Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Defense Advanced Research Projects Agency	DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	144.609	234.985	235.245	-	235.245	226.485	191.645	191.733	201.698	Continuing	Continuing
NET-01: *JOINT WARFARE SYSTEMS*	53.378	71.175	81.404	-	81.404	69.662	53.793	68.873	78.873	Continuing	Continuing
NET-02: *MARITIME SYSTEMS*	30.727	46.903	56.245	-	56.245	60.881	39.011	39.096	39.096	Continuing	Continuing
NET-CLS: *CLASSIFIED*	60.504	116.907	97.596	-	97.596	95.942	98.841	83.764	83.729	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Network-Centric Warfare Technology program element is budgeted in the Advanced Technology Development budget activity because it addresses high payoff opportunities to develop and rapidly mature advanced technologies and systems required for today's network-centric warfare concepts. It is imperative for the future of the U.S. forces to operate flawlessly with each other, regardless of which services and systems are involved in any particular mission. The overarching goal of this program element is to enable technologies at all levels, regardless of service component, to operate as one system.

The objective of the Joint Warfare Systems project is to create enabling technologies for seamless joint operations, from strategic planning to tactical and urban operations. Joint Warfare Systems leverage current and emerging network, robotic, and information technology and provide next generation U.S. forces with greatly expanded capability, lethality, and rapid responsiveness. Critical issues facing this project are: (1) U.S. opponents utilizing systems that are flexible, robust, and difficult to neutralize; and (2) U.S. doctrine that limits the use of firepower to lessen the impact of operations on noncombatants. These problems are magnified in urban and semi-urban areas where combatants and civilians are often collocated, and in peacekeeping operations where combatants and civilians are often indistinguishable. Meeting these challenges places a heavy burden on joint war planning. Understanding opponent networks is essential so that creative options can be developed to counter their strategies. Synchronization of air and ground operations to apply force only where needed and with specific effects is required.

The Maritime Systems project will identify, develop and rapidly mature critical advanced technologies and system concepts for the naval forces role in today's network centric warfare concept. Naval forces play an ever-increasing role in network centric warfare because of their forward deployed nature, their unique capability to operate simultaneously in the air, on the sea and under the sea and their versatile ability to provide both rapid strike and project sustained force. The technologies developed under this project will capitalize on these attributes, improve them and enable them to operate with other network centric forces.

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Defense Advanced Research Projects Agency	DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*

B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	138.361	234.985	220.099	-	220.099
Current President's Budget	144.609	234.985	235.245	-	235.245
Total Adjustments	6.248	-	15.146	-	15.146
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	9.918	-			
• SBIR/STTR Transfer	-3.670	-			
• TotalOtherAdjustments	-	-	15.146	-	15.146

Change Summary Explanation

FY 2010: Increase reflects internal below threshold reprogrammings offset by the SBIR/STTR transfer.

FY 2012: Increase reflects minor repricing of joint warfare and maritime programs, offset by reductions for Defense Efficiencies for contractor staff support and classified programs.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-01: *JOINT WARFARE SYSTEMS*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
NET-01: *JOINT WARFARE SYSTEMS*	53.378	71.175	81.404	-	81.404	69.662	53.793	68.873	78.873	Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of the Joint Warfare Systems project is to create enabling technologies for seamless joint operations, from strategic planning to tactical and urban operations. Joint Warfare Systems leverage current and emerging network, robotic, and information technology and provide next generation U.S. forces with greatly increased capability, lethality, and rapid responsiveness. Critical issues facing this project are: (1) U.S. opponents using systems that are flexible, robust, and difficult to neutralize; and (2) U.S. doctrine that limits the use of firepower to lessen the impact of operations on noncombatants. These problems are magnified in urban and semi-urban areas where combatants and civilians are often co-located, and in peacekeeping operations where combatants and civilians are often indistinguishable. Meeting these challenges places a heavy burden on joint war planning. Understanding opponent networks is essential so that creative options can be developed to counter their strategies. Synchronization of air and ground operations to apply force only where needed and with specific effects is required. This project supports all levels of the force structure including: (1) the strategic/operational level by generating targeting options against opponents' centers of gravity that have complex networked relationships; (2) the tactical/operational level by managing highly automated forces with tight coupling between air and ground platforms; and (3) the focused tactical level by developing platforms and tools, which acquire targets of opportunity and cue network-based analysis of likely enemy operations thus maximizing the effectiveness of ground forces in stability and support operations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Geospatial Exploitation (GEO)	4.127	7.516	-
Description: The Geospatial Exploitation (GEO) thrust will provide a new set of geospatial intelligence (GEOINT) products, continuously updated and maintained in a form that ensures their consistency across both product elements (digital elevation models, traditional maps, 3-D structure models, census summaries, and directories) and spatial nodes (coarse resolution country data for economic analysis to fine resolution building data for platoon-level combat operations). Techniques of interest include model-based image analysis (both object recognizers and change detectors), symbolic correlators (both temporal and spatial), and emerging cognitive methods to identify changes to objects, addresses, names, and functions of natural and human-made structures. These algorithms will be scaled to operate on data streams including full-motion video, Laser Identification Detection and Ranging (LIDAR), multi- and hyper-spectral, synthetic aperture radar (SAR), and Geographic Information Systems (GIS) in addition to conventional electro-optical (EO) geospatial imagery. GEO algorithm architectures will be explored to achieve scalability through spatial, temporal and ontological partitioning. GEO technologies are planned for transition to the National Geospatial-Intelligence Agency (NGA). Activities funded within the GEO research space include: The Urban Reasoning and Geospatial Exploitation Technology (URGENT) program is developing a 3-D urban object recognition and exploitation system that enables advanced mission planning and situation analysis capabilities for the warfighter operating in			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-01: *JOINT WARFARE SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012

urban environments. URGENT will create techniques for the rapid exploitation of EO and LIDAR sensor data at the city scale to recognize urban objects down to the soldier scale. URGENT will apply image processing technology to geospatially registered 2-D/3-D data collected from airborne and terrestrial sources, yielding precise annotations for the objects in an urban area. URGENT will also develop a 3-D reasoning engine to query object shapes, locations, and classifications for advanced geospatial exploitation capabilities.

The Geospatial Representation Integrated Dataspace (GRID) program is investigating an automated geospatial data fusion, modeling, and dissemination technology for the tactical warfighter. Geospatial registration algorithms have demonstrated success in automatically fusing geospatial data from multiple ISR sources (e.g., electro-optical, full motion video, hyperspectral, and LIDAR) and encoding the fused data as a temporally indexed volumetric model that can potentially reduce geospatial theater ISR sensor data storage requirements while enhancing image quality for exploitation. In addition, converting sensor data enables efficient delivery of geospatial information to the warfighter even with the bandwidth constraints of tactical networks. Based on the success of previous investigations, GRID is investigating a comprehensive 3-D representation of high-resolution data for a broad range of sensor data, including ISR sources as well as medical imaging and scans, common in the manufacturing process. The establishment of the GRID format as an open standard will enable revolutionary efficiencies in the storage, application, and exchange of 3-D information across myriad industries.

FY 2010 Accomplishments:

Urban Reasoning and Geospatial Exploitation Technology (URGENT)
- Developed capability for rapid retraining on one or more new geospatial areas and object classes.
- Developed interactive user environment for military geospatial exploitation.
- Began the process of transition of selected object recognition technology to a military geospatial analysis environment.

Geospatial Representation Integrated Dataspace (GRID)
- Investigated multiple implicit and explicit geometric modeling techniques and their applications in the defense, manufacturing, medical imaging, and simulation domains.

FY 2011 Plans:

Urban Reasoning and Geospatial Exploitation Technology (URGENT)
- Implement a reasoning capability that exploits knowledge from Geographic Information System (GIS) documents.
- Complete the process of transition of selected object recognition technology to a military geospatial analysis environment.

Geospatial Representation Integrated Dataspace (GRID)
- Define framework for the GRID format standard.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-01: *JOINT WARFARE SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Demonstrate the volumetric encoding of electro-optical data from tactical sensors.			
Title: Network Targeting ***Description:*** The Network Targeting program will develop advanced capabilities for a specified emitter density, operating environment, radio frequency (RF) signal location accuracy, probability of correct RF signal identification and probability of false alarm. Each phase will progressively mature the design and technologies required to achieve system performance goals and move incrementally toward an operational system. The technology is planned to transition to the Services in FY 2013. ***FY 2010 Accomplishments:*** - Developed components and software for a system. - Conducted performance validation via laboratory demonstrations in a controlled operational environment. ***FY 2011 Plans:*** - Demonstrate real-time processing on brassboard hardware. - Conduct performance validation via demonstrations in a complex operational environment. ***FY 2012 Plans:*** - Optimize and integrate algorithms with modified software radio platform. - Demonstrate networked real-time processing on a software radio platform.	12.260	12.310	7.220
Title: Legged Squad Support System (LS3) ***Description:*** The Legged Squad Support System (LS3) program will explore the development of a mission-relevant quadruped platform scaled to unburden the infantry squad and hence unburden the soldier. In current operations, soldiers carry upwards of 50lbs of equipment, in some cases over 100lbs, over long distances in terrain not always accessible by wheeled platforms that support infantry. As a result, the soldier's combat effectiveness can be compromised. The LS3 program will design and develop prototypes capable of carrying 400lbs of payload for 20 miles in 24 hours, negotiating terrain at endurance levels expected of typical squad maneuvers. LS3 will leverage technical breakthroughs of prior biologically inspired legged platform development efforts. It will develop system designs to the scale and performance adequate for infantry squad mission applications, focusing on platform, control, and human-machine interaction capabilities, as well as secondary design considerations, such as acoustic signature. Anticipated service users include the Army, Marines and Special Forces. ***FY 2010 Accomplishments:*** - Completed trade studies and initial powering, endurance, and load design estimates to narrow design options. - Began building/integrating preliminary subsystem and components for testing to prove design validity. - Modeled foot placement, stability against disturbances, self-righting, and advanced gaits.	8.776	16.083	15.452

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-01: *JOINT WARFARE SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Completed a preliminary perception sensing head for obstacle avoidance and leader tracking; performed early data collections. - Successfully completed preliminary design review. ***FY 2011 Plans:*** - Complete critical design review and prototype build plan. - Final subsystem test stand development, testing, and analysis of results to support design estimates. - Complete initial integration of controls to demonstrate walk and trot. - Integrate perception hardware. ***FY 2012 Plans:*** - Complete build phase of prototype system. - Conduct walkout and acceptance testing of system.			
Title: Chemical Analysis Sans Machinery (CASM) ***Description:*** The Chemical Analysis Sans Machinery (CASM) program will develop novel materials and fabrication methods to produce high throughput, autonomous, low cost, chemical analysis devices. This program will transition to the Services. ***FY 2010 Accomplishments:*** - Developed novel materials and technologies with unique chemical analysis properties. - Fabricated materials with high throughput for chemical analysis. - Fabricated materials for chemical analysis, amenable to low cost manufacturing. ***FY 2011 Plans:*** - Fabricate materials with more rapid response time for chemical analysis. - Fabricate materials that are more reliable and sensitive for chemical analysis. - Integrate novel materials and technologies into chemical analysis devices. ***FY 2012 Plans:*** - Test chemical analysis devices against representative levels of appropriate chemicals. - Demonstrate the utility of these devices under conditions expected during deployment. - Improve manufacturing processes to demonstrate clear path to low cost production. - Improve durability and robustness of device for increased shelf-life. - Compare effectiveness of chemical analysis devices to state-of-art technological alternatives.	9.817	8.026	13.880
Title: High Energy Liquid Laser Area Defense System (HELLADS)	-	24.000	25.630

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-01: *JOINT WARFARE SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: Building upon the achievements of the High Energy Liquid Laser Area Defense System (HELLADS) development program budgeted in DARPA PE 0602702E, Project TT-06, the goal of the HELLADS program is to develop a high-energy laser weapon system with an order of magnitude reduction in weight compared to existing laser systems. HELLADS will enable high-energy lasers (HELs) to be integrated onto tactical aircraft and will significantly increase engagement ranges compared to ground-based systems, enable high precision/low collateral damage, and rapid engagement of fleeting targets for both offensive and defensive missions. With the assistance of the U.S. Air Force, the HELLADS program will pursue the necessary analysis, coordination, and design activity for a prototype laser weapon system incorporating the HELLADS laser system into a test aircraft. DARPA will explore reductions in beam control and other subsystems that are required for the practical integration of a laser weapon into existing tactical platforms. ***FY 2011 Plans:*** - Initiate Laser Weapon System Module (LWSM) preliminary design to integrate laser, beam control, power, thermal management, and battle management systems in a flight qualifiable module. - Design suitable physical and functional aircraft interfaces for the modularize weapon system. - Initiate investigation of alternative approaches to beam control and laser integration to enable reduced size, weight, and power (SWaP) and reduced platform performance impacts. ***FY 2012 Plans:*** - Complete LWSM preliminary design. - Conduct necessary modeling and simulation for system performance and target interactions. - Coordinate other activities necessary for safe and effective operation of the prototype system on the test aircraft. - Complete critical design and initiate fabrication of LWSM subsystems including integrating structure, aircraft interfaces, beam control, and battle management subsystems to facilitate early low power demonstration of in-flight performance. - Design and assess the performance of alternative beam control approaches that reduce SWaP and enable integration with reduced platform performance penalties.			
Title: Robotic Activators and Physical Performance Improvements in Dynamic Environments (RAPPIDE)	-	-	19.222
Description: Advancements are being made in land-capable, high degree-of-freedom unmanned platforms to enable mobility over very complex terrain. Many current prototypes are inspired by biological systems and while proof-of-principle systems have or are demonstrating unprecedented mobility, limitations have emerged. Concurrently, soldier physical limitations are resulting in lower physical strength when operating at load in dismounted terrain and lower redeployment rates due to injury. The goals of the Robotic Activators and Physical Performance Improvements in Dynamic Environments (RAPPIDE) program will be to develop robust and efficient hardware components, physical performance models, and integrated prototypes for improved soldier			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-01: *JOINT WARFARE SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
performance in dynamic and complex environments. These are critical enablers for performing mission-relevant tasks in austere and remote terrain environments. Solving these technical challenges will result in high-degree-of-freedom manned/symbiotic systems that are high performance, provide longer range/endurance for soldiers, operational in multiple terrain environments, and improve the physical availability of soldiers due to mitigation of injury. This program will transition to the Army, Marines, and Special Forces. ***FY 2012 Plans:*** - Complete and review initial selection of novel hardware components. - Begin development of a physical performance model. - Investigate initial integrated concepts.			
Title: Seismic/Acoustic Vibration Imaging (SAVI) ***Description:*** The Seismic/Acoustic Vibration Imaging (SAVI) program developed the capability to locate both buried landmines and near-surface tunnels using active acoustic and seismic sources coupled with a multi-pixel laser vibrometer. These systems employed well characterized acoustic and seismic sources to stimulate the targets of interest from a remote platform. Focused acoustic sources to remotely stimulate plastic or metal antipersonnel and antitank mines and a laser vibrometer system then detects the stimulated resonant characteristic of the mines to discriminate against natural sources of clutter. The capabilities are transitioning to the Army and Marine ground forces for development and employment of operational systems. ***FY 2010 Accomplishments:*** - Completed scalable system integration for mobile buried landmine and static near surface tunnel detection. - Completed scalable system outdoor demonstration of acoustic landmine hunting and limited seismic tunnel testing. - Initiated scaled system development to improve coverage rate and standoff distance. ***FY 2011 Plans:*** - Demonstrate final scaled system for active acoustic landmine and active seismic tunnel detection with laser vibrometer.	8.733	1.000	-
Title: Multipath Exploitation Radar (MER) ***Description:*** The Multipath Exploitation Radar (MER) program will address radar deficiencies in urban operations: limited line of sight due to urban structures and excessive confusers due to multipath reflections. This program will exploit multipath bounces to detect and track moving targets beyond line-of-sight (LOS), and extend the area coverage rate of airborne sensors by a factor of six or more over physical line-of-sight limits. The urban coverage improvement will make it cost effective for airborne surveillance of an area the size of a large metropolitan area with a handful of airborne sensors. This capability will facilitate both manned and unmanned airborne Intelligence, Surveillance and Reconnaissance (ISR) and is planned to transition to the Air Force and Army.	4.000	2.240	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-01: *JOINT WARFARE SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: - Developed and validated urban target and clutter signature models accounting for non-line-of-sight (NLOS) propagation. - Developed urban tracking algorithms that predict, detect, and incorporate multipath radar returns using knowledge of the urban terrain. - Documented modeling and algorithm performance against urban collected field data. ***FY 2011 Plans:*** - Determine upper bounds on track accuracy, persistence, and target density that can be achieved using NLOS returns. - Develop system concept for persistent wide-area surveillance over large metropolitan areas using multiple platforms. - Quantify the radar hardware and processing requirements to implement MER and identify potential transition platforms. - Validate urban clutter model and tracking algorithms on urban radar data set. - Transition Multipath Exploitation Radar system to the Services.			
Title: Network Command ***Description:*** The Network Command program leveraged recent advances in network computing, simulation, and visualization to improve collaboration among physically separate command posts and lower echelons. Network Command enables warfighters to share situation information from the area of responsibility, develop coordinated battle plans, generate and compare alternate courses of action, and assess likely outcomes, without conventional group briefings. Network Command also enables warfighters to prepare for joint missions using high-fidelity, mixed-reality combat simulation and visualization technologies. The Joint Mission Rehearsal program integrated high-fidelity, mixed-reality combat simulations with situation assessment and planning tools to allow rehearsal of joint missions, prior to actual engagements. Technologies transitioned to the Army Simulation, Training & Instrumentation Command, Special Operations Command (SOCOM), and the Marine Corps Combat Development Command (MCCDC). ***FY 2010 Accomplishments:*** - Designed a game-based mission rehearsal environment that supports real-time learning assessment. - Demonstrated learning in a simulated urban training environment suitable for mission rehearsal.	2.665	-	-
Title: Mobile Intelligent Sensors (MIS) ***Description:*** There has been continuing interest in exploiting new legged, wheeled, and tracked robots to create "robot-enabled sensors" that are capable of sensing, moving, and self-organizing into a viable network for reliable data exfiltration. The Mobile Intelligent Sensors (MIS) program and the Remote Detection of Suspicious Vehicles (RDSV) program developed such advanced sensor, exploitation, networking, and battle management capabilities for joint dismounted forces. These nodes have a sufficient level of embedded intelligence so that they can identify, learn, adapt, and traverse through or under small openings and	1.000	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-01: *JOINT WARFARE SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
circumnavigate barriers larger than themselves, yet are capable of carrying an operationally-meaningful day/night sensor payload. Technologies transitioned to the Army, Special Operations Command, and the Marine Corps. ***FY 2010 Accomplishments:*** Mobile Intelligent Sensors (MIS) - Developed miniaturized sensor concepts meeting size, weight and power constraints and explored signal processing approaches. Remote Detection of Suspicious Vehicles (RDSV) - Conducted multiple field Army test and evaluation experiments to validate system performance, concept of operations, and reliability. - Transitioned RDSV to the Army and Marine Corps.			
Title: Human-carried Explosive Detection Stand-off System (HEDSS) ***Description:*** Insurgent and terrorist elements are increasingly relying on human carried explosives because they are nearly impossible to visibly detect. The goal of the Human-carried Explosive Detection Stand-off System (HEDSS) program was to develop a system that rapidly and automatically identifies human-carried explosives (HCEs) at stand-off ranges. While alternative technologies exist for HCE detection, they necessitate close-in sensing, are expensive and require extended processing times. Successful development of a HEDSS could provide reliable protection for deployed forces from suicide bombers by allowing enough time and space to interdict bombers before they cause maximum damage. The technology transitioned to the Army, Air Force and Marines. ***FY 2010 Accomplishments:*** - Completed development of processing software, and performed system integration.	2.000	-	-
Accomplishments/Planned Programs Subtotals	53.378	71.175	81.404

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Specific programmatic performance metrics are listed above in the program accomplishments and plans section.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-02: *MARITIME SYSTEMS*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
NET-02: *MARITIME SYSTEMS*	30.727	46.903	56.245	-	56.245	60.881	39.011	39.096	39.096	Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of the Maritime Systems project is to identify, develop and rapidly mature critical advanced technologies and system concepts for the naval forces' role in today's network centric warfare concept. Improvements in communications between and among submarines, surface ships and naval aircraft have allowed these forces to operate seamlessly with each other and with other Service's network centric systems. Naval forces will play an ever-increasing role in network centric warfare because of their forward deployed nature, their unique capability to operate simultaneously in the air, on the sea and under the sea and their versatile ability to provide both rapid strike and project-sustained force. The technologies developed under this project will capitalize on these attributes, improve them and enable them to operate with other network centric forces.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Blue Laser for Submarine Laser Communications (SLC)	10.025	23.550	12.100

Description: The Blue Laser for Submarine Laser Communications (SLC) program will develop the critical laser technology necessary to support the requirements for Non-Acoustic Anti-Submarine Warfare (NAASW), mine detection, and SLC. This program will develop the world's first wall-plug efficient laser that operates at an optimal water transmission band of open ocean water and at the wavelength of a Cesium Atomic Line Filter and will enable duplex communications for the submarine at speeds and depths. A Memorandum of Agreement (MOA) was signed among DARPA; Commander, Submarine Forces (COMSUBFOR); Deputy Chief of Naval Operations for Integration of Capabilities and Resources (N8); and Program Executive Officer, Command, Control, Communications, Computers and Intelligence (PEO C4I). The MOA establishes a joint program to conduct a demonstration of SLC technology during a recognized fleet exercise in FY 2012. Additionally, there is a pressing need for improved ASW capabilities in the current operating environment, particularly in shallow water and littoral areas of operations. This program will demonstrate significant improvements to Lidar hull detection depths during daylight conditions that meet Navy requirements. The Blue Laser technology is planned for transition to the Navy.

FY 2010 Accomplishments:
- Completed design, built, and tested the breadboard blue solid state laser.
- Demonstrated laser/filter compatibility in a laboratory environment.
- Successfully built and tested a blue solid-state laser and atomic line filter for the breadboard modules.

FY 2011 Plans:
- Initiate developments of the laser brassboard modules and Cesium Atomic Line Filter receivers.
- Test airborne and submarine based brassboard transmitters for wavelength, energy per pulse, repetition rate, and beam quality.
- Integrate the second gimbal and laser anamorphic zoom; test with the receiver subsystem in the lab.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-02: *MARITIME SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Develop the data recording and field calibration systems and the Low Probability of Intercept (LPI) receiver. - Complete demonstration of High Pulse Repetition Rate Blue Laser for Non-Acoustic Anti-Submarine Warfare laser identification detection and ranging applications. - Develop and pressure test the submarine transmitter canisters, test receiver canisters and develop fairings and electrical cabling. - Develop the aircraft installation, fabrications, and install aircraft modifications. - Conduct test planning and laser safety planning and reviews. ***FY 2012 Plans:*** - Install aircraft and submarine transceiver systems, and flight and water test, respectively. - Fly end-to-end system test and conduct engineering testing on demonstration system. - Investigate submarine hull detection using blue laser technology.			
Title: Distributed Agile Submarine Hunting (DASH) ***Description:*** *Formerly Deep Sea Operations (DSOP) The Distributed Agile Submarine Hunting (DASH) program goal is to counter the asymmetric diesel-electric submarine threat through the development of advanced standoff sensing from unmanned systems. Through a scalable number of collaborative sensor platforms that use multiple sensing modalities, the program will demonstrate system solutions to detect and localize submarines over large areas in both shallow and deep water environments. Initial efforts will focus on identifying the best detection methods leveraged from state-of-the-art sensors and new physical and operational insights. From this work, a prototype system will evolve through at-sea testing and sensor integration. The program will achieve breakthrough technology for long-range detection and classification, communications, energy management, sensor and platform integration, and robust semi-autonomous processing and control for distributed sensing platforms. This program will transition to the Navy. ***FY 2010 Accomplishments:*** - Conducted simulation and trade space analysis of various system architectures. - Conducted at-sea data collection supporting processing development and technology feasibility assessment. - Initiated design of deep ocean sub-system architectures. ***FY 2011 Plans:*** - Initiate designs of multiple configurable systems. - Initiate development of key deep ocean subsystems and conduct any necessary in water testing. - Collect additional signature and environmental data needed to support technology designs.	6.000	12.387	35.145

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-02: *MARITIME SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Conduct capability-based assessment to finalize requirements and assess cost-effectiveness. - Conduct trade studies to investigate feasibility of incorporating other sensing modalities employed by UAVs. ***FY 2012 Plans:*** - Complete development of key deep ocean sensing subsystem components. - Complete in-water testing of key deep ocean sensing subsystem components. - Begin integration of deep ocean sensing system for initial capability demonstration. - Explore various sensing modalities and sensors to determine the system architecture to incorporate shallow-water sensing capabilities. - Complete overall system design and test sensors in realistic ocean environments.			
Title: Unmanned/Minimally-manned Underwater Vehicle (UMUV) ***Description:*** Increasing requirements for missions in shallow littoral waters have created a need for a survivable and cost-effective capability to perform intelligence surveillance and reconnaissance, antisubmarine warfare, special operations forces, and other missions in the littorals. Today we risk manned submarines in waters that are shallower than the length of our hulls and we pit these high value assets against diesel electric submarines that in some cases pose an overmatching threat against our systems in these shallow waters. The Unmanned/Minimally-manned Underwater Vehicle (UMUV) program will develop a vehicle specifically designed to operate in the littoral battlespace with the capability of performing littoral missions that span a wide range of complexity and can be performed with a small manned crew or autonomously (ie, unmanned) depending upon mission requirements. The UMUV will have the autonomy, range and endurance to drive to the fight from a safe basing location, will be capable of carrying the full range of payloads that are needed to support operational needs in littoral waters, and will provide the capability to perform missions where risk to personnel limits our willingness to execute these missions. The program will explore low-cost derivatives of commercial underwater vehicles, the integration of advanced communication and sensor technologies, and the teaming of the UMUV with manned systems. The UMUV program will transition to the Navy. ***FY 2012 Plans:*** - Perform technology trades to address key vehicle capabilities. - Develop concept of operations. - Initiate development of enabling technologies. - Initiate system conceptual design.	-	-	9.000
Title: Tango Bravo ***Description:*** Based on the results of the DARPA/Navy Submarine Design Study, the Tango Bravo technology demonstration program is exploring design options for a reduced-size submarine with equivalent capability of the VIRGINIA Class submarine.	5.804	1.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-02: *MARITIME SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
The implicit goal of this program is to reduce platform infrastructure and, ultimately, the cost of future design and production of submarines. The program is a collaborative effort to overcome selected technological barriers that are judged to have a significant impact on submarine platform and infrastructure cost. DARPA and the Navy jointly formulated technical objectives for critical technology demonstrations in: 1) shaftless propulsion, 2) external weapons stowage and launch, 3) conformal alternatives to the existing spherical sonar array, 4) radical ship infrastructure reduction technologies that eliminate or substantially simplify hull, mechanical and electrical systems, and 5) automated attack center technologies to reduce crew manning. A Memorandum of Agreement (MOA) establishing joint DARPA/Navy funding for the Tango Bravo program was executed in September 2004. Anticipating success of shaftless propulsion technologies demonstrated in the Tango Bravo program, DARPA and the U.S. Navy collaborated in 2008 with the goal of designing, building, and testing a large scale Submarine Shaftless Stern Demonstrator (S3D) to characterize and mitigate risks associated with ship integration into a next generation submarine propulsion option. The S3D program focused on full-ship concept studies supported by Tango Bravo Shaftless Propulsion technical risk reduction activities. Elements of the Tango Bravo program began transition to the Navy in FY 2009. ***FY 2010 Accomplishments:*** - Completed Shaftless Propulsion demonstrator assembly. - Completed Shaftless Propulsion technical risk reduction integration tasks on S3D. - Completed cyclic testing of the X-Planes electrical actuator and concluded the Electric Actuation project (Radical Ship Infrastructure Reduction). ***FY 2011 Plans:*** - Complete Shaftless Propulsion integrated system testing (in-air, full load motor testing). - Complete Shaftless Propulsion in-water acoustic and endurance testing. - Complete Shaftless Propulsion demonstrator test results analysis and modeling validation/updates.			
Title: Thermal Management System for Ship Decks (TMD) ***Description:*** It is anticipated that the high engine exhaust temperatures from the next generation of Vertical Take Off and Landing (VTOL) aircraft deployed on Navy ships will dramatically reduce the life of both the deck structure and the non-skid surfaces. The Thermal Management System for Ship Decks (TMD) will address this problem by demonstrating a heat distribution system with an integrated thermally stable non-skid coating. Upon satisfactory completion of the development and certification of the design, the TMD will be transitioned to the Navy for integration into amphibious assault ships. ***FY 2010 Accomplishments:***	3.500	4.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-02: *MARITIME SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Initiated the design and development of scaled modular passively cooled thermal management system. ***FY 2011 Plans:*** - Conduct assessment of thermo physical properties of non-skid coatings and develop thermally resistant non-skid coating. - Complete development, construction and evaluation of a small-scale, non-skid, coated, passively cooled thermal management system.			
Title: Persistent Ocean Surveillance (POS) ***Description:*** The Persistent Ocean Surveillance (POS) program combines geolocation techniques such as global positioning systems, with station keeping and intra-sensor communication technologies, to provide long-term ocean environment sensing buoys. Application of these technologies with state-of-the-art undersea warfare sensors will result in a floating field of smart sensors capable of observing the undersea environment in an area, including the presence of submarines and other undersea vehicles. A range of technologies were considered, including those that rely on the local environment (such as wind, ocean waves, solar energy, temperature differentials, etc.) for their power, miniature geolocation technologies, and technologies for sensor data storage, transmission, and intra-field communications. The Renewable At-Sea Power program focuses on efficient energy capture from the environment in order to achieve capability for fully renewable power at sea. Technology from this program will be available for transition to the Navy. ***FY 2010 Accomplishments:*** - Completed numerical model of system performance and conducted trade studies to evaluate several design alternatives. - Built instrumented platform to test improved endurance and survivability in high sea conditions. - Conducted at-sea testing to validate performance of technologies and system models. ***FY 2011 Plans:*** - Complete design, fabrication and assembly of instrumented prototype platform. - Integrate power take-off device with instrumented prototype platform. - Conduct at-sea testing of instrumented platform. - Perform modeling and analyses of near-surface vehicle docking concepts.	1.850	1.500	-
Title: River Eye ***Description:*** Early entry maritime forces need maps of morphology, water depths, and currents in complex riverine/estuarine environments for mission planning and execution. This information is critical for route planning, sensor placement, rendezvous determination, vulnerability assessments, and determining objective assault engagement/disengagement strategies. For uncharted and/or denied areas, present methods are inadequate for obtaining this necessary information. Reliable remote	3.025	4.466	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-02: *MARITIME SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
sensing methods that produce bathymetry and current water data in waters that are sediment laden (bottom not visible) and/ or sheltered (swell and significant wind waves are not likely) do not exist. The River Eye effort provided a new capability to predict or assess, in real time, river and estuary conditions that enable special operations mission planning and execution. New techniques were developed to indirectly determine current speed and direction by remotely sensing advection of scene features. Using advanced modeling techniques, indirectly sensed current data provided bathymetry data. Forward circulation models used the bathymetry data to predict future currents and water heights in a mission planning decision support tool. An initial set of algorithms and processes transitioned to the Navy and National Geospatial-Intelligence Agency in FY 2010; in FY 2011 the algorithms will be extended to enable night-time capability, and will transition to the Navy and National Geospatial-Intelligence Agency. ***FY 2010 Accomplishments:*** - Improved the automation of the current extraction algorithms to handle clouds and moving objects in the time series data. - Developed a variable grid size to improve current resolution. - Developed capability to identify shoals. - Applied inverse model to new physical environments and improved the efficiency of the model. - Demonstrated the inverse model's capability to estimate bathymetry for a new location having an unknown environment. - Transitioned River Eye current and bathymetry algorithms to the Navy and National Geospatial-Intelligence Agency. ***FY 2011 Plans:*** - Develop current and bathymetry algorithms for use with infrared (IR) image data, leading to a day / night capability. - Collect IR data on rivers and estuaries for testing and evaluation of the algorithms. - Develop IR sensor payload prototype for a small tactical unmanned air vehicle (TUAV).			
Title: Maritime Persistent Surveillance and Awareness (MPSA) ***Description:*** The Maritime Persistent Surveillance and Awareness (MPSA) program developed an extensible battle management automation capability to provide persistent surveillance and situational awareness to protect naval forces against overwhelming threats. MPSA used layered and distributed sensing, and added data from all sources for the non-traditional areas of infrastructure, socio-political developments and economic indicators. These systems enable timely and coordinated decision-making and vastly improved situational awareness under uncertainty for naval commanders. MPSA enables intelligent deployment of sensors and network infrastructures to protect sea-based assets through effective cross-platform and multi-mission fusion and resource management with focus on stand-off and elusive threats. MPSA departed from previous approaches in assessing the operational environment in that it will not rely solely upon military indicators, but also expanded understanding	0.523	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-02: *MARITIME SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
to include national infrastructure, socio-political, and economic indicators to better assess trends and threat development. The program is transitioning to the Navy. ***FY 2010 Accomplishments:*** - Analyzed maritime and littoral sensor systems and developed an architectural approach to combining them into an effective Intelligence, Surveillance and Reconnaissance/Reconnaissance, Surveillance and Target Acquisition ISR/RSTA system.			
Accomplishments/Planned Programs Subtotals	30.727	46.903	56.245

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Specific programmatic performance metrics are listed above in the program accomplishments and plans section.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603766E: *NETWORK-CENTRIC WARFARE TECHNOLOGY*	PROJECT NET-CLS: *CLASSIFIED*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
NET-CLS: *CLASSIFIED*	60.504	116.907	97.596	-	97.596	95.942	98.841	83.764	83.729	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds classified DARPA programs that are reported in accordance with Title 10, United States Code, Section 119(a)(1) in the Special Access Program Annual Report to Congress.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Classified DARPA Program	60.504	116.907	97.596
Description: This project funds Classified DARPA Programs. Details of this submission are classified. ***FY 2010 Accomplishments:*** Details will be provided under separate cover. ***FY 2011 Plans:*** Details will be provided under separate cover. ***FY 2012 Plans:*** Details will be provided under separate cover.			
Accomplishments/Planned Programs Subtotals	60.504	116.907	97.596

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Details will be provided under separate cover.