Exhibit R-2, PB 2010 Navy RDT&E Budget Item Justification									DATE: May 2009	
APPROPRIATION/BUDGET ACTIVITY 1319 - Research, Development, Test & Evaluation, Navy/BA 3 - Advanced Technology Development (ATD)					R-1 ITEM NOMENCLATURE PE 0603271N ELECTROMAGNETIC SYSTEMS ADVANCED TECHNOLOGY					
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	43.599	55.866	65.827						Continuing	Continuing
2913: RF SYSTEMS ADVANCED TECHNOLOGY	25.272	36.918	65.827						Continuing	Continuing
9999: CONGRESSIONAL PLUS-UPS	18.327	18.948	0.000						Continuing	Continuing

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 (Jan 2007). 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.

Activities and efforts in this Program Element (PE) address technologies critical to enabling the transformation of discrete functions to network centric warfare capabilities which simultaneously perform Radar, Electronic Warfare (EW), and Communications and Network functions across platforms through multiple, simultaneous and continuous communications/data links. The Electromagnetic Systems Advanced Technology program addresses Radio Frequency (RF) technology for Surface and Aerospace Surveillance sensors and systems, EW sensors and systems, RF Communication Systems, and Multi-Function sensor systems. The Program emphasizes near to mid-term transition opportunities by developing and demonstrating technologies supporting the Future Naval Capabilities (FNC) Program Enabling Capabilities (ECs): Long Range Detection and Tracking, Advanced Electronic Sensor Systems for Missile Defense, SATCOM Vulnerability Mitigation; Affordable Common Radar Architecture, Next Generation Countermeasures Technologies for Ship Missile Defense, Next Generation Airborne Electronic Attack, Low Cost Over the Horizon Communication, Satellite Communication (SATCOM) and Line of Sight (LOS) Apertures, Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms, and Countermeasures Technologies for Anti-Ship Missile Defense (ASMD). Within the Naval Transformational Roadmap, this investment offers affordable options for the transformational capabilities required by the Sea Shield (Theater Air and Missile Defense), Sea Strike (Persistent Intelligence, Surveillance, and Reconnaissance), and ForceNet (Communications and Networking) SeaPower 21 Naval Warfighting Pillars.

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 2008	FY 2009	FY 2010	FY 2011
Previous President's Budget	41.204	37.058	59.356	
Current BES/President's Budget	43.599	55.866	65.827	
Total Adjustments	2.395	18.808	6.471	
Congressional Program Reductions		-0.191		
Congressional Rescissions				
Total Congressional Increases		19.000		
Total Reprogrammings	3.039			
SBIR/STTR Transfer	-0.644			
Program Adjustments			6.431	
Rate/Misc Adjustments		-0.001	0.040	

Congressional Increase Details ($ in Millions)	FY 2008	FY 2009
Project: 9999, **C-BAND RADAR REPLACEMENT DEVELOPMENT**	3.868	3.989
Project: 9999, **PACIFIC AIRBORNE SURVEILLANCE AND TESTING**	14.459	14.959

Change Summary Explanation

Technical: FY 2010 reflects the realignment of the Global Positioning System (GPS) & Navigation Technology Activity from PE 0603235N because the technology development efforts are directly related to the current mission of this Program Element.

Schedule: Not applicable.

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COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
2913: RF SYSTEMS ADVANCED TECHNOLOGY	25.272	36.918	65.827						Continuing	Continuing

A. Mission Description and Budget Item Justification

This project emphasizes near to mid-term transition opportunities by developing and demonstrating technologies which enable affordable options for transformational capabilities required by the Sea Shield, Sea Strike, and ForceNet pillars. Work in this project addresses cost-effective RF technology for Surface and Aerospace Surveillance sensors and systems, EW sensors and systems, RF Communication Systems, and Multi-Function sensor systems.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
ADVANCED MULTI-FUNCTION RF TECHNOLOGY	25.272	36.918	0.000	

This effort develops, demonstrates, and transitions affordable wideband, high performance Advanced Multifunction Radio Frequency (AMRF) apertures capable of transmitting and receiving multiple, simultaneous, independent RF beams while providing reduced signature and numbers of apertures. Program activity goals include development and demonstration of multi functional RF technologies applicable to systems development for Advanced Destroyers (DD(X)), Advanced Cruisers (CG(X)), Aircraft Carriers (CVNs), and other ship classes. These technologies will provide reduced recurring costs for total system functionality; reduced number of topside antennas and support systems; reduced ship radar cross section; reduced number of unique spares and lower ship manning requirements; ability to upgrade systems and capabilities with reduced cost, time, and complexity while mitigating the risk of obsolescence; and ability to rapidly exploit technological innovation through open systems concepts. This activity also includes Multifunction Systems Technology developments that directly support the Department of Defense Joint Warfighter Science and Technology Plan and the Defense Technology Area Plans.

The objective is as follows:

Development of an affordable, open architecture Digital Array Radar for CG(X). Development, testing, and technology demonstration of communications, electronic attack, electronic surveillance, and radar

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
functions in multi-function apertures. Development of a Multi Function Electronic Warfare/Electronic Surveillance (MFEW/ES) Advanced Development Model (ADM) architecture demonstrating key ES capabilities for several simultaneous ES functions and capable of supporting additional RF functions. Conducting MFEW/ES ADM testing that satisfies DD(X) acquisition program Technology Development (TD) phase requirements to enable a smooth transition of AMRF technology to the DD(X) System Development and Demonstration (SDD) Acquisition Phase with minimal changes in system architecture. Electronic Attack (EA) Techniques maintain effective countermeasures in the face of increasingly sophisticated naval threats. The increase from FY 2008 to FY 2009 is due to initiation of Integrated Digital Apertures and Array Radar System (IDAARS) within the Integrated Topside (INTOP) Innovative Naval Prototype effort. *FY 2008 Accomplishments:* - Completed operation of the wideband multi-function Communications and EW testbed in support of multi-function system development and multi-function technology insertion and demonstration for the Advanced Multifunction Radio Frequency- Concept (AMRF-C) effort. - Completed development of a High Band array antenna capable of simultaneously supporting multiple Electronic Support Measures (ESM) surveillance functions for the (MFEW/ES ADM) providing 4 high gain high sensitivity Electronics Support Measures beams. - Completed development of a Mid Band array antenna capable of simultaneously supporting multiple ESM functions for the MFEW/ES ADM. - Completed development of back-end analog receiver equipment supporting MFEW/ES ADM. - Completed systems integration, risk reduction, and Navy critical subsystem development effort leading to demonstration of MFEW/ES ADM in a relevant environment and support MFEW/ES hardware/ component testing within the AMRF-C testbed. - Completed Shipboard EW Improvement and EA Transmitter projects to develop Electronic Warfare/ Electronic Attack capability for rapid technology insertion into DD(X) and other ship classes utilizing MFEW/ES ADM components and architecture and AMRF-C testbed technology. Demonstrated capability to support 4 beams/band transmit functions.				

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
- Completed the Shipboard Electro-Optical/Infra Red (EO/IR) Closed Loop Self-Protection effort by final at-sea demonstration of the Shipboard Integrated Electro-optic Defense System (SHIELDS) hardware which includes a Mid-Wave IR (MWIR) camera operating in the 2-5 um wavelength spectral band. - Initiated FNC EC Long Range Detection and Tracking. Captured and extended the prototype development that occurred under Advanced Electronic Sensor Systems for Missile Defense, this project delivers an affordable, open-architecture Digital Array Radar (DAR) single face Advanced Development Model (ADM). - Initiated the Next Generation Airborne Electronic Attack effort by performing a threat assessment study. - Initiated FNC Enabling Capability (EC) Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms. Developed Partial Array consisting of high efficiency non-commercial off-the-shelf (COTS) transmitter element chains using wide band-gap semiconductors, mixed signal digital, RF, microwave, millimeter wave and associated passive components, exploiting Development & Implementation (D&I) advances in high power, high efficiency digital S- and X-band microwave amplifiers to reduce cooling and prime power needs, enabling affordable radar and EA solutions for CG(X) and DD(X). Developed and demonstrated the technology for extending the digital domain further into the transmitter RF hardware, i.e., bringing the digital domain closer to the radiating element, enabling Navy systems to continue to exploit advancements in COTS computing capacity for signal generation and processing, and require the activity to only develop the combined RF/digital hardware. Targeted cost reductions to enable ubiquitous deployment of advanced radiating systems with affordable development and procurement costs. This EC takes the lead for development of efficient, high power RF digital-microwave transmitter technology by exploiting new technologies such as Wide Band Gap (WBG) semiconductors for substantial savings of prime power requirements and topside weight and moment. This provides a potential for smaller ships and reduced acquisition and life cycle costs. - Initiated H-60 Tactical Common Data Link (TCDL) project. - Initiated Low cost SATCOM-on-the-Move array for Marine Corps. - Initiated nested, coplanar array/ Modular Integrated Link Electronics System (MILES) design and integration.					

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
FY 2009 Plans: In addition to being performed here in FY 2009, the following efforts transfer to the Integrated Topside (INTOP) Innovative Naval Prototype R2 Activity in FY 2010: - Initiate Integrated Digital Apertures and Array Radar System (IDAARS), a multi-function RF topside aperture prototype covering approximately 200MHz to 22 GHz and provide the appropriate control and synergy of the functionality such that the RF functions automatically support one another providing improved operational capability. Additionally, demonstrate reductions in size, weight, and power as well as cost (both acquisition and life cycle) by reducing the number of topside apertures needed for communication, electronic warfare, and some radar functions. A critical tenet of the prototype will be the demonstration of an open architecture so that not only can different companies supply the major components such as a given receive or transmit aperture, but even down to the subarray and lower component level throughout the life cycle to ensure continuing competition for maintenance and replacement parts. - Initiate technical studies of enabling radio frequency (RF) components for submarine Satellite Communications (SATCOM) arrays. (Which is a part of the above IDAARS effort.) - Initiate SATCOM Array technical designs. (Which is a part of the above IDAARS effort.) - Initiate studies for Electronic Attack (EA) design as follow-on to Multi-Function Electronic Warfare (MFEW) capability for forward-fit and back-fit. (Which is a part of the above IDAARS effort.) - Initiate development of architecture and interfaces and their application to wide-band SATCOM communications array for submarines. (Which is a part of the above IDAARS effort.) - Initiate development of functional queue management software. (Which is a part of the above IDAARS effort.) - Initiate development of control interface software for the resource allocation manager. (Which is a part of the above IDAARS effort.) In addition to being performed here in FY 2009, the following efforts transfer to the Electronic and Electromagnetic Systems R-2 Activity in FY 2010:				

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
- Continue FNC EC Long Range Detection and Tracking. Capture and extend the prototype development that occurred under Advanced Electronic Sensor Systems for Missile Defense, this project delivers an affordable, open-architecture Digital Array Radar (DAR) single face Advanced Development Model (ADM). - Continue the Next Generation Airborne Electronic Attack. - Continue FNC EC Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms. Develop Partial Array consisting of high efficiency non-commercial off-the-shelf (COTS) transmitter element chains using wide band-gap semiconductors, mixed signal digital, RF, microwave, millimeter wave and associated passive components, exploiting Development & Implementation (D&I) advances in high power, high efficiency digital S- and X-band microwave amplifiers to reduce cooling and prime power needs, enabling affordable radar and EA solutions for CG(X) and DD(X). Develop and demonstrate the technology for extending the digital domain further into the transmitter RF hardware, i.e., bringing the digital domain closer to the radiating element, enabling Navy systems to continue to exploit advancements in COTS computing capacity for signal generation and processing, and require the activity to only develop the combined RF/digital hardware. Targeted cost reductions to enable ubiquitous deployment of advanced radiating systems with affordable development and procurement costs. This EC takes the lead for development of efficient, high power RF digital-microwave transmitter technology by exploiting new technologies such as Wide Band Gap (WBG) semiconductors for substantial savings of prime power requirements and topside weight and moment. This provides a potential for smaller ships and reduced acquisition and life cycle costs. - Continue H-60 Tactical Common Data Link (TCDL) project. - Continue Low cost SATCOM-on-the-Move array for Marine Corps. - Continue nested, coplanar array/ Modular Integrated Link Electronics System (MILES) design and integration. - Initiate the Affordable Common Radar Architecture (ACRA) effort by defining interface specifications. - Initiate the Enhanced Nulka Payload FNC effort by starting system architecture design. - Initiate the Enhanced Surface Electronic Warfare Improvement Program (SEWIP) Transmitter FNC effort by starting system architecture design and Low Voltage Gallium Arsenide (GaAs) High Power Amplifier (HPA) Monolithic Microwave Integrated Circuit (MMIC) purchases.				
ELECTRONIC AND ELECTROMAGNETIC SYSTEMS	0.000	0.000	33.105	

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
The overarching objective of this activity is to develop, test, and demonstrate communications, electronic attack (EA), electronic surveillance (ES), electronic warfare (EW), and radar functions. This activity also includes development of affordable wideband, high performance Advanced Multifunction Radio Frequency (AMRF) apertures. A portion of this PE is devoted to mid-term technology development in close concert with acquisition programs of record. The products of these efforts are expected to transition at the end of their schedule into the associated acquisition program of record. In this PE, these Future Naval Capability (FNC) Enabling Capabilities (ECs) span across Electronics, EW, Radar, and Communications technology areas. This activity also appears in PE 0602271N. For ECs receiving funding from both PE's, the PE 0602271N portion is generally focused on component design and development while the funding from this PE is focused on integration and demonstration. Effective FY 2010, resources and budget justification associated with the FNC ECs, formerly identified with the ADVANCED MULTI-FUNCTION RF TECHNOLOGY activity, are realigned into this activity. This realignment serves to better describe the full electromagnetic spectrum nature of the research initiatives and improve the tracking and justification of FNC initiatives within the budget submission. The major objectives of this activity are: a) Affordable Common Radar Architecture (ACRA) - Develop a scalable, open radar architecture that addresses affordability challenges for 5 different radars. b) Low Cost Over The Horizon (OTH) Communication, Satellite Communication (SATCOM) and Line Of Sight (LOS) Apertures - Provide a set of apertures, link electronics and programmable core terminal components that are suitable for multiple platforms. c) SATCOM Vulnerability Mitigation - Develop a diverse, multi-tier communications networking capability for Naval strike forces. d) Long Range Detection and Tracking - Ability to detect, track and identify (ID) future anti-ship ballistic missiles, advanced cruise missiles, aircraft and Unmanned Air Vehicles (UAVs).				

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
e) Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms - Develop and demonstrate affordable components in beamforming element chains for efficient S- and X-Band radar, and Electronic Attack (EA)using highly efficient digital solid state electronics components covering the RF and microwave frequencies. f) Countermeasure Technologies for Anti-Ship Missile Defense (ASMD) - Improve ship survivability by disrupting the terminal engagement phase of hostile Anti-Ship Cruise Missiles/ Anti-Ship Ballistic Missiles (ASCM/ASBM), including improvements to both onboard Surface Electronic Warfare Improvement Program (SEWIP) and offboard Nulka Radio Frequency (RF) Electronic Attack (EA) systems. g) Next Generation Countermeasure Technologies for Ship Missile Defense - Develop and demonstrate the fundamental technologies required to conduct next generation, persistent EW in support of ship, sea base, and littoral force missile defense operations in a distributed, coordinated manner across the entire battlespace. h) Next Generation Airborne Electronic Attack - Develop and demonstrate advanced capability Airborne Electronic Attack (AEA) sub-systems (e.g., broadband exciters, power amplifiers, and transmit arrays) that provide Suppression of Enemy Air Defenses (SEAD), deliver Non-Kinetic Fires, counter Integrated Air Defense Systems (IADS), and provide suppression of Command, Control & Communications (C3) links and data networks. The following are non-inclusive examples of accomplishments and plans for projects funded in this activity. *FY 2010 Plans:* Affordable Common Radar Architecture (ACRA): - Continue the Affordable Common Radar Architecture (ACRA) effort by defining interface specifications. This effort is developing a radar architecture which moves the digital conversions as close to the antenna as possible for substantial performance and supportability improvements.				

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Low Cost Over The Horizon (OTH) Communication, Satellite Communication (SATCOM) and Line Of Sight (LOS) Apertures: - Continue H-60 Tactical Common Data Link (TCDL) project. This effort develops a scalable, low cost, light weight, low drag multichannel Jam Resistant (JR) Tactical Common Data Link (TCDL) relay and networking terminal. - Continue Low cost SATCOM-on-the-Move array for Marine Corps. This effort develops a low cost, scaleable Satellite Communication (SATCOM) on-the-move communication system for both High Data Rate (HDR) and Low Data Rate (LDR) Marine Corps vehicular communications. - Continue nested, coplanar array/ Modular Integrated Link Electronics System (MILES) design and integration. This effort develops a communications array which will provide UHF line of sight (LOS) functionality and Ku-Band communications for Naval Tactical Networking (NTN). SATCOM Vulnerability Mitigation: - Initiate development of hardware and software appliqués that implement waveforms, protocols, and techniques to significantly increase the data throughput on High Frequency (HF) communications channels. - Initiate development of multi-link, Ultra High Frequency (UHF), millimeter wave, air-to-air, air to ground and SATCOM terminals for networking airborne platforms with other airborne assets. Long Range Detection and Tracking: - Continue FNC EC Long Range Detection and Tracking. Capture and extend the prototype development that occurred under Advanced Electronic Sensor Systems for Missile Defense, this project delivers an affordable, open-architecture Digital Array Radar (DAR) single face Advanced Development Model (ADM). This effort demonstrates the ability to perform simultaneous full volume radar coverage of contacts at long ranges and in dense contact environments. Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms:				

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
- Continue to develop and demonstrate affordable components in beamforming element chains for efficient S- and X-Band radar, and Electronic Attack (EA)using highly efficient digital solid state electronics components covering the RF and microwave frequencies. Countermeasure Technologies for Anti-Ship Missile Defense (ASMD): - Continue the Enhanced Nulka Payload FNC effort by starting system architecture design. This effort develops an affordable and extremely compact RF payload for the NULKA offboard decoy with an Electronically Scanned Array (ESA) transmitter, compact receiver chain, and advanced isolation materials. - Continue the Enhanced Surface Electronic Warfare Improvement Program (SEWIP) Transmitter FNC effort by starting system architecture design and Low Voltage Gallium Arsenide (GaAs) High Power Amplifier (HPA) Monolithic Microwave Integrated Circuit (MMIC) purchases. This effort develops affordable and reliable solid state transmitter technologies to engage anti-ship cruise and ballistic missile RF seekers. Next Generation Countermeasure Technologies for Ship Missile Defense: - Continue the development of technologies to demonstrate effective Electronic Warfare (EW) countermeasures for ship missile defense operations in a distributed coordinated manner across the entire battlespace. Next Generation Airborne Electronic Attack: - Continue the Next Generation Airborne Electronic Attack FNC effort by demonstrating critical sub-systems operating in the RF low- and mid-bands. This effort develops and demonstrates advanced capability Airborne Electronic Attack (AEA) sub-systems (e.g., broadband exciters, power amplifiers, and transmit arrays) that provide suppression of enemy air defenses (SEAD), deliver non-kinetic fires, counter integrated air defense systems (IADS), and provide suppression of Command, Control & Communications (C3) links and data networks.					
GLOBAL POSITIONING SYSTEM (GPS) & NAVIGATION TECHNOLOGY		0.000	0.000	4.554	

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
The overarching objective of this activity is to develop technologies that enable the development of affordable, effective and robust Position, Navigation and Timing (PNT) capabilities using either GPS systems, non-GPS navigation devices, or atomic clocks. This activity will increase the operational effectiveness of U.S. Naval units. The focus is on the mitigation of GPS electronic threats, the development of atomic clocks that possess unique long-term stability and precision, and the development of compact, low-cost, Inertial Navigation Systems (INS). Efforts identified in this R2 activity transfer from PE 0603235N in FY 2010. The major objectives of this activity are: a) GPS Anti-Jam Antennas and Receivers - Integrate and demonstrate anti-jam antennas and antenna electronics for Navy platforms for the purpose of providing precision navigation capabilities in the presence of electronic threats; to integrate and demonstrate anti-spoofer/anti-jam processors for the purpose of providing precision navigation capabilities in the presence of emergent threats. b) Precision Time and Time Transfer - Integrate and demonstrate tactical grade atomic clocks that possess unique long-term stability and precision for the purpose of providing GPS-independent precision time; to integrate and demonstrate the capability of transferring GPS-derived time via radio frequency links for the purpose of providing GPS-independent precision time. c) Non-GPS Navigation Technology - To integrate and demonstrate inertial navigation systems for the purpose of providing an alternative means of providing precision navigation for those Naval platforms which may not have GPS navigation capabilities and/or loss of GPS signals; to integrate and demonstrate a correlation navigation technique using earth maps of high precision (including bathymetric, magnetic and gravimetric data) for navigation for those Naval platforms which may not have GPS navigation capabilities and/or loss of GPS signals. The following are non-inclusive examples for projects funded in this activity.				

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
FY 2010 Plans: GPS Anti-Jam Antennas and Receivers: - Continue the Adaptive Temporal Suppression of GPS Structured Interference project. - Continue the GPS anti-spoofer antenna electronics effort using Electronic Support Measures (ESM) and tracking/location-based system. Precision Time and Time Transfer: - Continue the development of algorithms for distributed time scaling; developed architectures necessary to establish a Navy Global Coordinated Time Scale; tested the algorithms via both simulation and using actual clock data provided by the U.S. Naval Observatory (USNO). Non-GPS Navigation Technology: - Continue the development of a small, lightweight Micro-Electro-Mechanical Systems (MEMS) Accelerometer for navigation systems; and fabricated an Electro-Optic Accelerometer. - Continue the 5-cc accelerometer with the Embedded GPS Inertial (EGI) System for aircraft avionics applications. - Continue the MEMS Gyro-cluster INS for Tactical Platforms project. - Continue the Precision Celestial Navigation System (PCNS) project. - Continue the Dead Reckoning Advanced Tight Coupling (DRATC) project. - Continue the navigation grade Inertial Navigation System (INS) using fiber optic/Micro-Electronic Mechanical System (MEMS) gyros and electro-optic accelerometers. - Initiate the development of the Sonar Aided Bathymetric Navigation Technology. - Initiate the Optically Transduced MEMS Inertial Navigation System project. - Initiate the Sub-harmonic Lateral Mode MEMS Inertial Navigation System project. - Initiate the Two-Axis Gyro-compass Fiber Optic Inertial Navigation System project.				
INTEGRATED TOPSIDE (INTOP) INNOVATIVE NAVAL PROTOTYPE (INP) The overarching objective of the Integrated Topside (INTOP) Innovative Naval Prototype (INP) is to develop and demonstrate a prototype that integrates RF functions (EW, Radar, Communications,	0.000	0.000	28.168	

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

Navigation) into a common set of multi-function apertures through an architecture that is modular, scalable across all platforms, and open at the RF as well as computer and software level. The apertures are capable of providing multiple simultaneous, independent beams any one of which can perform any of the above functions.

Effective FY 2010, resources and budget justification associated with Integrated Topside (INTOP) formerly referred to as Integrated Digital Apertures and Array Radar System (IDAARS) effort are realigned from the activity titled ADVANCED MULTI-FUNCTION RF TECHNOLOGY. This realignment allows for improved description of the critical and unique application of technology, program technical initiatives, and associated resources within the INP program. IDAARS commenced in FY 2009.

The major objectives of this activity are:

a) Submarine Satellite Communication (SATCOM) Array - Develop wide-band SATCOM array capable of supporting Electronic Warfare (EW) for submarines.

b) Electronic Attack for Surface Combatants - Develop wide-band transmit array to support Electronic Attack (EA) capability and other functions for surface combatants with potential application to other platforms.

c) Architecture, Standards and Devices - Develop architecture and standards for wide-band multi-beam, multi-band arrays and below deck systems and the technology and electronic devices needed to make integrated array systems affordable.

d) Surface Combatant Communication Array - Develop wide-band surface combatant communication array capable of supporting other RF functions.

e) Resource Allocation Manager - Develop enterprise common Resource Allocation Manager.

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

f) Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW) 3 - Develop integrated RF communications and RF jammer capability that addresses electromagnetic interference (EMI) issue to enable interoperability.

The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.

FY 2010 Plans:

Submarine SATCOM Array:
- Complete technical studies of enabling radio frequency (RF) components for submarine Satellite Communication (SATCOM) arrays.
- Continue SATCOM Array technical designs.
- Initiate prototype array development.

Electronic Attack for Surface Combatants:
- Complete studies for Electronic Attack (EA) design as follow-on to Multi-Function Electronic Warfare (MFEW) capability for forward-fit and back-fit.
- Initiate design of EA capability.

Architecture, Standards and Devices:
- Continue Integrated Digital Apertures and Array Radar System (IDAARS), a multi-function RF topside aperture prototype covering approximately 200MHz to 22 GHz and provide the appropriate control and synergy of the functionality such that the RF functions automatically support one another providing improved operational capability. Additionally, demonstrate reductions in size, weight, and power as well as cost (both acquisition and life cycle) by reducing the number of topside apertures needed for communication, electronic warfare, and some radar functions. A critical tenet of the prototype will be the demonstration of an open architecture so that not only can different companies supply the major components such as a given receive or transmit aperture, but even down to the subarray and lower component level throughout the life cycle to ensure continuing competition for maintenance and replacement parts.

Exhibit R-2a, PB 2010 Navy RDT&E Project Justification			DATE: May 2009	
APPROPRIATION/BUDGET ACTIVITY 1319 - Research, Development, Test & Evaluation, Navy/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603271N ELECTROMAGNETIC SYSTEMS ADVANCED TECHNOLOGY		PROJECT NUMBER 2913	
B. Accomplishments/Planned Program ($ in Millions)	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
- Continue development of architecture and interfaces and their application to wide-band SATCOM arrays for submarines. - Initiate development of deckhouse and platform integration strategies and concepts. Surface Combatants Communications Array: - Initiate studies of array concepts. Resource Allocation Manager: - Continue development of functional queue management software. - Continue development of control interface software for the resource allocation manager.				

Exhibit R-2a, PB 2010 Navy RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 1319 - Research, Development, Test & Evaluation, Navy/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603271N ELECTROMAGNETIC SYSTEMS ADVANCED TECHNOLOGY	PROJECT NUMBER 2913

C. Other Program Funding Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
PE 0204152N/E-2 Squadrons									Continuing	Continuing
PE 0601153N/Defense Research Sciences									Continuing	Continuing
PE 0602123N/Force Protection Applied Research									Continuing	Continuing
PE 0602131M/Marine Corps Landing Force Technology									Continuing	Continuing
PE 0602235N/Common Picture Applied Research									Continuing	Continuing
PE 0602271N/ Electromagnetic Systems Applied Research									Continuing	Continuing
PE 0603123N/Force Protection Advanced Technology									Continuing	Continuing
PE 0603235N/Common Picture Advanced Technology									Continuing	Continuing
PE 0603640M/USMC Advanced Technology Demonstration (ATD)									Continuing	Continuing
PE 0604307N/Surface Combatant Combat System Engineering									Continuing	Continuing

Exhibit R-2a, PB 2010 Navy RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 1319 - Research, Development, Test & Evaluation, Navy/BA 3 - Advanced Technology Development (ATD)	R-1 ITEM NOMENCLATURE PE 0603271N ELECTROMAGNETIC SYSTEMS ADVANCED TECHNOLOGY	PROJECT NUMBER 2913

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Advanced Electronic Sensor Systems for Missile Defense and Long Range Detection and Tracking ECs are aligned to the Navy's Advanced Cruiser (CG(X)) plans and closely coordinated with Naval Sea Systems Command Integrated Warfare Systems (PEO IWS 2.0). Other performance metrics are discussed within the R-2a.

Exhibit R-2a, PB 2010 Navy RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 1319 - Research, Development, Test & Evaluation, Navy/BA 3 - Advanced Technology Development (ATD)				R-1 ITEM NOMENCLATURE PE 0603271N ELECTROMAGNETIC SYSTEMS ADVANCED TECHNOLOGY					PROJECT NUMBER 9999	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
9999: CONGRESSIONAL PLUS-UPS	18.327	18.948	0.000						Continuing	Continuing

A. Mission Description and Budget Item Justification

N/A

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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