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Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Navy										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 1319: Research, Development, Test & Evaluation, Navy BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602123N: Force Protection Applied Res							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 [#]	FY 2014 Base	FY 2014 OCO ^{##}	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	0.000	194.050	143.301	145.307	-	145.307	147.814	141.320	133.255	129.546	Continuing	Continuing
0000: Force Protection Applied Res	0.000	154.050	143.301	145.307	-	145.307	147.814	141.320	133.255	129.546	Continuing	Continuing
9999: Congressional Adds	0.000	40.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	40.000
[#] FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012												
^{##} The FY 2014 OCO Request will be submitted at a later date												
Note												
FY 2013 funding associated with Future Naval Capability (FNC) efforts are transferring to a new Program Element titled Future Naval Capabilities Applied Research (PE 0602750N). This is to enhance the visibility of the FNC Program by providing an easily navigable overview of all 6.2 FNC investments in a single location.												
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 (Sep 2011). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.												
This PE addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. It supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. The goal is to provide the ability to win or avoid engagements with other platforms or weapons and, in the event of engagement, to resist and control damage while preserving operational capability. Within the Naval Transformational Roadmap, this investment directly supports the Theater Air and Missile Defense transformational capability required by Sea Shield and the Ship to Objective Maneuver key transformational capability. This is accomplished by improvements in platform offensive performance, stealth, and self defense.												
Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.												

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B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	196.734	143.301	136.588	-	136.588
Current President's Budget	194.050	143.301	145.307	-	145.307
Total Adjustments	-2.684	0.000	8.719	-	8.719
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.601	0.000			
• SBIR/STTR Transfer	-3.286	0.000			
• Program Adjustments	0.000	0.000	5.719	-	5.719
• Rate/Misc Adjustments	0.001	0.000	3.000	-	3.000
Congressional Add Details (\$ in Millions, and Includes General Reductions)					
Project: 9999: Congressional Adds					
Congressional Add: Alternative Energy Research					
Congressional Add Subtotals for Project: 9999					
Congressional Add Totals for all Projects					
Change Summary Explanation					
Technical: Not applicable.					
Schedule: Not applicable.					

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0000: Force Protection Applied Res	0.000	154.050	143.301	145.307	-	145.307	147.814	141.320	133.255	129.546	Continuing	Continuing
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A. Mission Description and Budget Item Justification												
This project addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. It supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. The goal is to provide the ability to win or avoid engagements with other platforms or weapons and, in the event of engagement, to resist and control damage while preserving operational capability. Within the Naval Transformational Roadmap, this investment directly supports the Theater Air and Missile Defense transformational capability required by Sea Shield and the Ship to Objective Maneuver key transformational capability by virtue of improvements in platform offensive performance, stealth, and self defense.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2012	FY 2013	FY 2014	
Title: AIRCRAFT TECHNOLOGY									41.496	51.715	60.663	
Description: The Aircraft Technology activity develops technologies for enhanced capability of naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, scaleable naval air vehicle technologies, such as - autonomous air vehicle command and control, helicopter and tiltrotor rotor systems, aerodynamics, propulsion systems, materials, structures and flight controls for future and legacy air vehicles. This activity directly supports the Naval Aviation Enterprise Science and Technology Objectives and the Naval Science and Technology Strategic Plan, principally in the Autonomy and Unmanned Systems, Platform Design and Survivability, Power and Energy and Total Ownership Cost Focus Areas, Sea-Based Aviation was designated as a National Naval Responsibility (SBA NNR) in FY 2011 and will refocus investments beginning in FY 2014 in areas that are Naval unique or dominated by Naval requirements.												
FY 2013 funding increase due to two programs that began in FY12 and are ramping up in FY 2013: Variable Cycle Advanced Technology (VCAT) and Autonomous Aerial Cargo/Utility System (AACUS). VCAT will identify and mature critical, relevant variable/adaptive cycle propulsion system technologies for the next generation carrier-based TACAIR/ISR systems. AACUS will develop advanced autonomous capabilities to enable rapid resupply of distributed forces in the short term. The SBA NNR Structures and Materials program is also ramping up in FY 2013. This program will develop the next generation structural capability and material response science for aircraft technology in fixed and rotary wing, manned and unmanned airframe technology to achieve reduced weight, increased durability, strength, streamlined manufacturability, reduced life-cycle cost and												

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
maintenance/readiness gaps improvements. Program payoffs include increased availability/readiness, reduced sustainment requirements, fatigue/loads life enhancement, reduced weight and improved range, and advanced prognostics design tools. Beginning in FY 2014, applied research efforts will begin under the Sea-Based Aviation National Naval Responsibility (SBA NNR) Propulsion thrust area as well, resulting in the funding increase in FY 2014. These efforts addresses unique attributes to propulsion and power technologies for Naval Aviation, as well as those having higher importance to Naval Aviation and some that are more pervasive to all of military aviation. Related basic research efforts are addressed under 0601153N. FY 2012 Accomplishments: - Continued development of survivability/reduced observables technology. Metrics are classified. - Continued development of flight control, intelligent autonomy, command & control, and multi-vehicle cooperation technologies for Unmanned Air Vehicle (UAV). - Continued development of a Computational Fluid Dynamics (CFD) based integration system to maximize operational capability of autonomous aircraft by choosing optimal flight pattern for any environmental condition including low speed operations and brownout. - Continued vertical lift technology investments. - Continued research in fixed wing aircraft/vertical lift/rotorcraft technology areas such as aeromechanics, propulsion, active rotor control for enhanced ship board operations, structural concepts compatible with shipboard operations, autonomous operations in the shipboard and austere environment, and innovative vehicle concepts for naval application. - Continued research in vertical lift aircraft /rotorcraft technology areas such as aeromechanics, propulsion, active rotor control for enhanced ship board operations, structural concepts compatible with shipboard operations, autonomous operations in the shipboard and austere environment, and innovative vehicle concepts for naval application. - Continued effort to develop a portable system for stand-off detection of explosives and other illicit materials, including trace residues. - Continued effort to demonstrate the solution processing of an inorganic nanowire based photovoltaic device that operates in the infrared region. - Continued efforts on future deck operations with mixed manned and autonomous air systems. - Continued efforts on autonomy for low-altitude persistence by small UAVs. - Continued research in integrated design analysis/prognosis to optimize airframe structural properties and match material selection to operational requirements. Light weight, flexible, and degradation resistant advanced materials can improve fatigue life, reduce risk of catastrophic failure and facilitate control of weight/balance. Model complex behaviors/interactions to predict risk, probability and mechanism of failure and forecast lifetime performance. - Completed physics based analysis of morphing optimized rotor technology trades, and analytical methodology development for ducted fans and fan-in-wing configurations.			
			FY 2014

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B. Accomplishments/Planned Programs (\$ in Millions)			FY 2012	FY 2013	FY 2014
- Completed experiments with UAS autonomy for scouting of riverine environments. - Completed flight test of time-critical distributed multiple unmanned air system collaboration. - Completed experiments on using predictive models to improve UAS supervisory control performance. - Initiated demonstration of initial core software, sensor, air vehicle, and capability applications for Autonomous Aerial Cargo/Utility System (AACUS). - Initiated study of rotorcraft/VTOL systems automated launch and recovery technology. FY 2013 Plans: - Continue all efforts of FY 2012. - Complete effort to develop a portable system for stand-off detection of explosives and other illicit materials, including trace residues. - Initiate development of rotorcraft/VTOL systems automated launch and recovery technology. - Initiate mixed-mode mechanical/environmental failure prediction research. - Initiate advanced composite durability technology. - Initiate material degradation risk prediction and operational environment-driven materials selection methods. - Initiate demonstration of initial core software, sensor, air vehicle, and capability applications for Autonomous Aerial Cargo/Utility System (AACUS). - Initiate the advanced technology demonstration portion of the Variable Cycle Advanced Technology (VCAT) Program. Critical technology development efforts will begin with major engine manufactures and system contractors to develop/mature the highest priority, long-lead propulsion system technologies, including variable/adaptive cycle engine components, for next generation carrier-based TACAIR/ISR systems. FY 2014 Plans: - Continue all efforts of FY 2013, less those noted as completed above. - Complete VCAT Application Studies systems analysis efforts and the majority of Phase I variable cycle engine/propulsion subsystem technology development efforts. - Complete experiments on user interaction methods/decision tools for future deck operations with mixed manned and autonomous air systems. - Complete efforts on autonomy for low-altitude persistence by small UAVs. - Complete effort to demonstrate the solution processing of an inorganic nanowire based photovoltaic device that operates in the infrared region. - Initiate new efforts on high confidence/Safe Autonomous Control in naval environments and on supervisory control of decentralized heterogeneous UAS. - Initiate SBA NNR related projects in Virtual Ship/Aircraft Dynamic Interface, Manned/Unmanned Handling Qualities and Control, Automated Deck Operations, High Lift Aerodynamics and Vertical/Short Takeoff and Landing (V/STOL) Operations.					

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
- Initiate applied research efforts under the Sea-Based Aviation National Naval Responsibility Propulsion thrust area.			
Title: FLEET FORCE PROTECTION AND DEFENSE AGAINST UNDERSEA THREATS		13.119	2.434
Description: Fleet Force Protection and Defense against Undersea Threats efforts include applied research for complementary sensor and processing technologies for platform protection and shipboard technologies to increase the survivability of surface ship and submarine platforms against torpedo threats and to develop the capability to interdict underwater asymmetric threats to ships and infrastructure in harbors. Current small platforms (both surface and airborne) have little to no situational awareness (SA) or self-protection against air, surface, and asymmetric threats. A goal of this activity is to provide these platforms with effective self-protection. The technology areas specific to platform protection will develop individual, multispectral electro-optical (EO), infrared (IR), radio frequency (RF), electro-magnetic (EM), visual and acoustic or chemical sensors/biosensors and associated processing. To defend platforms from current and advanced threats in at-sea littoral environments and in port, these technologies must improve multispectral detection and distribution of specific threat information. Another goal of this activity is to develop a torpedo defense capability to fill Sea Shield Warfighting Capability Gap/Enabling Capability: Platform Defense against Undersea Threats, including Four Torpedo Salvo Defense. This provides a capability to prevent any of the torpedoes, in up to four-torpedo salvos fired at high value units, from hitting those units. This activity supports the Fleet and Force Protection FNC and includes support to Sea Shield and Sea Strike Pillars and FNC Enabling Capabilities for: Aircraft Integrated Self-protection Suite; Fortified Position Security; Advanced Electronic Sensor Systems for Missile Defense; and Shipboard Force Protection in Port and Restricted Waters - Detection and Classification. This activity supports the development of technologies that aid the helicopter pilot when operating in degraded visual cue environments (brown-out). FY 2013 funding decrease is due to completion of the STK-FY09-07 FNC for Helicopter Low-Level Operations (HELO). The decrease of funding from FY 2012 to FY 2013 is the result of the transfer of resources from this R2 activity to new FNC R2 activities titled Sea Strike and Sea Shield. Efforts in these R2 activities have been continued from FY 2012 to FY 2013 into new R2 activities to support all FNC program EC Investments. FY 2012 Accomplishments: Sensors & Associated Processing - Continued efforts in biomimetic sonar systems for operation in air and aquatic environments based on bat echolocation neurophysiology and information processing algorithms.		1.408	

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
- Continued efforts in biomimetic signal processing: panoramic periscope for submarines and temporal pattern recognition for Systems for Security Breaching Noise Detection. - Continued efforts in bioinspired quiet, efficient and maneuverable self-propelled line array using high-lift propulsors based on insect biomechanics. - Continued studies to develop catalytic activity profile of bioactive coatings against chemical agents. - Continued design and initiated fabrication of coatings to degrade both, chemical and biological agents. - Continued advanced concept development to integrate object recognition and tracking algorithms, machine vision, multiple networked video streams into different classes of EO/IR sensors within the Intelligent Video Surveillance FNC product (transferred from PE 0602131M). - Continued FNC EC Shipboard Force Protection in Port and Restricted Waters - Detection and Classification. This project will develop mission specific electro-optic/infrared sensors to detect, classify, and determine the intent of potential terrorist and special operations force threats to ships and craft import and transiting restricted waters. - Continued the Multifunction Capabilities for Missile Warning Sensors FNC effort by commencing data collection and analysis. - Continued efforts to design microfabricated system for 3-color fluorescence measurements using integrated waveguides. - Continued effort to develop new, highly selective, preferential oxidation catalysts for the generation of power from the reformat gas purification process. - Continued effort to develop aspheric gradient index optics - Continued the Helicopter Laser-Based Landing Aids FNC effort by development of a ladar capable of sensing through degraded visual cue environments (brown-out) and providing a display format that is usable to the pilot. - Completed the Countermeasures for Millimeter Wave Guided Missiles FNC effort by bench testing the decoy power supply and power amplifier modules. - Completed the Countermeasures for Advanced Imaging Infrared (I2R) Guided Missiles FNC effort by completing the final techniques and advanced component designs. In support of FNC (Force Projection Applied Research), perform the following efforts: - Continued development of low-cost, light weight swimmer detection and localization technologies. - Continued development of software encoded algorithms for the Anti-Torpedo Torpedo (ATT) sensor and controller that will enable ATT's to successfully engage torpedo salvos of up to four attacking units - Underwater Platform Self-Defense - Continued the development and application of emerging technologies that support delivery of Navy approved FNC enabling capabilities structured to close operational capability gaps in force projection. - Continued the packaging of emerging force projection technologies into deliverable FNC products and ECs that can be integrated into acquisition programs within a five year period.			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
- Continued the development of force projection technologies that support naval requirements identified within the Sea Shield and Sea Strike naval capability pillars as well as those applicable to specific naval platforms and those that apply across the naval enterprise. FY 2013 Plans: Sensors & Associated Processing - Continue all efforts of FY 2012, less those noted as completed above. Underwater Platform Self-Defense - Continue all efforts of FY 2012. FY 2014 Plans: Sensors & Associated Processing - Continue all efforts of FY 2013, less those noted as completed above. Underwater Platform Self-Defense - Continue all efforts of FY 2013.				
Title: MISSILE DEFENSE (MD) Description: This activity describes Missile Defense S&T projects of the Sea Shield FNC program, and non-FNC-related Navy research. - Naval Interceptor Improvements (NII) technology upgrades for STANDARD Missile (SM) future fleet air defense missile. Metrics are to achieve SM performance requirements in specified tactical rain environments and achieve SM performance requirements in all specified electronic countermeasures environments. - Extended Distributed Weapons Coordination (EDWC) algorithms for an Automated Battle Management Aid (ABMA) that recommends hard kill weapons, soft kill countermeasures, and emission control measures to reduce the probability of being hit or to optimally engage threats with self-defense weapons. Metric is improved probability of negation (Pneg) against advanced ballistic & cruise missile anti-ship threats that may be susceptible to decoys and jamming. - Positive Control of Naval Weapons (PCNW) - additional technology upgrades for SM to enable forward relay, remote launch & potentially forward pass engagements. Metrics are classified. - Midcourse and Terminal Algorithms (MTA) for prototype state-of-the art weapon system algorithms for STANDARD Missile (SM) engagements vs modern anti-ship missile threats. Specific metrics are classified. - Enhanced Lethality Guidance Algorithms (ELGA) to increase Navy shipboard missile probability of kill versus an expanded threat set including ASBMs and advanced ASCMs. Metrics for this project are classified.		12.982	1.899	1.186

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
- Enhanced Maneuverability Missile Airframe (EMMA) technology for Navy shipboard missile systems to intercept highly agile maneuvering ASCMs and ASBMs. Metrics for this project are classified. - Integrated Active & Electronic Defense (IAED) technology basis for response combinations of active and electronic weapons & systems to optimize Pneg against ASBMs and ASCMs, including potential interactions. Metrics are classified. - Radar Resource Manager (RRM) algorithms and software for weapon control system capability to provide dynamic platform and force-level radar management and coordination of radar resources for integrated air and missile defense (IAMD). Metrics will be classified. - Non-FNC-related investigation of effects of charged particle layers on UHF to S-Band radars used to track space vehicles and initiate development of advanced electromagnetic decoy launchers and payloads. The decrease of funding from FY 2012 to FY 2013 is the result of the transfer of resources from this R2 activity to new FNC R2 activities titled Sea Shield and Sea Strike. Efforts in these R2 activities have been continued from FY 2012 to FY 2013 into the new R2 activities to support all FNC program EC Investments. FY 2012 Accomplishments: - Continued IAED project effort. FY 2013 Plans: - Continue all efforts of FY 2012. FY 2014 Plans: - Continue all efforts of FY 2013.			
Title: STOPPAGE OF LARGE SURFACE VESSELS AT SEA Description: The Chief of Naval Operations (CNO) in the Navy Strategic Plan (NSP) has specified that the Navy must combat Weapons of Mass Destruction (WMD) at sea and ashore. To support this requirement, the Navy must be able to temporarily stop ships that are suspected of carrying WMDs or their component materials. This activity addresses the development of key technologies that will enable the Navy to use non-lethal methods for temporarily stopping and delaying non-cooperative large, greater than 20 meters or 300 gross tons, vessels at sea that will not comply with voice commands or warning devices. The technologies will be deployable by ship or aircraft and should be capable of disabling the vessel at safe distances from high-valued assets and infrastructures. Funding zeroed in FY 2013 due to termination of further applied research in this investment area. FY 2012 Accomplishments:		4.789	0.000
			0.000

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
- Completed development of a submergible autonomous delivery and deployment capability for a device emplacement package to externally inhibit seawater cooling flow to ship propulsion equipment. - Completed large-scale demonstrations of submergible autonomous device components to externally inhibit seawater cooling flow to ship propulsion equipment.			
Title: ADVANCED ENERGETICS Description: Advanced Energetics efforts address technology development to provide substantial improvements in energetic material systems and subsystems, primarily in terms of performance, but also addressing safety, reliability, and affordability concerns. Goals include: advanced energetic materials for warheads, propellants, and reactive material based subsystems for both defensive and offensive applications. Efforts include: development of new fuels, oxidizers, explosive ingredients and formulations; and reliable simulation tools and diagnostics to develop and design superior-performance, and/or reduced-vulnerability systems tailored to specific warfighter missions. FY 2012 to FY 2013 funding increase is due to increased funding for advanced energetics materials efforts. FY 2012 Accomplishments: - Continued Advanced Energetics research in development and evaluation of advanced explosive/propellant/reactive ingredients and formulations for the next generation higher performing systems. - Continued proof-of-concept efforts to develop insensitive explosives, propellants, and munitions without compromising performance. - Continued Advanced Energetics research in development and diagnostics of novel energy conversion concepts. - Continued non-traditional energy conversion studies with columbic and cluster material investigations. - Continued Advanced Energetics research in technology development for the next generation reactive material warhead concepts(formulations, material properties, target interaction, lethality models, and experiments) for highly reactive materials, high density reactive materials and novel reactive structural materials. - Continued Advanced Energetics research in development of advanced directed hydro-reactive material warhead concepts to enhance performance of undersea warheads. - Continued proof of concept efforts to develop insensitive explosives, propellants, and munitions without compromising performance. This work involves development of high quality, small particle energetic ingredients, novel processing techniques, and advanced energy conversion concepts; and involves both theoretical and experimental efforts. - Continued Advanced Energetics research in advanced multiphase blast concepts employing dense metalized explosives to enhance performance of air and underwater blast warheads.		0.198	4.091
			4.188

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
- Continued Advanced Energetics research in development and diagnostics of novel energy conversion concepts to enhance performance, more efficiently exploit available energy, and more effectively couple energy to target for air, surface, and underwater warhead application - Continued research in technology development for the next generation reactive material warhead concepts formulations, material properties, and energy release experiments) for highly reactive materials, high density reactive materials and novel reactive structural materials. Transition application specific target interaction, lethality modeling and ordnance specific experiments and demonstrations to Electromagnetic Rail Gun, PE 0603114N. - Continued development of novel energy conversion concepts to enhance performance, more efficiently exploit available energy, and more effectively couple energy to target. Limit efforts to analytical and laboratory scale proof of concept experimental efforts. - Continued development and evaluation of energetic ingredients and formulations for next generation higher performance applications. Conclude scale-up development and testing. - Initiated processing optimization studies for MTX-1 (1-[(2E)-3-(1H-tetrazol-5-yl)triaz-2-en-1-ylidene] methanediamine), an additive to percussion primers. - Initiated the processing optimization design of material compositions for Reactive Material explosive fragment applications. - Initiated optimization and refinement studies of Poly NitratoOxetane (3-PNO) process for solid rocket motor propellants. - Initiated the development of a reliable chemical scale-up and material specification process techniques. - Initiated ultra-high density reactive material investigations (13 - 15 grams/cc) for the next generation reactive material warhead material (formulations, material properties, target interaction, letality models, and experiments). FY 2013 Plans: - Continue all efforts of FY12 FY 2014 Plans: - Continue all efforts of FY 2013. - Complete Studies on Poly NitratoOxetane (3-PNO). - Initiate process research and development of Ammonium Nitrotetrazolate-2N-oxide (AONT). - Initiate process optimization of Ammonium Tetrakis (3,5-Dinitro-1,2,4-Triazolyl)Borate (ATDTB).			
Title: SURFACE SHIP & SUBMARINE HULL MECHANICAL & ELECTRICAL (HM&E)		81.466	78.812
Description: Efforts include: signature reduction, hull life assurance, hydromechanics, distributed control for automated survivability (includes damage control), and advanced naval power systems. Signature reduction addresses electromagnetic, infrared, and acoustic signature tailoring, both topside and underwater. Hull life assurance addresses development of new structural system approaches for surface ships and submarines, including the management of weapons effects to control structural damage and the improvement of structural materials. Hydromechanics addresses hydrodynamic technologies, including the signature aspects of the hull-propulsor interface and maneuvering. Distributed intelligence for automated survivability			73.533

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
addresses both the basic technology of automating machinery control systems, as well as, distributed control of systems utilizing autonomy for mission context based reconfiguration. Advanced naval power systems efforts address electrical and auxiliary system and component technology to provide improvement in energy and power density, operating efficiency and recoverability from casualties. Advanced Naval Power efforts include: developing technologies to improve warfighting capability with more energy efficient systems; reducing the time & cost to certify alternative fuels, and mitigate adverse alternative fuel impacts on Naval platforms and equipment; developing sustainable biomass models to support alternative fuel availability to Naval forces; utilizing the Electric Ship Research and Development Consortium (ESRDC) efforts to develop modeling and simulation tools to provide critical design & operational capabilities for the all-electric ship program, accelerate development and demonstration of technologies, reduce risk of new technology insertion and address the national shortage of electrical power engineers. Efforts for ONR Science Advisors are also funded in this R-2 Activity. Long Endurance UUV technologies will deliver to the Office of Naval Research modular fuel cell systems for UUVs, including practical systems demonstrations, and a path forward for future developments. It will also keep the US Navy at the forefront of advanced electric propulsion technologies. The decrease of funding from FY 2012 to FY 2013 is the result of the transfer of resources from these R2 activities to new FNC R2 activities titled Enterprise and Platform Enablers and Power and Energy. Efforts in these R2 activities have been continued from FY 2012 to FY 2013 in the new R2 activities to support all FNC program EC Investments. The \$5M decrease from FY 2013 to FY 2014 is to due to the Electric Ship Technologies and the Damage Control Technologies Leap Ahead efforts completing in FY 2013. Additionally, funding for Science Advisors has been realigned from this R-2 Activity to a new stand-alone R-2 Activity in PE 0602236N starting in FY 2014. FY 2012 Accomplishments: Survivable Platforms - Reduced Signatures - Continued advanced numerical acoustic codes (and gridding methods for those codes) for submarines. - Continued mmWave Signatures measurement to identify key signature characteristics. - Continued Alternating Current (AC) propagation experiments. - Continued the next generation Infrared Electro-Optic Visual (IR/EO/VIS) model for surface ships by development of mitigation strategy supporting low observable infrared platforms, development of supporting physics, and prototype measurement techniques. - Continued development of quiet control surface design tool based on control surface flow noise studies. - Continued IR and radar detectability prediction capability. - Continued surface ship super-conductive degaussing with laboratory demonstration loop for Electromagnetic (EM) field accuracy measurements and control methods. - Continued testing on Advanced Electric Ship Demonstrator (AESD) to assess energy propagation and acoustic radiation mechanisms and to develop mitigation concepts for surface ships.			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
- Continued IR assessment of two advanced treatments. - Continued first of a series of IR validation experiments and critical sensitivity analysis. - Continued Improved Corrosion Related Magnetic (CRM) Field Prediction Model to design compensation systems to reduce ship's CRM signature. - Continued assessment of ship biostatic Radar Cross Section (RCS). - Continued large-scale tests on AESD to develop signature prediction and design tools for surface ship incorporating a variety of propulsion technologies including external podded propulsion. - Continued experimental effort to characterize electric drive motor signature mechanisms and verify modeling and simulation approaches for signature prediction. - Continued development of modeling methods and noise control concepts for modular/reconfigurable submarine architectures. - Continued investigation into hull treatment concepts for acoustic signature/vibration control for surface ships. - Continued development of advanced RF metamaterials for platform signature control. - Continued development of signature modeling approaches for electric actuation and alternate electric drive system architectures. - Continued development of Low probability Intercept (LPI) technologies for surface ship emissions including communication, navigation, electronic warfare, and combat systems. - Continued advanced EM modeling tools development and validation. - Continued next generation deckhouse integration technology development. - Continued modeling of hydroacoustics of turbulence-propulsor interaction. - Completed U. S./Japan Advanced Hull Materials & Structures Technology (AHMS&T) and continued with emphasis on addressing cost reduction of hybrid joints and development of low cost (adhesive steel/composite) joining techniques for topside construction. - Initiated joint effort with UK/MoD on adhesively joined aluminum in lieu of welding of marine structures and thus reduce cost. - Initiated joint effort with NLRN on adhesive joined composite to metals in lieu of bolting of marine structures and thus reduce cost for topside structures. - Initiated efforts on shock mitigation and shock diversion for ship hulls to reduce cost of machinery mounts and equipments, based on successful results from the ERC helmets for protection against TBI. Survivable Platforms - Hull Life Assurance - Continued development of global surface wave measurement capability for ship models. - Continued Dynamic Behavior of Composite Ship Structures (DYCOSS) (joint effort with Dutch Navy). - Continued development of structural analysis codes describing failure mechanism of sandwich composites. - Continued Explosion Resistant Coatings (ERC) effort, providing US input to trilateral agreement with UK and Australia.			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
- Continued composite and composite-metal hull performance characterization and testing including structural loading, thermal stress and signatures. - Continued effort on an advanced class of polymers as a follow-on to current ERC for application against advanced threats, Overseas Contingency Operations (OCO). - Continued Payload Implosion and Platform Damage Avoidance efforts. - Continued development of reliability-based recoverability methods for assessing damaged ship structures. - Continued development of advanced analytical, numerical and experimental methods in support of platform signature reduction. - Continued effort on exploitation of polymers for the deflection and dissipation of shock wave impact on ship and submarine hull structures. - Initiated efforts on combinations of highly rate-sensitive materials through experiment and modeling for extreme hyper velocity threat conditions. Survivable Platforms - Distributed Intelligence for Automated Survivability - Continued development of modeling and simulation methods for robust design and virtual testing of integration of shipboard auxiliary systems including their control systems. - Continued research into advanced HM&E system reconfiguration approaches, including agent-based control systems and algorithms, and model-based reasoning. - Continued demonstration of Genetic Algorithm(s) for determining optimal distributed system control strategy. - Continued development of Survivability Analysis Algorithms Operable on a Total Ship Modeling Environment. - Continued the transition of the small scale hardware-in-the-loop demonstrator to the academic community for challenge problem formulation. - Continued demonstration of the developed model based reasoning control algorithms on full scale hardware test beds. Advanced Platforms - Advanced Platform Concepts and Designs - Continued validation of asymmetric hull forms with experimental data. - Continued development of analytical models to further define submarine modular hull concepts. - Continued development of reliability based design and structural analysis code development. - Continued development design tools for integrated antenna and composite topside. - Continued circulation control analysis for three-dimensional flow effects. - Continued aperstructures microwave communication system. - Continued concept for Ultra High Frequency (UHF)/Very High Frequency (VHF) aperstructures opportunistic array (Advanced Hull-form Inshore Demonstrator - AHFID). - Continued development of methods for determining reliability and vulnerability of aluminum ship structures. - Initiated large scale demonstration efforts of advanced mitigation technologies.			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
Advanced Platforms - Hydromechanics - Continued experimental database/computational tools development for extreme submarine maneuvers (e.g., crashback). - Continued the validation of circulation control and advanced control surfaces with experiments. - Continued to investigate improved maneuvering simulation capability for submarines. - Continued validation of Reynolds Average Navier-Stokes (RANS) code for advanced waterjet propulsor performance predictions. - Continued development of two-phase flow waterjet concept, Detached Eddy Simulation (DES) method for crashback prediction and numerical prediction method(s) of waterjet cavitation. - Continued modeling of turbulent flow interaction with propeller Leading Edge (LE) and Trailing Edge (TE) and modeling and simulation of rough-wall boundary layer noise. - Continued development of podded propulsor design/analysis tools. - Continued prediction and validation of damaged stability and capsize. - Continued non-body-of-revolution tool development for advanced submarine configurations. - Continued the multi-platform interaction analysis and tool development. - Continued modeling of performance of composite propellers in extreme maneuvers. Advanced Naval Power Systems - Continued demonstration of dynamic stability of an advanced intelligent, reconfigurable, solid-state-based, zonal-electrical power system that reconfigures within 10 milliseconds. - Continued designing software for the system manager for the Universal Control Architecture (UCA). - Continued development of thermal management technology for shipboard power distribution. - Continued investigation of potential applications of silicon-carbide in future high voltage and high power applications. - Continued improvements in electrical component and device technology allowing a reduction in motor propulsion and motor controllers weight and volume. - Continued development of technologies to support dynamic reconfiguration of shipboard systems under conditions of stressing scenarios and/or system degradation. - Continued multi-year program to directly convert thermal energy to electricity. Such a capability would allow elimination of the steam cycle on an electric warship. - Continued studies of alternative cooling systems for future shipboard radar systems. - Continued control surface actuator project focused on the technologies needed to define the design space for control surface actuators supporting submarines. - Continued development of automated HVAC system architectures for future Naval platforms. - Continued development of common universal stator design to accommodate varying rotor topologies to improve affordability of motor design and development.			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
- Continued ship service fuel cell development. - Continued development of shipboard waste heat driven chiller systems. - Continued program to develop and demonstrate 3 - 50 kW class solid oxide fuel cell onboard mobile power generation capabilities having compatibility with future logistics fuels to enable rapid recharge of batteries and direct power for C4ISR equipment. - Continued analytical model and reduced scale component development of power conversion technologies for multi-function motor drives, bi-directional power conversion modules, and power management controllers focusing on closing technology gaps associated with Alternative Integrated Power System (IPS) Architectures. - Continued studies of advanced heating, ventilation, and air-conditioning architectures, including studies of alternative (nonvapor-compression) refrigeration systems and concepts for waste heat reuse, to enhance ship cooling and provide thermal energy storage. - Continued research into the development of fuel chemistries, materials, and energy conversion technologies for optimal performance in Naval power systems. - Continued energy programs in support of SECNAV Energy Goals including biofuels, ship energy efficiencies and unmanned vehicle power systems. - Continued effort to develop energy storage and conversion devices (e.g., batteries, capacitors, fuel cells) that are critical to many military missions. - Completed Electrically Actuated Submarine Control Surfaces FNC to develop electric actuation for submarine control surfaces. - Completed fabrication of scaled control surface actuator systems under the FNC program. - Initiated effort to develop SIC power device with fast switching and ability to parallel devices for higher current. Surface Ship & Submarine HM&E Applied Research - Continued to increase emphasis of the Science Advisor engagement within the joint S&T community across DOD, which will focus on addressing the operational and strategic needs of the Fleet. - Continued efforts to expand counter-improvised explosive devices (C-IED) enhancement to support urgent operational needs. FY 2013 Plans: Survivable Platforms - Reduced Signatures - Continue all efforts of FY 2012. Survivable Platforms - Hull Life Assurance - Continue all efforts of FY 2012, less those noted as completed above. - Initiate efforts on combinations of highly rate-sensitive materials through experiment and modeling for extreme hyper velocity threat conditions.			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
Survivable Platforms - Distributed Intelligence for Automated Survivability - Continue all efforts of FY 2012.			
Advanced Platforms - Advanced Platform Concepts and Designs - Continue all efforts of FY 2012. - Initiate large scale demonstration efforts of advanced mitigation technologies.			
Advanced Platforms - Hydromechanics - Continue all efforts of FY 2012, less those noted as completed above.			
Advanced Naval Power Systems - Continue all efforts of FY 2012.			
Surface Ship & Submarine HM&E Applied Research - Continue all efforts of FY 2012. - Increase emphasis of the Science Advisor engagement within the joint S&T community across DOD, which will focus on addressing the operational and strategic needs of the Fleet.			
FY 2014 Plans:			
Survivable Platforms - Reduced Signatures - Continue all efforts of FY 2013.			
Survivable Platforms - Hull Life Assurance - Continue all efforts of FY 2013. - Complete development of reliability-based recoverability methods for assessing damaged ship structures.			
Survivable Platforms - Distributed Intelligence for Automated Survivability - Continue all efforts of FY 2013.			
Advanced Platforms - Advanced Platform Concepts and Designs - Continue all efforts of FY 2013.			
Advanced Platforms - Hydromechanics			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
- Continue all efforts of FY 2013. Advanced Naval Power Systems - Continue all efforts of FY 2013. - Complete effort to develop energy storage and conversion devices (e.g., batteries, capacitors, fuel cells) that are critical to many military missions. - Complete effort to develop SIC power device with fast switching and ability to parallel devices for higher current. Surface Ship & Submarine HM&E Applied Research - Continue all efforts of FY 2013. - Initiate efforts to implement the results from hybrid composite blisters /appendages and their effect on ship drag resistance and fuel saving performance, motion and stability in ship models to verify computations and adapt shapes of appendages. - Initiate the ONR Applied Research Challenge (ARC) to stimulate new, high-risk applied research projects in areas not currently addressed by the current ONR core applied research programs. Advanced ASW Surveillance -Initiate development of Long Endurance UUV technologies.			
Title: NAVAL RESEARCH ENTERPRISE Description: The Naval Research Enterprise (NRE) is the in-house Independent Applied Research (IAR) efforts focused on solving a wide range of Naval Science and Technology (S&T) fleet issues utilizing the unique warfare center (WC) laboratory capabilities. Efforts under this activity address the full spectrum of the DON S&T Strategic Plan technology focus areas that engage Naval aviation, sea surface, undersea, space, weapons, communication, information, and human systems. The IAR Program provides participating Naval Warfare Centers and Laboratories with in-house funding for: applied 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 the hiring and development of talented new scientists and engineers (S&E) with the insurance of proper mentoring with senior personnel; and encouraging collaboration with universities, private industry, and other Navy and Department of Defense laboratories. Efforts are selected by Naval Warfare Centers Commanding Officers and Technical Directors each fiscal year through rigorous internal competition. Efforts typically last two to three years, are generally designed to promote the investment in high-risk high-payoff research, and allow young S&Es to manage a Navy relevant research project. A limited number of successful efforts developed under the basic research Program Element 0601152N are matured and further developed under the IAR program with the goal of transitioning these technologies to the warfighter.		0.000	4.350
			4.329

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
This is a new R2 activity effective 2013, titled: Naval Research Enterprise (NRE). This activity consolidates all NRE related investments. FY 2013 Plans: - Continue research for Unmanned Sensor Network Concepts for Counter-Surveillance and Explosive Hazard Detection by investigating autonomy with imperfect perception, sensor and signal processing techniques supporting autonomy and battlefield sensing missions, and Human-Machine Interaction (HMI). - Continue research for Advanced Search and Tracking routines through the utilization and modification of advanced algorithms such as Maximum Likelihood Probabilistic Data Association Tracker (ML-PDA) and Moving-Source Matched Field Processing (MFP). - Continue research for sensors and ultra-low/self-powered sensors for remote applications addressing sub-threshold hydrophones, undersea wireless networks, and communication networks. - Continue research for advanced energetic materials with significantly enhanced explosive yields (over HMX) while improving insensitivity characteristics such as shock and thermal stabilities. - Continue research for reduced drag on surface ship hull designs utilizing advanced computational analysis and hydrodynamic model testing addressing scaling effects due to non-dimensional parameters such as the Froude number. - Complete research for the Mitigation of Acute and Chronic spinal pain in Naval Aircrew project by determining the efficacy of interventions to reduce neck and low back pain severity and incidence in a randomized controlled series of trials with U.S. Navy aircrew. - Complete research for Mid- to Long-Wavelength Infrared Optical Emitter Sources for Chemicals and Explosives Detection through the development of a high-performance long-wavelength infrared tunable laser that would enable a significant increase in standoff detection. - Complete research for Viscoelastic Materials Study for the Mitigation of Blast-Related Brain Injury where the investigation of viscoelastic polymers are identified for use as a helmet liner to protect the warfighter from exposure to blast pressure and reduce the incidence of blast-related Traumatic Brain Injury (TBI). - Complete research for the Development of a Solid Propellant Burning Rate Model to optimize the performance of Navy missiles by addressing: surface decomposition of propellant ingredients, gas-phase diffusion rates, reaction kinetics, particle-size, and the effects of pressure and initial temperature. - Initiate research for the repair and repair process of Navy aircraft and ship alloys such as titanium and high-strength low-alloy steels. - Initiate research for warfighter performance predictions utilizing cognitive information and other human factors to enhance training experience and outcome. - Initiate research for highly accurate autonomous unmanned undersea vehicles (UUV) communication and navigation.			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
- Initiate projects that are intended to be approximately two to three years in length. Based on historical trends approximately 30% of these projects will turn over each year. FY 2014 Plans: - Continue all efforts of FY 2013.			
Accomplishments/Planned Programs Subtotals		154.050	143.301
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			
D. Acquisition Strategy			
N/A			
E. Performance Metrics			
This PE supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial and air) and the protection of those platforms. Each PE Activity has unique goals and metrics, some of which include classified quantitative measurements. Overall metric goals are focused on achieving sufficient improvement in component or system capability such that the 6.2 applied research projects meet the need of or produce a demand for inclusion in advanced technology that may lead to incorporation into acquisition programs or industry products available to acquisition programs. Efforts funded in this PE also include energy programs in support of SECNAV energy goals and efforts in support of the Ohio Replacement program. Specific examples of metrics under this PE include: - Torpedo defense thresholds will be validated by modeling and simulation to satisfy the overall system performance specification of a Probability of Survival (PS) of the US Navy platform, as specified in the draft Capabilities Development Document (CDD) for Surface Ship Torpedo Defense.			

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COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013[#]	FY 2014 Base	FY 2014 OCO ^{##}	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	0.000	40.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	40.000

[#] FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012
^{##} The FY 2014 OCO Request will be submitted at a later date

A. Mission Description and Budget Item Justification
 Congressional Interest Items not included in other Projects.

<u>B. Accomplishments/Planned Programs (\$ in Millions)</u>	FY 2012	FY 2013
<i>Congressional Add:</i> Alternative Energy Research	40.000	-
<i>FY 2012 Accomplishments:</i> The Alternative Energy Research program addressed critical energy technology needs to meet the Department of Navy's energy security and energy efficiency goals. A key element of the program was the focus on sustainability in the Asia-Pacific region through alternative energy research, technology development and education. Technology areas pursued include: renewable power generation (solar, wind and ocean energy); alternative fuels (biofuels and hydrogen); fuel cells for unmanned vehicles and non-tactical ground vehicles; energy storage for grid management and stabilization; energy efficiency technologies and energy efficient structures; and waste-to-energy. The program incorporated and integrated energy research, STEM (science, technology, engineering and mathematics) education and technology evaluation.		
Congressional Adds Subtotals	40.000	0.000

C. Other Program Funding Summary (\$ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 Not applicable.

E. Performance Metrics
 Congressional Interest Items not included in other Projects.