Adds</i>	9.560	-	-	-	-	-	-	-	-	0.000	9.560

**A. Mission Description and Budget Item Justification**

Congressional Interest Items not included in other Projects.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	<b>FY 2010</b>	<b>FY 2011</b>
<b>Congressional Add:</b> Advanced High Energy Density Surveillance Power Module <i>FY 2010 Accomplishments:</i> This effort developed battery packs based on high quality lithium carbon monofluoride D-diameter cells.	3.187	-
<b>Congressional Add:</b> Autonomous UUV Delivery and Communication System Integration <i>FY 2010 Accomplishments:</i> This effort provided for technical expertise in developing and designing technology for autonomous docking of Unmanned Undersea Vehicles (UUV) in support of the autonomous UUV delivery and communications demonstration effort.	3.585	-
<b>Congressional Add:</b> Galfenol Energy Harvesting <i>FY 2010 Accomplishments:</i> This effort advanced the Galfenol force-based energy harvester technology from a proof-of-principle to a prototype device targeted toward a real-world Naval application. A prototype energy harvesting system, hardware and power conditioning electronics were designed, built, and tested.	2.788	-
<b>Congressional Adds Subtotals</b>	9.560	-

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**D. Acquisition Strategy**

Not applicable.

**E. Performance Metrics**

Congressional Interest Items not included in other Projects.

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