| Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Navy | DATE: April 2013 |
|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>1319: *Research, Development, Test & Evaluation, Navy*<br>BA 2: *Applied Research* | R-1 ITEM NOMENCLATURE<br>PE 0602750N: *(U)Future Naval Capabilities Applied Research* |

| 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 | 0.000 | 162.417 | 169.710 | - | 169.710 | 177.012 | 182.294 | 187.875 | 194.774 | Continuing | Continuing |
| 0000: *(U)Future Naval Capabilities Applied Research* | 0.000 | 0.000 | 162.417 | 169.710 | - | 169.710 | 177.012 | 182.294 | 187.875 | 194.774 | Continuing | Continuing |

# 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**

The efforts described in this Program Element (PE) address the Applied Research associated with the Future Naval Capabilities (FNC) Program. The FNC Program represents the requirements-driven, delivery-oriented portion of the Navy Science and Technology (S&T) portfolio. FNC investments respond to Naval S&T Gaps that are identified by the Navy and Marine Corps after receiving input from Naval Research Enterprise (NRE) stakeholders. The Enabling Capabilities (ECs) and associated technology product investments of the FNC Program are competitively selected by a 3-star Technology Oversight Group (TOG), chartered by the S&T Corporate Board and representing the requirements, acquisition, research and fleet/forces communities of the Navy and the Marine Corps.

This was a new PE in FY 2013 that consolidated all Navy 6.2 FNC Program investments into a single Navy 6.2 PE. Marine Corps FNC 6.2 investments are consolidated in a single Marine Corps 6.2 PE (0602131M). In FY 2011 and FY 2012, Navy 6.2 FNC Program investments were spread across 7 separate 6.2 PEs: 0602114N, 0602123N, 0602235N, 0602236N, 0602271N, 0602747N and 0602782N. The consolidation in this PE allows all investments to be viewed by FNC Pillar, Enabling Capability (EC) and Technology Product. It greatly enhances the visibility of the FNC Program by providing an easily navigable overview of all 6.2 FNC investments in a single place.

| B. Program Change Summary ($ in Millions) | FY 2012 | FY 2013 | FY 2014 Base | FY 2014 OCO | FY 2014 Total |
|---|---|---|---|---|---|
| Previous President's Budget | 0.000 | 162.417 | 164.205 | - | 164.205 |
| Current President's Budget | 0.000 | 162.417 | 169.710 | - | 169.710 |
| Total Adjustments | 0.000 | 0.000 | 5.505 | - | 5.505 |
| • Congressional General Reductions | - | - | | | |
| • Congressional Directed Reductions | - | - | | | |
| • Congressional Rescissions | - | - | | | |
| • Congressional Adds | - | - | | | |
| • Congressional Directed Transfers | - | - | | | |
| • Reprogrammings | - | - | | | |
| • SBIR/STTR Transfer | - | - | | | |
| • Program Adjustments | 0.000 | 0.000 | 2.595 | - | 2.595 |
| • Rate/Misc Adjustments | 0.000 | 0.000 | 2.910 | - | 2.910 |

| Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Navy | DATE: April 2013 |
|---|---|
| **APPROPRIATION/BUDGET ACTIVITY**<br>1319: *Research, Development, Test & Evaluation, Navy*<br>BA 2: *Applied Research* | **R-1 ITEM NOMENCLATURE**<br>PE 0602750N: *(U)Future Naval Capabilities Applied Research* |

**Change Summary Explanation**

Technical: Not applicable.

Schedule: Not applicable.

| Exhibit R-2A, RDT&E Project Justification: PB 2014 Navy | | | DATE: April 2013 |
|---|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>1319: *Research, Development, Test & Evaluation, Navy*<br>BA 2: *Applied Research* | R-1 ITEM NOMENCLATURE<br>PE 0602750N: *(U)Future Naval Capabilities Applied Research* | PROJECT<br>0000: *(U)Future Naval Capabilities Applied Research* | |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0000: *(U)Future Naval Capabilities Applied Research* | 0.000 | 0.000 | 162.417 | 169.710 | - | 169.710 | 177.012 | 182.294 | 187.875 | 194.774 | Continuing | Continuing |

# 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**

FNC investments are typically 3-5 years in duration. They provide a continuance of basic research by maturing technologies from a Technology Readiness Level (TRL) of 3 or 4 to a TRL of 6. All FNC products require BA2 and BA3 funded technology development, which is coordinated to ensure tangible technology products are delivered upon completion of each investment. Each year the TOG refreshes the FNC Program by approving new ECs and technology products as older ones get delivered. After transition to an acquisition program, FNC products are further engineered, integrated and, ultimately, delivered to the warfighter. The development and delivery of each FNC product is guided by a Technology Transition Agreement (TTA) that is signed by the requirements and acquisition sponsors, as well as the S&T developer.

This project supports the naval pillars of Capable Manpower, Enterprise and Platform Enablers, Expeditionary Maneuver Warfare, Force Health Protection, Forcenet, Power and Energy, Sea Basing, Sea Shield and Sea Strike. Each of these pillars is listed as a separate R-2 Activity, as is FNC Management. Under each R-2 Activity, the BA 6.2 accomplishments and plans for every Enabling Capability (EC) and Technology Product in the FNC Program are listed. ECs are composed of one or more interrelated technology products, so for clarity, each product is shown under its EC.

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| ***Title:*** CAPABLE MANPOWER (CMP) | 0.000 | 9.552 | 8.805 |
| ***Description:*** This R-2 Activity contains all Future Naval Capabilities (FNC) Program Enabling Capability (ECs) investments in this PE that are aligned to the Capable Manpower (CMP) FNC pillar. The CMP Pillar develops deliverable technologies that provide new capabilities in manpower and personnel management, training and education, and human-systems integration for more intuitive systems. | | | |
| ***FY 2013 Plans:***<br>EC: CMP-FY10-01 Information Architecture for Improved Decision Making<br>- Continue Data Triage - Develop mission performance optimizations that encompass task centered design and advanced human performance modeling to achieve the requisite manning, both in numbers and capabilities, for the complex ships and systems of the future fleet. | | | |

| Exhibit R-2A, RDT&E Project Justification: PB 2014 Navy | | DATE: April 2013 |
|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>1319: *Research, Development, Test & Evaluation, Navy*<br>BA 2: *Applied Research* | R-1 ITEM NOMENCLATURE<br>PE 0602750N: *(U)Future Naval Capabilities Applied Research* | PROJECT<br>0000: *(U)Future Naval Capabilities Applied Research* |

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Continue Display Information with Uncertainty - Improve the capability to fuse imaging, electronic warfare, and inorganic and acoustic sensor inputs into integrated, fused, and intuitive displays that enhance the presentation and command level understanding of uncertain information.<br><br>EC: CMP-FY10-02 Adaptive Training to Enhance Individual and Team Learning and Performance<br>- Continue Adaptive Training for Combat Information Center Teams - Validate effective and adaptive training system components to enhance individual and team training for surface ship Combat Information Center (CIC) training.<br>- Continue Adaptive Training for Submarine Navigation & Piloting Teams - Validate effective and adaptive training system components to enhance individual and team training for submarine navigation and piloting skills training.<br><br>EC: CMP-FY11-01 Naval Next-generation Immersive Technology (N2IT)<br>- Continue Augmented Immersive Team Training (AITT) - Develop software and hardware to expand training architectures and enablers to enhance training in uncontrolled and uninstrumented locations.<br>- Continue Perceptual Training Systems and Tools (PercepTs) - Identify the perceptual cues in urban and dense infrastructure environments to improve warfighter performance.<br><br>EC: CMP-FY11-02 Performance Shaping Functions for Environmental Stressors<br>- Continue Performance Shaping Functions - Study the impact of incorporating environmental stressors for fatigue, motion, vibration and extreme temperatures into systems engineering tools for the development of complex Navy systems.<br><br>EC: CMP-FY12-01 Live, Virtual, & Constructive Training Fidelity<br>- Continue Cognitive Fidelity Synthetic Environment - Develop optimal characteristics of virtual simulations to elicit the appropriate perceptual/cognitive responses for Naval aviation training.<br>- Continue Tactics & Speech Capable Semi-Automated Forces - Develop virtual constructive representations on live avionics displays.<br>- Continue Virtual-Constructive Representations on Live Avionics Displays - Develop design guidelines for effective and safe representation of virtual and constructive assets on live displays, including developing the symbology used during experimentation and validation efforts.<br><br>EC: CMP-FY13-02 Simulation Toolset for Analysis of Mission, Personnel and Systems (STAMPS)<br>- Initiate/Complete Manpower Planning and Optimization Toolset - Develop methods and models for manpower assessment and allocations. | | | |

| Exhibit R-2A, RDT&E Project Justification: PB 2014 Navy | | DATE: April 2013 |
|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>1319: *Research, Development, Test & Evaluation, Navy*<br>BA 2: *Applied Research* | R-1 ITEM NOMENCLATURE<br>PE 0602750N: *(U)Future Naval Capabilities Applied Research* | PROJECT<br>0000: *(U)Future Naval Capabilities Applied Research* |

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Initiate Platform Design and Acquisition Toolset - Develop methods and models for manpower assessment and allocation in early platform design.<br><br>***FY 2014 Plans:***<br>EC: CMP-FY10-01 INFORMATION ARCHITECTURE FOR IMPROVED DECISION MAKING<br>- Complete Data Triage - Develop an information architecture that merges the data 'behind the glass' in support of a submarine mission planning toolset.<br>- Complete Display Information with Uncertainty - Develop an intuitive submarine mission planning display that combines navigation planning, intelligence tasking, search planning, bathymetry and operational planning.<br><br>EC: CMP-FY10-02 ADAPTIVE TRAINING TO ENHANCE INDIVIDUAL AND TEAM LEARNING AND PERFORMANCE<br>- Complete Adaptive Training for Combat Information Center Teams - Develop adaptive training system components to enhance individual and team training for surface ship Combat Information Center personnel.<br>- Complete Adaptive Training for Submarine Navigation & Piloting Teams - Develop an operator assessment framework that consists of performance measures, performance algorithms, and expert models to help instructors better judge performance and provide tailored, meaningful feedback to the sailor.<br><br>EC: CMP-FY11-01 NAVAL NEXT-GENERATION IMMERSIVE TECHNOLOGY (N2IT)<br>- Continue Augmented Immersive Team Training (AITT) - Identify perceptual cues and expand the virtual training architecture for immersive training in urban and dense infrastructure environments.<br>- Continue Perceptual Training Systems and Tools (PercepTs) - Identify the perceptual cues in the urban and dense infrastructure and environment that may improve warfighter performance.<br><br>EC: CMP-FY11-02 PERFORMANCE SHAPING FUNCTIONS FOR ENVIRONMENTAL STRESSORS<br>- Continue Performance Shaping Functions - Evaluate the impact of incorporating environmental stressors (fatigue, motion, vibration and extreme temperatures) into systems engineering tools for the development of complex Navy systems.<br><br>EC: CMP-FY12-01 LIVE, VIRTUAL, & CONSTRUCTIVE TRAINING FIDELITY<br>- Continue Cognitive Fidelity Synthetic Environment - Develop optimal characteristics for virtual simulations to elicit the appropriate perceptual-cognitive responses for Naval aviation training.<br>- Continue Tactics & Speech Capable Semi-Automated Forces - Conduct applied research to develop learner-aware semi autonomous forces.<br>- Continue Virtual-Constructive Representations on Live Avionics Displays - Develop design guidelines for effective and safe representation of virtual and constructive assets on live displays. | | | |

| Exhibit R-2A, RDT&E Project Justification: PB 2014 Navy | | DATE: April 2013 |
|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>1319: *Research, Development, Test & Evaluation, Navy*<br>BA 2: *Applied Research* | R-1 ITEM NOMENCLATURE<br>PE 0602750N: *(U)Future Naval Capabilities Applied Research* | PROJECT<br>0000: *(U)Future Naval Capabilities Applied Research* |

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| EC: CMP-FY13-02 SIMULATION TOOLSET FOR ANALYSIS OF MISSION, PERSONNEL AND SYSTEMS (STAMPS)<br>- Continue Platform Design and Acquisition Toolset - Develop methods and models to identify the crew capabilities required to operate a specific ship design during various missions under varying physical and cognitive loads.<br><br>EC: CMP-FY14-02 UNMANNED AERIAL SYSTEMS INTERFACE, SELECTION AND TRAINING TECHNOLOGIES (U-ASISTT)<br>- Initiate Dynamic, Adaptive & Modular Training for Unmanned Aerial Systems (UAS) - Characterize knowledge structures for semi-automated forces source data.<br>- Initiate Selection for UAS Personnel (SUPer) - Characterize the knowledge skills and abilities required for operating Navy unmanned aircraft systems.<br>- Initiate Unmanned Aerial Systems (UAS) Control Station Human Machine Interface - Identify the core platform-common and platform-specific information requirements leading to successful unmanned aircraft system operation. | | | |
| ***Title:*** ENTERPRISE AND PLATFORM ENABLERS (EPE) | 0.000 | 14.405 | 16.724 |
| ***Description:*** This R-2 Activity contains all Future Naval Capabilities (FNC) Program Enabling Capability (ECs) investments in this PE that are aligned to the Enterprise and Platform Enablers (EPE) FNC pillar. The EPE Pillar develops cross-cutting, deliverable technologies that provide new capabilities for naval service platforms that lower acquisition, operations and maintenance costs, improve system safety and availability, and improve platform survivability.<br><br>The FY14 increase is due to the initiation of EPE-FY14-02 and EPE-FY15-03.<br><br>***FY 2013 Plans:***<br>EC: EPE-FY09-01 Affordable Common Radar Architecture<br>- Complete Affordable Common Radar Architecture - Develop software and components for a low cost surface radar replacement.<br><br>EC: EPE-FY09-03 Air Platforms Safety and Affordability Technologies<br>- Complete Adaptive Expert System for the Autonomous Detection of Aviation Mishap Leading Indicators - Investigate adaptive expert systems to automatically and rapidly analyze aircrew performance to detect human factors related to mishap leading indicators.<br>- Complete Advanced Rotor Blade Erosion Protection - Conduct materials research for developing robust erosion resistant systems for the MV-22 aircraft.<br><br>EC: EPE-FY09-07 Affordable Submarine Propulsion and Control Actuation | | | |

| Exhibit R-2A, RDT&E Project Justification: PB 2014 Navy | | DATE: April 2013 |
|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>1319: *Research, Development, Test & Evaluation, Navy*<br>BA 2: *Applied Research* | R-1 ITEM NOMENCLATURE<br>PE 0602750N: *(U)Future Naval Capabilities Applied Research* | PROJECT<br>0000: *(U)Future Naval Capabilities Applied Research* |

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Continue Advanced Material Propeller - Conduct Applied Research to understand the effects of failure mechanisms, shock, and fluid-structure interaction on composite marine propellers.<br><br>EC: EPE-FY10-01 Advanced Shipboard Water Desalination<br>- Continue Desalination System - Conduct Applied Research to understand fouling and maintenance issues for reverse osmosis systems and approaches to mitigate these problems.<br>- Continue Pretreatment System - Conduct Applied Research to understand fouling and maintenance issues for pretreatment systems and operational approaches to mitigate these problems.<br><br>EC: EPE-FY10-02 Affordable Modular Panoramic Photonics Mast<br>- Continue Compact Hyper-spectral Scanning Imager - Conduct Applied Research of shortwave infrared hyperspectral sensors to detect anomalies and targets.<br>- Continue Compact Low Light Level Shortwave Infrared (SWIR) Video Camera - Develop highly sensitive shortwave infrared sensors to detect anomalies and targets.<br>- Continue Modular Photonics Mast Housing - Develop technology to reduce the fabrication and life cycle costs of the SSN/SSGN next generation photonics mast.<br><br>EC: EPE-FY10-03 Corrosion and Corrosion Related Signature Technologies for Increased Operational Availability<br>- Continue Advanced Active Shaft Grounding System (ASGS)/Shaft Current Sensor - Develop an advanced active shaft grounding system with integrated shaft current sensing and extremely low frequency electromagnetic control.<br>- Continue Advanced-Robust Impressed Current Cathodic Protection (ICCP) Anodes and Reference Cells - Develop novel impressed current cathodic protection anodes, reference cells and sensors with high mean time between failure.<br>- Continue Dual-Use Corrosion/Signature Sensor for Ballast Tanks - Develop dual-use impressed current cathodic protection and novel sensor technology for corrosion-based maintenance and closed-loop deamping to extend hull-ballast coating longevity and reduce recalibration frequency.<br><br>EC: EPE-FY11-01 Flight Deck Thermal Management<br>- Complete Advanced Thermal Management System - Develop materials and processes for a thermal management system.<br>- Continue Integrated Thermal Management System Design - Finish large panel construction and initiation of a land-based demonstration of large thermal management system panels.<br><br>EC: EPE-FY12-01 Corrosion Mitigation Technologies and Design Integration<br>- Continue Corrosion Resistant Surface Treatment - Determine interstitial hardening parameters for improved corrosion resistance and surface hardness to materials in erosion-corrosion environments. | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Continue Sprayable Acoustic Damping Systems - Develop synthesis of sprayable acoustic damping resin systems for future application in submarine acoustic damping for reduced costs and maintenance.<br><br>EC: EPE-FY12-02 Integrated Hybrid Structural Management System (IHSMS)<br>- Continue Distributed Structural Micro-Sensor Nodes - Conduct research in wireless energy harvesting sensors, architecture, and diagnostics for rotorcraft structural health management.<br>- Continue Rotor - Hot Spot Sensors and Integration - Evaluate and optimize rotor-hot spot sensors and integration technologies that allow improved health assessment of rotating frame and selected structural hot spots.<br><br>EC: EPE-FY13-01 Towed Array System Reliability Improvement<br>- Initiate Tools for Predicting Array Operational Loading & Distribution - Develop an analytical modeling tool for predicting the magnitude and distribution of forces on the array and cable as a function of system design and operational environment.<br>***FY 2014 Plans:***<br>EC: EPE-FY09-07 AFFORDABLE SUBMARINE PROPULSION AND CONTROL ACTUATION<br>- Continue Advanced Material Propeller - Conduct applied research to understand the failure mechanisms, cavitation erosion, shock, and fluid-structure interaction on composite marine propellers and develop predictive capability of these phenomena.<br><br>EC: EPE-FY10-01 ADVANCED SHIPBOARD WATER DESALINATION<br>- Complete Advanced Navy Reverse Osmosis System (formerly known as both Desalination System and Pretreatment System)<br>- Conduct Applied Research to understand fouling and maintenance issues for shipboard Reverse Osmosis desalination/ pretreatment systems and operational approaches to mitigate these problems.<br><br>EC: EPE-FY10-02 AFFORDABLE MODULAR PANORAMIC PHOTONICS MAST<br>- Complete Compact Hyper-spectral Scanning Imager - Develop and integrate camera electronics, optics, scanner, imaging chips, and algorithms for a hyper-spectral imager providing low noise and high spectral fidelity in a small form factor.<br>- Complete Compact Low Light Level Short, Wavelength Infrared (SWIR) Video Camera - Develop and integrate a Low Light Level Short, Wavelength Infrared (SWIR) Video Camera for an Affordable Modular Panoramic Photonics Mast.<br>- Complete Modular Photonics Mast Housing - Develop, fabricate, and integrate panoramic headwindows into a prototype for an Affordable Modular Panoramic Photonics Mast.<br><br>EC: EPE-FY10-03 CORROSION AND CORROSION RELATED SIGNATURE TECHNOLOGIES FOR INCREASED OPERATIONAL AVAILABILITY | | | |

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| APPROPRIATION/BUDGET ACTIVITY<br>1319: *Research, Development, Test & Evaluation, Navy*<br>BA 2: *Applied Research* | R-1 ITEM NOMENCLATURE<br>PE 0602750N: *(U)Future Naval Capabilities Applied Research* | PROJECT<br>0000: *(U)Future Naval Capabilities Applied Research* |

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Complete Advanced Active Shaft Grounding System (ASGS)/Shaft Current Sensor - Evaluate system interaction with Impressed Current Cathodic Protection (ICCP) control.<br>- Complete Dual-Use Corrosion/Signature Sensor for Ballast Tanks - Complete development of analysis and control methods to negate current flow and maintain corrosion control.<br>- Continue Advanced-Robust Impressed Current Cathodic Protection (ICCP) Anodes and Reference Cells - Conduct scale modeling to define optimum routing of cables to minimize corrosion related magnetic signature.<br><br>EC: EPE-FY11-01 FLIGHT DECK THERMAL MANAGEMENT<br>- Complete Integrated Thermal Management System Design - Test panels for heat transfer capabilities.<br><br>EC: EPE-FY12-01 CORROSION MITIGATION TECHNOLOGIES<br>- Continue Corrosion Resistant Surface Treatment - Develop a single step treatment to eliminate the need for pre- and post-processes.<br>- Continue Sprayable Acoustic Damping Systems - Verify damping characteristics and complete evaluation of corrosion properties and application methodologies.<br><br>EC: EPE-FY12-02 INTEGRATED HYBRID STRUCTURAL MANAGEMENT SYSTEM (IHSMS)<br>- Continue Distributed Structural Micro-Sensor Nodes - Conduct research in wireless energy harvesting sensors and other advanced sensors, architectures, and diagnostics technologies for rotorcraft structural health management.<br>- Continue Rotor - Hot Spot Sensors and Integration - Evaluate and optimize rotor-hot spot sensors and integration technologies that allow improved health assessment of rotating frame and selected structural hot spots.<br><br>EC: EPE-FY13-01 TOWED ARRAY SYSTEM RELIABILITY IMPROVEMENT<br>- Continue Tools for Predicting Array Operational Loading & Distribution - Move from Phase I to Phase II of the model development effort building upon the initial effort to incorporate global/multi-scale models and coupling on the array under all operating conditions<br><br>EC: EPE-FY14-02 ALUMINUM ALLOY CORROSION CONTROL AND PREVENTION<br>- Initiate Aluminum Alloy Corrosion Mitigation Technologies - Formulate coatings and investigate coating properties on corrosion inhibition, degree of thermal load reduction, and adhesion over Al 5XXX alloys.<br>- Initiate Aluminum Alloy Corrosion Prediction Tool - Develop algorithm for Al 5XXX alloy evaluation and for prediction of time-to-failure.<br><br>EC: EPE -FY15-03 SPECIAL HULL TREATMENT | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Initiate New Materials Development and Laboratory Characterization- Begin applied research. | | | |
| ***Title:*** EXPEDITIONARY MANEUVER WARFARE (EMW) | 0.000 | 6.597 | 9.297 |
| ***Description:*** This R-2 Activity contains all Navy funded Future Naval Capabilities (FNC) Program Enabling Capability (ECs) investments in this PE that are aligned to the Expeditionary Maneuver Warfare (EMW) FNC Pillar. The EMW Pillar develops deliverable technologies that provide new capabilities in expeditionary maneuver warfare, including naval ground forces, with special emphasis on regular and irregular warfare in urban environments and combating terrorism.<br><br>The FY14 increase was due to the initiation of EMW-FY14-01.<br><br>***FY 2013 Plans:***<br>EC: EMW-FY12-02 Future Joint Counter Radio-Controlled Improvised Explosive Devices (C-RCIED) Electronic Warfare (JCREW)<br>- Continue Distributed C-RCIED - Develop advanced techniques for networking distributed counter-radio controlled Improvised Explosive Device (IED) resources.<br>- Continue Integrated Counter-RCIED EW (ICEW) - Develop advanced techniques for defeating radio controlled Improvised Explosive Devices (IEDs) and achieving interoperable communications and electronic warfare capabilities.<br><br>EC: EMW-FY13-01 Azimuth and Inertial MEMS Navigation System<br>- Initiate MEMS Inertial Navigation System - Characterize the operational limitations and shortcomings of the digital magnetic compass and optimize sensor performance of MEMS to reduce target location error in the navigation system of hand-held targeting systems.<br>***FY 2014 Plans:***<br>EC: EMW-FY12-02 FUTURE JOINT COUNTER RADIO-CONTROLLED IMPROVISED EXPLOSIVE DEVICE ELECTRONIC WARFARE (JCREW)<br>- Continue Distributed Joint Counter Radio-Controlled Improvised Explosive Device Electronic Warfare (D-JCREW) - Develop techniques for real-time networking and cross-platform synchronization of distributed Joint Counter Radio-Controlled Improvised Explosive Device Electronic Warfare (JCREW) platforms for improved efficiency and coordinated tasking.<br>- Continue Integrated Joint Counter Radio-Controlled Improvised Explosive Device Electronic Warfare (I-JCREW) - Develop techniques for improving compatibility between Radio Frequency (RF) systems, particularly jammers and communications, in order to allow continuous operations of each in a shared battlespace.<br><br>EC: EMW-FY13-01 AZIMUTH AND INERTIAL MICRO-ELECTRO-MECHANICA SYSTEM (MEMS) NAVIGATION SYSTEM | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Continue Micro-Electro-Mechanical System (MEMS) Inertial Navigation System - Characterize the operational limitations and shortcomings of the digital magnetic compass and optimize sensor performance of MEMS to reduce target location error in the Navigation System of hand-held targeting systems.<br><br>EC: EMW-FY14-01 SPECTRAL AND RECONNAISSANCE IMAGERY FOR TACTICAL EXPLOITATION (SPRITE)<br>- Initiate Automated Processing for Spectral Exploitation and Dissemination (APSED) - Conduct a feasibility effort to develop an Electro-Optical (EO) and Hyper-Spectral Imagery (HSI) image processing architecture that includes EO-to-HSI cross-correlation and fusion, image archiving and retrieval, and exploitation product generation.<br>- Initiate Compact Wide Area Reconnaissance and Spectral Sensor (CWARSS) - Initiate efforts to develop a wide-area intelligence, surveillance and reconnaissance capability with simultaneous high spatial and spectral resolution. | | | |
| ***Title:*** FNC MANAGEMENT | 0.000 | 8.796 | 9.028 |
| ***Description:*** This R-2 Activity includes the Science and Technology (S&T) analyses and studies required to take new Future Naval Capabilities (FNC) Program Enabling Capabilities (ECs) approved by the Technology Oversight Group and produce the detailed technology specifications and performance metrics needed to procure the component level technologies that must be developed and tested in order to deliver technology products to the acquisition community. This activity includes development and implementation of innovative and dynamically changing technology management business processes required to manage FNC investments supporting the naval capability pillars.<br><br>***FY 2013 Plans:***<br>FNC Management<br>- Continue Enabling Capability New Start Preparations - Conduct technology analysis and studies to support the development and validation of technology performance specifications to ensure new enabling capabilities are able to commence execution in a timely manner.<br>- Continue Support/Operations (OPS) Analysis - Conduct warfighter sustainment Applied Research and analysis, including technology management of FNC investments supporting the naval capability pillars.<br><br>***FY 2014 Plans:***<br>EC: FNC MGMT-NEW START PREPARATIONS<br>- Continue FNC Management - New Start Preparations - Conduct technology analysis and studies to support the development and validation of technology performance specifications to ensure new enabling capabilities are able to commence execution in a timely manner.<br><br>EC: FNC MGMT-SUPPORT/OPS ANALYSIS | | | |

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|---|---|---|
| APPROPRIATION/BUDGET ACTIVITY<br>1319: *Research, Development, Test & Evaluation, Navy*<br>BA 2: *Applied Research* | R-1 ITEM NOMENCLATURE<br>PE 0602750N: *(U)Future Naval Capabilities Applied Research* | PROJECT<br>0000: *(U)Future Naval Capabilities Applied Research* |

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| Continue FNC Management - Support/OPS Analysis - Conduct warfighter sustainment Applied Research and analysis, including technology management of FNC investments supporting the naval capability pillars. | | | |
| ***Title:*** FORCE HEALTH PROTECTION (FHP) | 0.000 | 11.583 | 10.106 |
| ***Description:*** This R-2 Activity contains all Future Naval Capabilities (FNC) Program Enabling Capability (ECs) investments in this PE that are aligned to the Force Health Protection (FHP) FNC pillar. The FHP Pillar develops deliverable technologies that provide new capabilities that provide Sailors and Marines with the best possible protection from operational threats by reducing morbidity and mortality when casualties occur.<br><br>The FY14 decrease was due primarily to the completion of FHP-FY08-01, FHP-FY08-02, FHP-FY08-03 and FHP-FY08-04, and the planned ramp-down of FHP-FY10-01, FHP-FY11-01 and FHP-FY12-01.<br><br>***FY 2013 Plans:***<br>EC: FHP-FY08-01 Casualty Prevention<br>- Complete Models of Head and Cervical Spine - Conduct preclinical animal and post-mortem human specimen testing of tissue failure and strain rates.<br><br>EC: FHP-FY08-02 Advanced Forward Care<br>- Complete Closed Loop Fluid Delivery System - Develop physiologically-based software algorithms to perform constant monitoring of patient condition and render the proper fluid resuscitation.<br>- Complete Non-Pulmonary Oxygenation - Develop the requisite formulation of hydrogen-peroxide to produce a constant concentration of oxygen during a Casualty Evacuation (CASEVAC) scenario.<br><br>EC: FHP-FY08-03 Rapid Blood Treatment<br>- Complete Hemostatic Agents - Conduct biochemical analysis of the efficacy of hemostatic materials as determined by platelet aggregation.<br>- Complete Pharmacologic Resuscitation - Conduct feasibility testing of the use of low-volume resuscitation in severe hemorrhage models.<br><br>EC: FHP-FY08-04 Warfighter Restoration<br>- Complete Hearing Loss Prevention and Treatment - Conduct data collection and determination of appropriate technologies for the purposes of noise dosimetry and personal protection from noise. | | | |

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|---|---|---|
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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Complete Post Traumatic Stress Mitigation - Conduct research that will support the development of stress resilience technologies, including stress resilience, physiological markers of stress/resilience, studies on the effects of fatigue, and pilot information on the effectiveness of interventions.<br>- Complete Repetitive Neurotrauma Mitigation - Identify molecular markers of mild Traumatic Brain Injury (mTBI).<br>- Complete Wound Healing - Determine the optimal drug and delivery combination for restoring muscle and bone.<br><br>EC: FHP-FY10-01 Human Injury & Treatment Model<br>- Continue Human Injury & Treatment Model - Develop a model for predicting outcomes of personnel exposure to shipboard damage.<br><br>EC: FHP-FY11-01 Multifunctional Blood Substitute (MFBS)<br>- Continue Multifunctional Blood Substitute (MFBS) - Determine the optimal blood component mixture for a complete and shelf-stable resuscitation fluid.<br><br>EC: FHP-FY12-01 Automated Critical Care System (ACCS)<br>- Continue Automated Critical Care System (ACCS) - Develop physiologically-based software algorithms to perform constant monitoring of 15 patient conditions and render the proper treatment for all conditions monitored during a 2-6 hour Casualty Evacuation (CASEVAC) scenario.<br><br>EC: FHP-FY12-02 Saving lives with Emergency Medical Perfluorocarbons in the Field (SEMPer Fi) for Sea, Air & Land Dysoxia.<br>- Continue SEMPer Fi for Air Dysoxia - Conduct advanced preclinical to early clinical studies on safety, efficacy and dosing of therapeutics for the immediate treatment of pulmonary hypoxia/hypoxemia.<br>- Continue SEMPer Fi for Land Blast Kit - Conduct advanced preclinical to early clinical studies on safety, efficacy and dosing of targeted therapeutics or immediate treatment of blast overpressure, including injury to the brain and/or internal organs.<br><br>EC: FHP-FY13-03 Extreme Operations: Mitigating Oxygen Imbalance at Altitude and at Depth<br>- Initiate Hypoxia Alert and Mitigation System - Conduct cognitive assessment of performance under hypoxic conditions. | | | |
| ***FY 2014 Plans:***<br>EC: FHP-FY10-01 HUMAN INJURY & TREATMENT MODEL<br>- Complete Human Injury & Treatment Model - Complete the model for predicting outcomes of personnel exposure to shipboard damage.<br><br>EC: FHP-FY11-01 MULTIFUNCTIONAL BLOOD SUBSTITUTE (MFBS) | | | |

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|---|---|---|
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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Continue Multifunctional Blood Substitute (MFBS) - Determine the optimal blood component mixture for a complete and shelf stable resuscitation fluid.<br><br>EC: FHP-FY12-01 AUTOMATED CRITICAL CARE SYSTEM (ACCS)<br>- Continue Automated Critical Care System (ACCS) - Formulate autonomous hardware and software system to monitor and maintain combat causalities with minimal human intervention during a 2-6 hour Casualty Evacuation (CASEVAC) scenario.<br><br>EC: FHP-FY12-02 SAVING LIVES WITH EMERGENCY MEDICAL PERFLUOROCARBONS IN THE FIELD (SEMPER FI) FOR SEA, AIR & LAND DYSOXIA<br>- Continue Saving Lives with Emergency Medical Perfluorocarbons in the Field (SEMPer Fi) for Air Dysoxia - Perform down-select of candidate drugs based on small and large animal testing for treatment of pulmonary hypoxia/hypoxemia.<br>- Continue Saving Lives with Emergency Medical Perfluorocarbons in the Field (SEMPer Fi) for Land Blast Kit - Determine window of therapeutic intervention and dosing for immediate treatment of blast overpressure in small and large animals, including injury to the brain and/or internal organs.<br><br>EC: FHP-FY13-03 EXTREME OPERATIONS: MITIGATING OXYGEN IMBALANCE AT ALTITUDE AND AT DEPTH<br>- Continue Hypoxia Alert and Mitigation System - Evaluate and adapt methods of detecting individual-specific detriments in performance in hypoxic conditions.<br><br>EC: FHP-FY14-01 ACUTE CARE COVER FOR SEVERELY INJURED LIMBS (ACCSIL)<br>- Initiate Acute Care Cover for Severely Injured Limbs (ACCSIL) - Establish efficacy test parameters for innovative pharmaceutical solutions and novel materials for feasibility of use.<br><br>EC: FHP-FY14-03 BLAST LOAD ASSESSMENT: SENSE AND TEST (BLAST)<br>- Initiate Algorithm - Determine, establish and design test parameters of algorithm.<br>- Initiate Neuro-Cognitive Assessment Tool - Establish and design a repeatable sensory modality.<br>- Initiate Sensor - Determine and establish sensor metrics. | | | |
| ***Title:*** FORCENET (FNT)<br><br>***Description:*** This R-2 Activity contains all Future Naval Capabilities (FNC) Program Enabling Capability (ECs) investments in this PE that are aligned to the Forcenet (FNT) FNC Pillar. The FNT pillar develops deliverable technologies that provide new capabilities in Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), networking, navigation, sensors, decision support, cyber-space, intelligence, and space technologies that will provide the architectural framework for naval warfare in the information age. | 0.000 | 32.921 | 36.050 |

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| APPROPRIATION/BUDGET ACTIVITY<br>1319: *Research, Development, Test & Evaluation, Navy*<br>BA 2: *Applied Research* | R-1 ITEM NOMENCLATURE<br>PE 0602750N: *(U)Future Naval Capabilities Applied Research* | PROJECT<br>0000: *(U)Future Naval Capabilities Applied Research* |

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| The FY14 increase was due primarily to the initiation of FNT-FY13-03, FNT-FY14-02 and FNT-FY14-03.<br><br>***FY 2013 Plans:***<br>EC: FNT-FY09-02 Dynamic Tactical Communications Networks<br>- Complete Assured information exchange - Develop capabilities for strict priority queuing, adaptive routing and route control agent mechanisms.<br>- Complete Self-Organizing Networks - Develop policy-based network management, mobile adhoc networking routing enhancements, radio-router interfaces, and dynamic routing across in-line network encrypters.<br><br>EC: FNT-FY09-04 Dynamic Command and Control (C2) for Tactical Forces and Maritime Operations Center (MOC)<br>- Complete Dynamic C2 for Tactical Forces and Maritime Operations Center (MOC) - Conduct Applied Research for the timely and accurate sharing of information between Combat Systems and Tactical Command and Control through disconnected, intermittent, and limited communications.<br><br>EC: FNT-FY10-01 High-bandwidth Free-space Lasercomm<br>- Continue Free-space Optical Terminal (FOT) - Develop free space optical terminal components supporting the development of an active optical communication system.<br>- Complete Modulating Retro-reflector Unit (MRU) - Develop modulating retro-reflector components supporting the development of a passive optical communication system.<br><br>EC: FNT-FY10-02 Actionable Intelligence Enabled by Persistent Surveillance<br>- Continue Autonomous UAV Collision Avoidance System (ACAS) - Develop light weight, low cost sensor components and autonomy algorithms to enable detection and avoidance of all classes of aircraft or unmanned aerial vehicles.<br>- Continue Operational Adaptation Enterprise Services - Develop an information enterprise for the organization of contextual Resource Description Framework (RDF) statements for rapid association of data into meaningful graphs and of application services that could be orchestrated in near real-time for hybrid complex operations.<br>- Continue Ultra Wide Field-of-View (FOV) Area Surveillance System - Develop unmanned aerial vehicle deployable Electro-Optic / Infrared (EO/IR) sensor components for adaptable wide and narrow fields-of-view.<br><br>EC: FNT-FY10-03 SATCOM Vulnerability Mitigation<br>- Continue Airborne Communications Suite (ACS) - Develop algorithms for fast switching phased arrays suitable for use on aircraft and radio architectures and prototype interim common data link radio units suitable for aircraft. | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| EC: FNT-FY11-01 Pro-Active Computer Network Defense and Information Assurance<br>- Continue Common Operational Security Decision System - Develop a real-time network topology map and visualization model for identifying and displaying network activity.<br>- Continue Next Generation Security and Security Management Protocols - Develop real-time system and autonomous control models for network security components.<br>- Continue Next Generation Sensors and Gateways - Develop real-time malicious code detection and remediation algorithms for network data.<br><br>EC: FNT-FY11-02 Fast Magic<br>- Continue Fast Magic Product 1 - Conduct Applied Research. (details classified)<br>- Continue Fast Magic Product 2 - Conduct Applied Research. (details classified)<br><br>EC: FNT-FY11-05 NRL Space<br>- Continue Multi-INT Tracking - Conduct Applied Research in the emerging area of vessel tracking.<br>- Continue Tagging - Develop data tags based on key parametric values used in the Maritime environment.<br><br>EC: FNT-FY12-01 Advanced Tactical Data Link (ATDL)<br>- Continue Mission Based Waveform Controls and Networking - Develop waveform controls and networking capabilities to support integrated systems.<br><br>EC: FNT-FY12-02 Autonomous Persistent Tactical Surveillance<br>- Continue Autonomous Information-Based Surveillance Control - Develop algorithms for information based collection and planning.<br>- Continue Contextual Enterprise Information - Conduct Applied Research to provide enterprise exploitation services for situation context between relevant theater sensor collections and exploitation products.<br>- Continue Mobile Autonomous Intelligence Surveillance Reconnaissance (ISR) to Command and Control (C2) Synchronization<br>- Conduct Applied Research to develop enterprise distributed software that will manage complex event processing and temporal modeling of the ISR to C2 time link budget.<br><br>EC: FNT-FY13-01 EW Battle Management for Surface Defense<br>- Initiate Electronic Warfare Battle Management (EWBM) - Conduct Applied Research on the application of multi-variable discrete optimization for distributed surface platforms in support of electronic warfare battle management.<br><br>EC: FNT-FY13-04 Detection and Fusion for Remote Sensors | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Initiate Adaptive Multi-Int Correlation & Identification (AMICA) - Conduct Applied Research for the integration of emerging Information Operations (IO) and new sensors at the tactical level.<br>- Initiate Detection & Classification Algorithms (DCA) - Begin development of detection and classification algorithms.<br>***FY 2014 Plans:***<br>EC: FNT-FY10-01 HIGH-BANDWIDTH FREE-SPACE LASERCOMM<br>- Complete Free-space Optical Terminal (FOT) - Develop Free-space Optical Terminal (FOT) components for an active optical communication system.<br><br>EC: FNT-FY10-02 ACTIONABLE INTELLIGENCE ENABLED BY PERSISTENT SURVEILLANCE<br>- Complete Autonomous Unmanned Aerial Vehicle (UAV) Collision Avoidance System - Develop and integrate a prototype with lab-test hardware, software, and subsystems for collision avoidance of Unmanned Air Systems in the National Airspace System (NAS).<br>- Complete Operational Adaptation Enterprise Services - Develop an information enterprise for the organization of contextual Resource Description Framework statements for rapid association of data into meaningful graphs and application services that could be orchestrated in near real-time for hybrid complex operations.<br>- Complete Ultra Wide Field of View (FOV) Area Surveillance System - Develop and integrate lab-test algorithms and individual components of the sensor system.<br><br>EC: FNT-FY10-03 SATELLITE COMMUNICATIONS (SATCOM) VULNERABILITY MITIGATION<br>- Complete Multi-Link Common Data Link (CDL) System - Complete supporting architecture, Radio Frequency (RF) distribution, and networking technology developments needed for a Multi-Link Common Data Link (CDL) System.<br><br>EC: FNT-FY11-01 PRO-ACTIVE COMPUTER NETWORK DEFENSE AND INFORMATION ASSURANCE<br>- Continue Common Operational Security Decision System -Develop techniques for assessing the impact of network security policy on network operations.<br>- Continue Next Generation Security and Security Management Protocols - Develop techniques for evaluating the security and performance of network communication paths to support fault-aware overlay routing.<br>- Continue Next Generation Sensors and Gateways - Develop techniques for modeling network behavior, identifying abnormal events, and deriving corrective transformations.<br><br>EC: FNT-FY11-02 FAST MAGIC<br>- Continue Fast Magic Product 1 - Conduct Applied Research (details classified).<br>- Continue Fast Magic Product 2 - Conduct Applied Research (details classified). | | | |

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| APPROPRIATION/BUDGET ACTIVITY<br>1319: *Research, Development, Test & Evaluation, Navy*<br>BA 2: *Applied Research* | R-1 ITEM NOMENCLATURE<br>PE 0602750N: *(U)Future Naval Capabilities Applied Research* | PROJECT<br>0000: *(U)Future Naval Capabilities Applied Research* |

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| EC: FNT-FY11-05 NRL SPACE<br>- Continue Multi-INT Tracking - Develop vessel tracking algorithms and characterization techniques.<br>- Continue Tagging - Perform data tagging research based on key parametric values used in the Maritime environment.<br><br>EC: FNT-FY12-01 ADVANCED TACTICAL DATA LINK (ATDL)<br>- Continue Mission-Based Waveform Controls & Networking - Emulate preliminary design to validate performance against operational scenarios.<br><br>EC: FNT-FY12-02 AUTONOMOUS PERSISTENT TACTICAL SURVEILLANCE<br>- Continue Autonomous Information-Based Surveillance Control - Analyze and continue development of improved algorithms and processing for information based collection and planning.<br>- Continue Contextual Enterprise Information - Develop the analytical services framework, including enterprise exploitation services for situation context between relevant theater sensor collections and exploitation products.<br>- Continue Mobile Autonomous Intelligence, Surveillance and Reconnaissance (ISR) to Command and Control (C2) Synchronization - Conduct applied research to develop enterprise distributed software that will manage complex event processing and temporal modeling of the Intelligence, Surveillance and Reconnaissance (ISR) to Command and Control (C2) time link budget.<br><br>EC: FNT-FY13-01 ELECTRONIC WARFARE BATTLE MANAGEMENT (EWBM) FOR SURFACE DEFENSE<br>- Continue Electronic Warfare Battle Management (EWBM) - Develop coordinated Electronic Attack and deception (decoy) techniques to include novel use of existing hardware capabilities in real time necessary to manage the Electronic Warfare (EW) battle space.<br><br>EC: FNT-FY13-03 SILK THREAD<br>- Initiate Product 1 - Conduct applied research (details classified).<br>- Initiate Product 2 - Conduct applied research (details classified).<br><br>EC: FNT-FY13-04 DETECTION AND FUSION FOR REMOTE SENSORS<br>- Continue Adaptive Multi-Int Correlation & Identification (AMICA) - Research and analyze algorithms to enable cross-domain information fusion and optimize use of remote sensing assets.<br>- Continue Detection & Classification Algorithms (DCA) - Research and analyze algorithms to provide enhanced detection and classification metrics and robust performance under stressing environmental conditions. | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| EC: FNT-FY14-02 ADAPTIVE TASKING, COLLECTION, PROCESSING, EXPLOITATION AND DISSEMINATION (TCPED) SERVICES<br>- Initiate Adaptive Tasking, Collection, Processing, Exploitation and Dissemination (TCPED) for Anti-Submarine Warfare (ASW) Services - Develop advanced techniques for automated, high accuracy, low error rate, adaptive processing.<br>- Initiate Data Exfiltration and Networked Platform Interaction - Details classified.<br><br>EC: FNT-FY14-03 EXCHANGE OF ACTIONABLE INFORMATION AT THE TACTICAL EDGE (EAITE)<br>- Initiate/Complete Actionable Information Tactical Applications - Development of orchestration mechanisms to generate products, semantics for machine understanding of content, and automatic generation of pedigreed reports responsive to available network resources.<br>- Initiate/Complete Data Conditioning - Development of machine understanding of information exchange requirements, algorithms aligned to content, product tailoring, and processing efficiency necessary to work on native hardware.<br>- Initiate/Complete Network Adaptive Communication Services - Development of distributed mission- and information needs-based network functionality, information dissemination control mechanisms, and network-wide condition determination. | | | |
| ***Title:*** POWER AND ENERGY (P&E) | 0.000 | 4.668 | 5.530 |
| ***Description:*** This R-2 Activity contains all Future Naval Capabilities (FNC) Program Enabling Capability (ECs) investments in this PE that are aligned to the Power and Energy (P&E) FNC pillar. The P&E Pillar develops deliverable technologies that provide new capabilities in energy security, efficient power and energy systems, high energy and pulse power.<br><br>The FY14 increase was due to the initiation of P&E-FY14-01.<br><br>***FY 2013 Plans:***<br>EC: P&E-FY12-01 Renewable-Sustainable Expeditionary Power<br>- Continue Renewable Thermal Engine - Conduct research of sustainable energy technologies for mobile tactical applications.<br><br>EC: P&E-FY12-03 Long Endurance Undersea Vehicle Propulsion<br>- Continue Air Independent Propulsion System - Develop full-scale air independent energy system detailed design, technical-cost analysis, and initiate full-scale component procurements.<br>***FY 2014 Plans:***<br>EC: P&E-FY12-01 RENEWABLE-SUSTAINABLE EXPEDITIONARY POWER<br>- Continue Renewable Thermal Engine - Continue detailed design for integration of component technologies including connections and user interfaces/controls. | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| EC: P&E-FY12-03 LONG ENDURANCE UNDERSEA VEHICLE PROPULSION<br>- Continue Air Independent Propulsion System - Finalize Energy System layout drawings of critical components, interfaces and subsystems integrated into the Unmanned Underwater Vehicle (UUV) hull.<br><br>EC: P&E-FY14-01 EFFICIENT AND POWER DENSE ARCHITECTURE AND COMPONENTS<br>- Initiate High Power Solid State Circuit Protection for Power Distribution and Energy Storage -<br>Conduct trade study to investigate suitable circuit protection methods and create analytical models of their operation. | | | |
| ***Title:*** SEA BASING (BAS) | 0.000 | 9.848 | 2.577 |
| ***Description:*** This R-2 Activity contains all Future Naval Capabilities (FNC) Program Enabling Capability (ECs) investments in this PE that are aligned to the Sea Basing (BAS) FNC pillar. The BAS Pillar develops deliverable logistics, shipping and at-sea transfer technologies that provide new capabilities for projecting expeditionary force from the sea base and providing sea based joint operational independence through improved connector, at-sea transfer and shipboard logistical capabilities.<br><br>The FY14 decrease was due to the completion of BAS-FY08-03 and the planned ramp-down of BAS-FY11-01.<br><br>***FY 2013 Plans:***<br>EC: BAS-FY08-03 Sense and Respond Logistics<br>- Complete Common Operating Picture Logistics Decision Support Tool - Develop software to perform human cognitive functions for logistics planning decision support.<br><br>EC: BAS-FY11-01 Connectors and the Sea Base<br>- Continue Advanced Mooring System - Construct vacuum mooring and motion control components.<br>- Continue Environmental Ship Motion Forecasting - Conduct research on sensing and wave and ship motion sensing and forecasting.<br>***FY 2014 Plans:***<br>EC: BAS-FY11-01 CONNECTORS AND THE SEA BASE<br>- Complete Advanced Mooring System - Conduct research on vacuum mooring and motion control components.<br>- Continue Environmental Ship Motion Forecasting - Conduct research on sensing and wave and ship motion sensing and forecasting. | | | |
| ***Title:*** SEA SHIELD (SHD) | 0.000 | 39.509 | 39.204 |
| ***Description:*** This R-2 Activity contains all Future Naval Capabilities (FNC) Program Enabling Capability (ECs) investments in this PE that are aligned to the Sea Shield (SHD) FNC pillar. The SHD Pillar develops deliverable technologies that provide new | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| capabilities in theater air and missile defense, anti-submarine warfare, mine countermeasures, defensive surface warfare, global defensive assurance, anti-terrorism, and fleet/force protection.<br><br>***FY 2013 Plans:***<br>EC: SHD-FY09-01 Operation of ASW Active Distributed Systems<br>- Complete Mobile System Placement, Source Control, and Pattern Keeping Algorithm - Develop algorithms used to coordinate the search and track capability between mobile, low frequency active Anti-Submarine Warfare (ASW) systems.<br><br>EC: SHD-FY09-06 Countermeasure Technologies for Anti-Ship Missile Defense (ASMD)<br>- Complete Enhanced SEWIP Transmitter - Conduct a final test of the enhanced Surface Electronic Warfare Improvement Program (SEWIP) transmit array in the anechoic chamber.<br><br>EC: SHD-FY09-08 Four-Torpedo Salvo Defense<br>- Complete Anti Torpedo Torpedo (ATT) for Surface Ship Defense against Complex Salvo - Develop software encoded algorithms for the anti-torpedo torpedo sensor and controller enabling engagement of torpedo salvoes of up to four attacking units.<br><br>EC: SHD-FY10-01 Anti-Ship Missile Defense Technologies (Hardkill)<br>- Continue Enhanced Lethality Guidance Algorithms (ELGA) - Design and model STANDARD Missile guidance algorithms for advanced maneuvering missile threats.<br>- Continue Enhanced Maneuverability Missile Airframe (EMMA) - Design and model STANDARD Missile motor and control techniques for advanced maneuvering threats.<br><br>EC: SHD-FY10-02 High Fidelity Active Sonar Training<br>- Continue ASW Command Level Training - Develop algorithms for training ASW Commanders by utilizing human cognitive factors and evaluate them in the laboratory for performance improvement.<br>- Continue Operator Training - Develop algorithms to enhance the realism of simulated submarine targets, environmental clutter and reverberation, and evaluate their laboratory performance.<br><br>EC: SHD-FY10-03 Advanced Sonar Technology for High Clearance Rate Mine Countermeasures (MCM)<br>- Continue Integrated Forward Looking Sonar - Dual Frequency Synthetic Aperture Sonar (FLS-DFSAS) - Develop autonomy, automatic target recognition and real-time change detection, including conducting laboratory/pond data collection.<br>- Continue Long Range Low Frequency Broad Band (LFBB) Sonar (Autonomous Underwater Vehicle (AUV) Platform Option) - Conduct long range acoustics experiments and develop classification algorithms. | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Continue Very Shallow Water (VSW) Acoustic Color/Imaging Sonar - Develop acoustic color/synthetic aperture sonar imaging algorithms and performance of controlled data collection.<br><br>EC: SHD-FY10-04 Next Generation Countermeasure Technologies for Ship Missile Defense<br>- Continue Next Generation Countermeasure Technologies for Ship Missile Defense - Develop distributed resource optimization and coordinated electronic attack techniques for ship missile defense.<br><br>EC: SHD-FY10-05 Affordable Vector Sensor Towed Array and Signal Processing<br>- Continue Vector Sensor Towed Array - Develop component level technology for use in a thin-line Vector Sensor Towed Array and develop a physics-based performance model.<br>- Continue Vector Sensor Towed Array Signal Processing - Develop the noise reduction and passive signal processing algorithms unique to a thin line Vector Sensor Towed Array.<br><br>EC: SHD-FY11-01 Torpedo Common Hybrid Fuzing System<br>- Continue Torpedo Common Hybrid Fuzing System - Conduct developmental simulation and testing.<br><br>EC: SHD-FY11-02 Integrated Hardkill-Softkill<br>- Complete Integrated Active and Electronic Defense (IAED) - Design and model optimized response combinations of kinetic and non-kinetic anti-ship missile defenses.<br><br>EC: SHD-FY12-01 Force Level Radar Resource Management for Integrated Air and Missile Defense (IAMD)<br>- Continue Radar Resource Manager for Integrated Air & Missile Defense (IAMD) - Design and model algorithms for management and coordination of force level AEGIS radar resources.<br><br>EC: SHD-FY12-03 Sonar Automation<br>- Continue Active Sonar Automation - Identify and evaluate in lab performance of algorithms to improve active sonar operator performance in detecting submarines while reducing false contact rates.<br>- Continue Passive Sonar Automation - Identify and evaluate in laboratory performance of algorithms that improve passive sonar operator performance against quiet submarines in the presence of clutter.<br><br>EC: SHD-FY12-04 Detection and Neutralization of Near-Surface Drifting-Oscillating Mines<br>- Continue Compact Modular Sensor-Processing Suite (CMSS) - Develop target recognition algorithms.<br><br>EC: SHD-FY13-01 Cooperative Networked Radar | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Initiate Cooperative Networked Radar - Develop software and algorithms to integrate multiple shipboard radars.<br><br>EC: SHD-FY13-02 Ground Based Air Defense On-the-Move (GBAD-OTM)<br>- Initiate/Complete GBAD-OTM High Energy Laser Demonstrator - Conduct Applied Research supporting development of a radar-cued high energy laser system capable of detecting low radar cross section threats and perform soft and hard kills of unmanned aerial systems while on-the-move.<br><br>EC: SHD-FY13-05 High Altitude ASW (HAASW) from the P-8<br>- Initiate Next Generation Multistatic Active Capability (NGMAC) - Identify and evaluate transducer source level improvements and conduct early development work on algorithms capable of providing state estimation for use in multi-static active coherent buoys.<br>- Initiate Unmanned Targeting Air System (UTAS) - Identify and evaluate magnetic sensors and algorithms for use on an unmanned aerial vehicle for localization of a submarine.<br><br>EC: SHD-FY13-07 USV Payloads for Single Sortie Mine Countermeasures<br>- Initiate Drifting Mine Neutralization Technology - Develop low-cost sensing solutions, algorithm development, and associated autonomy.<br>- Initiate MCM Payload Automation - Develop command and control, planning and recognition algorithms and models.<br>- Initiate Single Sortie MCM Detect-to-Engage Payload - Develop architecture, command and control, planning algorithms and design options for hardware.<br>***FY 2014 Plans:***<br>EC: SHD-FY10-01 ANTI-SHIP MISSILE DEFENSE TECHNOLOGIES<br>- Continue Enhanced Lethality Guidance Algorithms (ELGA) - Continue design and modeling of STANDARD Missile guidance algorithms for advanced maneuvering missile threats.<br>- Continue Enhanced Maneuverability Missile Airframe (EMMA) - Continue design and modeling STANDARD Missile motor and thrust vector control for advanced maneuvering threats.<br><br>EC: SHD-FY10-02 HIGH FIDELITY ACTIVE SONAR TRAINING<br>- Complete Anti-Submarine Warfare (ASW) Command Level Training - Develop algorithms for training Anti-Submarine Warfare (ASW) Commanders and their Aircraft Carrier supporting personnel by utilizing human cognitive factors and evaluating them in the laboratory for performance improvements.<br>- Complete Operator Training - Develop algorithms to enhance the realism of simulated submarine targets, environmental clutter and reverberation, and evaluate their laboratory performance. | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| EC: SHD-FY10-03 ADVANCED SONAR TECHNOLOGY FOR HIGH CLEARANCE RATE MINE COUNTERMEASURES (MCM)<br>- Continue Integrated Forward looking Sonar - Dual Frequency Synthetic Aperture Sonar (FLS-DFSAS) -<br>Develop autonomy, automatic target recognition and real-time change detection, including conducting laboratory/pond data collection.<br>- Complete Long Range Low Frequency Broadband (LFBB) Sonar (Autonomous Underwater Vehicle (AUV) Platform Option) - Develop detection and classification algorithms for stealthy mines.<br>- Complete Very Shallow Water (VSW) Acoustic Color/Imaging Sonar - Develop acoustic color/synthetic aperture sonar imaging algorithms and performance of controlled data collection.<br><br>EC: SHD-FY10-04 NEXT GENERATION COUNTERMEASURE TECHNOLOGIES FOR SHIP MISSILE DEFENSE<br>- Complete Next Generation Countermeasure Technologies for Ship Missile Defense - Develop, test and modify algorithms to allow networked, multi-platform Electronic Attack (EA) control to deliver synchronized jamming and deception effects to counter emergent anti-ship missile target prosecution modalities.<br><br>EC: SHD-FY10-05 AFFORDABLE VECTOR SENSOR TOWED ARRAY AND SIGNAL PROCESSING<br>- Continue Vector Sensor Towed Array - Develop component level technology for use in a thin-line Vector Sensor Towed Array and develop a physics-based performance model.<br>- Continue Vector Sensor Towed Array Signal Processing - Develop the noise reduction and passive signal processing algorithms unique to a thin-line Vector Sensor Towed Array.<br><br>EC: SHD-FY11-01 TORPEDO COMMON HYBRID FUZING SYSTEM<br>- Continue Torpedo Common Hybrid Fuzing System - Conduct developmental simulations and testing.<br><br>EC: SHD-FY12-01 FORCE LEVEL RADAR RESOURCE MANAGEMENT FOR INTEGRATED AIR AND MISSILE DEFENSE (IAMD)<br>- Continue Radar Resource Manager for Integrated Air and Missile Defense (IAMD) - Design and model algorithms for management and coordination of force level AEGIS radar resources.<br><br>EC: SHD-FY12-03 SONAR AUTOMATION<br>- Continue Active Sonar Automation - Evaluate in lab performance of algorithms to improve active sonar operator performance in detecting submarines while reducing false contact rates.<br>- Continue Passive Sonar Automation - Evaluate in laboratory performance of algorithms that improve passive sonar operator performance against quiet submarines in the presence of clutter. | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| EC: SHD-FY12-04 DETECTION AND NEUTRALIZATION OF NEAR-SURFACE DRIFTING-OSCILLATING MINES<br>- Continue Compact Modular Sensor-Processing Suite (CMSS) - Develop target recognition algorithms.<br><br>EC: SHD-FY13-01 COOPERATIVE NETWORKED RADAR<br>- Continue Cooperative Networked Radar - Develop, collect, and process real-world data to integrate multiple shipboard radars.<br><br>EC: SHD-FY13-05 HIGH ALTITUDE ANTI-SUBMARINE WARFARE (HAASW) FROM THE P-8<br>- Continue Next Generation Multistatic Active Capability (NGMAC) - Identify and evaluate transducer source level improvements and conduct early development work on algorithms capable of providing state estimation for use in multi-static active coherent sonobuoys.<br>- Continue Unmanned Targeting Air System (UTAS) - Identify and evaluate magnetic sensors and algorithms for use on an unmanned aerial vehicle for locating a submarine.<br><br>EC: SHD-FY13-07 UNMANNED SURFACE VEHICLE (USV) PAYLOADS FOR SINGLE SORTIE MINE COUNTERMEASURES<br>- Continue Drifting Mine Neutralization Technology - Develop low-cost sensing solutions, algorithm development, and associated autonomy.<br>- Continue Mine Countermeasure (MCM) Payload Automation - Develop command and control, planning and recognition algorithms and models.<br>- Continue Single Sortie Mine Countermeasure (MCM) Detect-to-Engage Payload - Develop architecture, command and control, planning algorithms and design options for hardware.<br><br>EC: SHD-FY14-02 FULL SECTOR TORPEDO DEFENSE<br>- Initiate ATT Timeline Compression (ATTTC) - Begin algorithm development.<br>- Initiate Concept C Countermeasure - Finalize requirements definition and performance prediction.<br>- Initiate High Value Unit (HVU) Mounted Sonar - Conduct requirements studies and ship scope checks.<br><br>EC: SHD-FY14-04 ADVANCED UNDERSEA WEAPON SYSTEM (AUWS)<br>- Initiate Autonomous Threat Detection and Localization - Develop sensor architecture, algorithms and fusion methodology for autonomously detecting and tracking targets in real-time.<br>- Initiate Remote Command & Control - Develop communications protocols and algorithms to assure the exchange of messages between sensor nodes and with the weapon node, on demand.<br>- Initiate Tactical Positioning & Fire Control - Develop Advanced Undersea Weapon System (AUWS) algorithms for positioning the sensor, weapon and gateway nodes, efficiently combining intra-node information, and autonomously generating an effective weapon fire solution. | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| EC: SHD-FY14-08 TIER 3 HIGH VALUE UNIT (HVU) SELF-DEFENSE<br>- Initiate Adaptive Hypothesis-based Fire Control - Design and model fire control solutions using modern electronic support data.<br>- Initiate Advanced ESSM Guidance - Design and model guidance algorithms to increase lethality over the maximum outer self-defense kinematic envelope.<br>- Initiate Advanced Rolling Airframe Missile (RAM) Block 2 Guidance - Design and model guidance algorithms to increase lethality over the maximum inner self-defense kinematic envelope. | | | |
| ***Title:*** SEA STRIKE (STK) | 0.000 | 24.538 | 32.389 |
| ***Description:*** This R-2 Activity contains all Future Naval Capabilities (FNC) Program Enabling Capability (ECs) investments in this PE. The Sea Strike (STK) FNC pillar develops deliverable technologies that provide new capabilities in power projection and deterrence, precise and persistent offensive power, weapons, aircraft, and expeditionary warfare.<br><br>The FY14 increase was due primarily to the initiation of STK-FY13-01, STK-FY13-03, STK-FY14-01 and STK-FY14-03, and the planned ramp-up of STK-FY13-04.<br><br>***FY 2013 Plans:***<br>EC: STK-FY08-04 Next Generation Airborne Electronic Attack<br>- Complete Next Generation Airborne Electronic Attack - Develop advanced broadband, high-power active arrays, digital and photonics based beamformers and ultra wide band digital techniques generators.<br><br>EC: STK-FY08-06 Increased Capability Against Moving and Stationary Targets<br>- Complete Direct Attack Seeker Head automatic target recognition algorithm development and low cost optics enhancements.<br><br>EC: STK-FY09-03 Enhanced Weapons Technologies<br>- Complete High Speed Components - Investigate radome manufacturing methodologies to improve product through-put.<br>- Continue Counter Air Defense Improvements - Investigate materials and design concepts, and develop high temperature resin-fiber and high temperature, oxidative-exhaust resistant materials with associated design implementations.<br><br>EC: STK-FY09-05 Advanced Threat Aircraft Countermeasures<br>- Complete Countermeasures for Advanced Imaging Infrared (I2R) - Develop final techniques and advanced component designs for countermeasures to advanced imaging infrared sensors.<br>- Complete Countermeasures for millimeter wave - Bench test decoy power supply and power amplifier modules. | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| EC: STK-FY10-02 Multi-Target Track and Terminate (MTTT)<br>- Continue Multi-Target Laser Designator (MTLD) - Develop, fabricate and test advanced optical techniques to enable multiple simultaneous target designations in order to defeat multiple targets (e.g., Swarm attacks).<br><br>EC: STK-FY11-01 Strike Accelerator<br>- Continue Strike Accelerator - Develop and understand advanced airborne capability to accurately identify targets using Advanced Target Recognition.<br><br>EC: STK-FY11-02 Radar Electronic Attack Protection (REAP)<br>- Continue Identification and Defeat of EA Systems (IDEAS) - Conduct Applied Research in support of algorithm development.<br>- Continue Network "Sentric" Electronic Protection (EP) - Develop software and algorithms for electronic protection solutions.<br><br>EC: STK-FY12-01 Submarine Survivability - Electronic Warfare<br>- Continue Coherent Electronic Attack for Submarines (CEAS) - Develop electronic attack waveforms and techniques to counter advanced coastal radars.<br><br>EC: STK-FY12-02 High Energy Spectrally Beam Combined (SBC) Fiber Laser System<br>- Continue High Energy Fiber Laser System - Investigate and understand high energy laser, beam control and other technologies to enable a high energy laser weapons system.<br><br>EC: STK-FY13-02 Hostile Fire (HF) Suppression<br>- Initiate Hostile Fire Suppression System - Develop efficient, low weight, multi-band HF suppression system components and fire detection (flash tracking) algorithms.<br><br>EC: STK-FY13-04 AIM-9X Enablers (AXE)<br>- Initiate SMOKE - Design and model an advanced rocket motor, warhead, and safe-arm device for the AIM-9X Sidewinder missile. | | | |
| ***FY 2014 Plans:***<br>EC: STK-FY09-03 ENHANCED WEAPONS TECHNOLOGIES<br>- Complete Counter Air Defense Improvements - Finish materials and design concepts, and develop high temperature resin-fiber and high temperature oxidative-exhaust resistant materials with associated design implementations.<br><br>EC: STK-FY10-02 MULTI-TARGET TRACK AND TERMINATE (MTTT) | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Complete Multi-Target Laser Designation (MTLD) - Design system components to fit the Fire Scout form factor and conduct laboratory testing.<br><br>EC: STK-FY11-01 STRIKE ACCELERATOR<br>- Continue Strike Accelerator - Develop and understand advanced airborne capability to accurately identify targets using Advanced Target Recognition.<br><br>EC: STK-FY11-02 RADAR ELECTRONIC ATTACK PROTECTION (REAP)<br>- Continue Identification and Defeat of Electronic Attack Systems (IDEAS) - Develop Electronic Support and Electronic Protection algorithms and techniques to counter hostile modern jammers.<br>- Continue Network "Sentric" Electronic Protection (EP) - Develop improved software and algorithms for electronic protection solutions.<br><br>EC: STK-FY12-01 SUBMARINE SURVIVABILITY - ELECTRONIC WARFARE.<br>- Continue Coherent Electronic Attack for Submarines (CEAS) - Update the Spiral 1 System Requirements, Architecture, Implementation and Fabrication from the assessments developed with 6.2 Applied Research, with the intention of Capability Demonstration and System Acceptance Testing in FY15.<br><br>EC: STK-FY12-02 HIGH ENERGY SPECTRAL BEAM COMBINED (SBC) FIBER LASER SYSTEM<br>- Continue High Energy Fiber Laser System - Investigate and understand high energy laser, beam control and other technologies to enable a high energy laser weapons system.<br><br>EC: STK-FY13-01 LONG RANGE RADIO FREQUENCY (RF) FIND, FIX AND ID<br>- Initiate Long Range Find, Fix and ID - Develop software and algorithms to enable long range Radio Frequency (RF) localization and identification from airborne radars.<br><br>EC: STK-FY13-02 HOSTILE FIRE (HF) SUPPRESSION<br>- Continue Hostile Fire Suppression System - Develop tracking techniques to point closed loop eye-safe laser.<br><br>EC: STK-FY13-03 ANTI-SURFACE WARFARE (ASUW) WEAPON UPGRADE<br>- Initiate Anti-Surface Warfare (ASuW) Weapon Upgrade - Begin subsystem design and development.<br><br>EC: STK-FY13-04 AIM-9X ENABLERS (AXE) | | | |

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| B. Accomplishments/Planned Programs ($ in Millions) | FY 2012 | FY 2013 | FY 2014 |
|---|---|---|---|
| - Continue SMOKE - Design and model an advanced rocket motor, warhead, and safe-arm device for the AIM-9X Sidewinder missile.<br><br>EC: STK-FY14-01 PASSIVE SENSOR SURVEILLANCE (PASS)<br>- Initiate PAssive Sensor Surveillance (PASS) - Study and understand passive sensor phenomenology to enable its use for surveillance.<br><br>EC: STK-FY14-03 INTELLIGENT COLLABORATIVE ENGAGEMENT (ICE)<br>- Initiate Collaborative Electronic Attack (CEA) - Define Mission Objectives and System Architecture.<br>- Initiate Collaborative Anti-Surface Warfare Engagement (CASE) - Initiate design, development, and improvement of weapon-to-weapon communications, coupled with algorithms for limited weapon autonomy, to address the surface warfare mission area. | | | |
| **Accomplishments/Planned Programs Subtotals** | 0.000 | 162.417 | 169.710 |

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

N/A

**Remarks**

**D. Acquisition Strategy**

N/A

**E. Performance Metrics**

As discussed in Section A, there are a significant number of FNC technology products within this PE. In all cases, these technology products support the Department of the Navy FNC Program and are managed at the Office of Naval Research. All FNC investments in this PE are subjected to management oversight by 2-star chaired Integrated Product Teams (IPTs) that control the naval pillars of Sea Shield, Sea Strike, Sea Basing, Forcenet, Naval Expeditionary Maneuver Warfare, Enterprise and Platform Enablers, Power and Energy, Capable Manpower, and Force Health Protection. Each EC is aligned to a pillar and each technology product is aligned to an EC. At the lowest level, each technology product is measured against both technical and financial milestones on a monthly basis. Annually, each technology product is reviewed in depth for technical performance and development status by the Chief of Naval Research against goals that have been approved by the Navy's 3-star Technology Oversight Group (TOG). Also annually, each technology product is reviewed by its 2-star chaired pillar IPT for transition planning adequacy and transition commitment level. Products must meet TOG required transition commitment levels for S&T development to continue. Transition issues and required adjustments are reported annually by the Chief of Naval Research to the TOG, which establishes investment priorities for the FNC Program.