Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Defense Advanced Research Projects Agency										DATE: February 2012	

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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
Total Program Element	219.185	208.503	236.883	-	236.883	245.684	242.142	232.651	242.378	Continuing	Continuing
NET-01: *JOINT WARFARE SYSTEMS*	61.875	61.087	68.593	-	68.593	70.793	73.873	69.217	71.312	Continuing	Continuing
NET-02: *MARITIME SYSTEMS*	41.839	49.704	54.250	-	54.250	57.011	53.096	39.096	40.535	Continuing	Continuing
NET-CLS: *CLASSIFIED*	115.471	97.712	114.040	-	114.040	117.880	115.173	124.338	130.531	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 2013 Defense Advanced Research Projects Agency			DATE: February 2012		
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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Previous President's Budget	234.985	235.245	226.485	-	226.485
Current President's Budget	219.185	208.503	236.883	-	236.883
Total Adjustments	-15.800	-26.742	10.398	-	10.398
• Congressional General Reductions	-1.159	-			
• Congressional Directed Reductions	-7.000	-26.742			
• Congressional Rescissions	-3.973	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	5.500	-			
• Reprogrammings	-3.300	-			
• SBIR/STTR Transfer	-5.868	-			
• TotalOtherAdjustments	-	-	10.398	-	10.398

Change Summary Explanation

FY 2011: Decrease reflects reductions for the Section 8117 Economic Adjustment, unsustained growth, internal below threshold reprogrammings, rescissions and the SBIR/STTR transfer.

FY 2012: Decrease reflects reductions for unsustained growth and reduction to new starts.

FY 2013: Increase reflects minor repricing.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Defense Advanced Research Projects Agency		DATE: February 2012								

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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
NET-01: *JOINT WARFARE SYSTEMS*	61.875	61.087	68.593	-	68.593	70.793	73.873	69.217	71.312	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 2011	FY 2012	FY 2013
Title: High Energy Liquid Laser Area Defense System (HELLADS) **Description:** This program builds upon the past achievements of the High Energy Liquid Laser Area Defense System (HELLADS) development program and the Aero-Adaptive Aero-Optic Beam Control (ABC) program, budgeted in DARPA PE 0602702E, Project TT-06. The goal of the HELLADS program is to develop a high-energy laser weapon system that will provide 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, in addition to enabling high precision/low collateral damage and rapid engagement of fleeting targets for both offensive and defensive missions. Advancements in beam control and other subsystems that are required for the practical integration of a laser weapon into existing tactical platforms will be explored. With the assistance of the Services, the HELLADS program will pursue the necessary analysis, coordination, and design activity for a prototype laser weapon system incorporating the HELLADS laser system and the ABC turret into air, ground, or sea-based tactical vehicles. **FY 2011 Accomplishments:** - Initiated investigation of alternative approaches to beam control and laser integration to enable reduced size, weight, and power (SWaP) as well as reduced platform performance impacts.	15.175	25.130	40.962

Exhibit R-2A, RDT&E Project Justification: PB 2013 Defense Advanced Research Projects Agency		DATE: February 2012
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 2011	FY 2012	FY 2013
- Conducted initial modeling and simulation for system performance and target interactions. *FY 2012 Plans:* - Initiate laser weapon system module preliminary design to integrate laser, beam control, power, thermal management, and battle management systems in a flight-qualifiable package. - Design suitable physical and functional platform interfaces for the modularized weapon system. - Coordinate other activities necessary for safe and effective operation of the prototype system on the test platform. *FY 2013 Plans:* - Complete critical design and initiate fabrication of laser weapon module's subsystems including integrating structure, platform interfaces, beam control, and battle management subsystems to facilitate early low power demonstration of tactical performance.			
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 2011 Accomplishments:* - Completed critical design review and prototype build plan. - Conducted final subsystem test stand development, testing, and analysis of results to support design estimates. - Completed initial integration of controls to demonstrate walk and trot. - Integrated and tested initial perception components in a preliminary perception head system. *FY 2012 Plans:* - Conduct walkout and acceptance testing of system. - Integrate perception and control techniques into the platform to facilitate the use of autonomy. - Conduct trades and select heavy fuel engine for system upgrade. *FY 2013 Plans:* - Complete build of prototype systems resulting in two standard systems and one that utilizes a heavy fueled engine option.	16.083	18.052	11.231

Exhibit R-2A, RDT&E Project Justification: PB 2013 Defense Advanced Research Projects Agency		DATE: February 2012
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 2011**	**FY 2012**	**FY 2013**
- Perform experiments to assess the mobility and perception capabilities of the platform from a technology standpoint. - Complete technical and operational assessments with the U.S. Marine Corps to evaluate the abilities of the LS3 platform within mission objectives and applied to the LS3 mission profile.			
Title: Robotics Olympics* *Description:* *Formerly Robotic Activators and Physical Performance Improvements in Dynamic Environments (RAPPIDE) 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. Advanced capabilities in perception, control, and physical capability/coordination are needed to work autonomously in human environments. These are critical enablers for performing mission-relevant tasks in austere and remote regions, partially-destroyed roads, high-threat anti-access/area denied environments, rubble-filled areas, and providing greater range/endurance for soldiers, platforms, and personnel. The Robotics Olympics program will boost innovation in autonomous systems and expand platform utility through enhanced actuation, energy density, perception, locomotion, agile reconfiguration, and design efficiency. Program thrusts are centered on a progressive regimen of physical problem solving, real-time team oriented tasks, and dynamic adaptation designed to build "machine trust", especially when integrated with humans in a variety of operational environments. The Robotics Olympics program consists of a series of Olympic and military obstacle course style challenge events that will focus on technology solutions to demonstrate and test robot athleticism for human capabilities. Robotics Olympics events will drive advances in power systems, agility and speed, precision in perception tied to platform coordination, dexterity, and impulsive power. Program objectives focus on regenerative technologies to expand mobility and extend endurance of unmanned platforms, advanced tactile and manipulation capabilities, and tools for cost effective test, build, and validation of autonomous technology. The effort is also aimed at inspiring and promoting Science Technology and Mathematics (STEM) initiatives. Anticipated Service users include the Army, Marines, and Special Forces. *FY 2012 Plans:* - Develop online outreach support for the Robotics Olympics challenge. - Conduct DoD and industry baseline assessment. - Initiate development of specific challenge events, including methodology, metrics, and parameters. *FY 2013 Plans:* - Coordinate funded prizes and support for the Robotics Olympics Challenge.	-	5.885	8.200

Exhibit R-2A, RDT&E Project Justification: PB 2013 Defense Advanced Research Projects Agency		DATE: February 2012
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 2011	FY 2012	FY 2013
- Define Robotics Olympics event performance and test criteria.			
Title: Counter Laser Technologies	-	-	4.100
Description: The goal of the Counter Laser Technologies program is to develop a suite of technologies to increase the survivability of United States weapons platforms when encountering a high energy laser attack. Laser countermeasures include systems and materials for detection and warning, material treatments to harden vulnerable surfaces, computer models to plan mission engagements to favor U.S. system survivability when under high energy laser attack, and techniques to degrade or destroy the offending laser weapon. The High Energy Laser (HEL) lethality of concern in this program is apart from on-going efforts within the Services for sensor or eye protection from laser illumination. Counter Laser Technologies addresses the HEL's ability to deposit energy on the weapon or platform to melt through, fracture, or weaken the body, thereby disabling or destroying it. This effort will initially focus on characterizing the vulnerability mechanisms of a candidate set of weapons and platforms, developing warning systems to rapidly determine the attributes of the inbound threat (vector of origin, wavelength, power, format), and developing material solutions (skin treatments, material hardening methods). Additional effort will focus on ways to proactively degrade or destroy offending laser performance by altering the laser's internal optics or by modifying the laser's line of sight to the target. Technologies from this program will transition to platform and weapon system developers in all Services. *FY 2013 Plans:* - Assess vulnerability mechanisms for a candidate set of U.S. weapons and platforms. - Initiate development of material treatments and sensor systems to enhance platform situational awareness of laser attack. - Initiate laser engagement modeling effort to advise development of material solutions and tactics to survive high energy laser attack.			
Title: Battlefield Illusion	-	-	4.100
Description: This program will develop methods and technologies to enable our forces to manage the adversary's sensory perception to confuse, delay, inhibit, or misdirect their actions in the highly dynamic, close-range, visual/acoustic-dominated environment. The current operational art of human-sensory battlefield deception is largely an ad-hoc practice; advancements in the understanding of how humans use their brains to process sensory inputs will inform the development of techniques and systems in the auditory and visual regimes to provide tactical advantage for our forces, and provide technology tools for incorporation into the design of battlefield systems. This interdisciplinary effort will develop methodologies based on human cognitive insights and investigations, and apply those methodologies to develop, integrate, demonstrate and assess the operational effectiveness of advanced human-deceptive technologies on military ground, sea, and airborne systems. Technologies from this program are anticipated to transition to the Services.			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Defense Advanced Research Projects Agency		DATE: February 2012
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 2011	FY 2012	FY 2013
FY 2013 Plans: - Investigate novel technologies to apply to the audio and visual deception regimes, and assess their applicability to an operationally-relevant demonstration of value, both in the battlefield and as a design tool. - Develop and demonstrate the effectiveness of deceptive techniques and technologies against adversaries in the visual and auditory regimes; quantify the results in operationally relevant terms.			
Title: Network Targeting ***Description:*** The Network Targeting program will develop advanced capabilities for a specified emitter density, operating environment, radio frequency (RF) signal geo-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 2011 Accomplishments:*** - Demonstrated real-time processing on brassboard hardware. - Conducted 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.	12.310	7.220	-
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 2011 Accomplishments:*** - Fabricated materials with more rapid response time for chemical analysis. - Fabricated materials that are more reliable and sensitive for chemical analysis. - Integrated novel materials and technologies into chemical analysis devices. ***FY 2012 Plans:*** - Test chemical analysis devices against representative levels of appropriate chemicals. - Improve manufacturing processes to demonstrate clear path to low cost production. - Improve durability and robustness of device for increased shelf-life.	7.551	4.800	-
Title: Geospatial Exploitation (GEO)	7.516	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Defense Advanced Research Projects Agency		DATE: February 2012
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 2011	FY 2012	FY 2013
Description: The Geospatial Exploitation (GEO) thrust explored 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). GEO algorithm architectures were 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 developed a 3-D urban object recognition and exploitation system that enabled advanced mission planning and situation analysis capabilities for the warfighter operating in urban environments. URGENT created techniques for the rapid exploitation of EO and LIDAR sensor data at the city scale to recognize urban objects down to the soldier scale. The Geospatial Representation Integrated Dataspace (GRID) program investigated 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 Intelligence, Surveillance and Reconnaissance (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. *FY 2011 Accomplishments:* Urban Reasoning and Geospatial Exploitation Technology (URGENT) - Implemented a reasoning capability that exploits knowledge from Geographic Information System (GIS) documents. - Completed the process of transition of selected object recognition technology to a military geospatial analysis environment. Geospatial Representation Integrated Dataspace (GRID) - Defined framework for the GRID format standard. - Demonstrated the volumetric encoding of electro-optical data from tactical sensors.			
Title: Multipath Exploitation Radar (MER) *Description:* The Multipath Exploitation Radar (MER) program addressed radar deficiencies in urban operations: limited line of sight due to urban structures and excessive "confusers" due to multipath reflections. This program exploited multipath bounces to detect and track moving targets beyond non-line-of-sight (NLOS) and extended the area coverage rate of airborne sensors by a factor of six or more over physical line-of-sight limits. This capability has been transitioned to the Air Force and Army. *FY 2011 Accomplishments:*	2.240	-	-

Exhibit R-2A, **RDT&E Project Justification:** PB 2013 Defense Advanced Research Projects Agency		**DATE:** February 2012
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 2011**	**FY 2012**	**FY 2013**
- Determined upper bounds for track accuracy, persistence, and target density that can be achieved using NLOS returns. - Developed system concept for persistent wide-area surveillance over large metropolitan areas using multiple platforms. - Quantified the radar hardware and processing requirements to implement MER and identified potential transition platforms. - Validated urban clutter model and tracking algorithms on urban radar data set. - Transitioned Multipath Exploitation Radar system technology to the Services.			
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. The capabilities have transitioned to the U.S. Army for development and employment of operational systems. **FY 2011 Accomplishments:** - Demonstrated final scaled system for active acoustic landmine and active seismic tunnel detection with laser vibrometer. - Transitioned system to the U.S. Army to support extended field trials and performance characterization against varied terrain and target types.	1.000	-	-
Accomplishments/Planned Programs Subtotals	61.875	61.087	68.593

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 2013 Defense Advanced Research Projects Agency									DATE: February 2012	

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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
NET-02: *MARITIME SYSTEMS*	41.839	49.704	54.250	-	54.250	57.011	53.096	39.096	40.535	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 2011	FY 2012	FY 2013
Title: Distributed Agile Submarine Hunting (DASH)	12.387	37.995	43.000

Description: The diesel-electric submarine is an asymmetric threat in terms of its cost and consequential growth in numbers relative to our legacy maritime platforms. In addition, these submarines have trended toward lower acoustic signature levels, and have grown in lethality. The Distributed Agile Submarine Hunting (DASH) program intends to reverse the asymmetric advantage of this threat through the development of advanced standoff sensing from unmanned systems. Deep ocean sonar nodes will operate at significant depths in open ocean areas to achieve large fields of view to detect submarines overhead. Each deep node is the maritime equivalent of a satellite, and is referred to as a subullite. The significant field of view, along with the advantage of low-noise phenomena at extreme depths will permit a scalable number of collaborative sensor platforms to detect and track submarines over large areas. For the vast shallow continental shelf areas, the program similarly adopts distributed mobile sensors, but instead leverages insights in non-acoustic sensing from above. The effort is highly focused on achieving new detection modalities with sufficient low power, weight, and size, to enable UAV implementations. 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, prototype systems 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 semiautonomous processing and control for distributed sensing platforms. This program will transition to the Navy.

FY 2011 Accomplishments:
- Initiated designs of multiple configurable sonar systems.
- Initiated development of key deep ocean subsystems.
- Conducted in-water measurements to assess the feasibility of advanced sensor and communication concepts.
- Collected signature and environmental data needed to support technology designs.
- Demonstrated feasibility of non-traditional active sonar concept on at-sea data and provided this concept to the Navy.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Defense Advanced Research Projects Agency		DATE: February 2012
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 2011	FY 2012	FY 2013
- Initiated trade studies to investigate non-acoustic sensing approaches for UAV-based Antisubmarine Warfare (ASW) in shallow water. *FY 2012 Plans:* - Complete in-water feasibility measurements using key deep-ocean sensing subsystems. - Complete designs for distributed (multi-node) deep-ocean system prototypes. - Begin integration of deep-ocean sensing and communication subsystems for initial capability demonstration of a single node. - Conduct testing of single node prototypes (sensor/communications) in realistic ocean environments. - Demonstrate non-traditional active sonar concept on operationally relevant data and develop a transition plan with the Navy. - Complete non-acoustic sensor and system studies to guide development trajectories for UAV-based ASW. - Initiate non-acoustic sensor designs for UAV-based ASW. - Initiate on-going data collections for non-acoustic ASW effort. - Assess performance of candidate non-acoustic ASW sensors by analysis of collected data. *FY 2013 Plans:* - Integrate multiple sonar nodes into a system prototype scalable to relevant areas and duration for deep-ocean surveillance. - Initiate planning for the demonstration of a multi-node system prototype in a realistic environment. - Complete non-acoustic signature discovery and assessment. - Begin development of non-acoustic sensors tailored to discovered signatures. - Conduct trade analysis for UAV-based non-acoustic ASW system designs to produce preliminary system designs.			
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 (i.e., 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.	-	5.500	3.250

Exhibit R-2A, RDT&E Project Justification: PB 2013 Defense Advanced Research Projects Agency		DATE: February 2012
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 2011	FY 2012	FY 2013
FY 2012 Plans: - Perform technology trades to assess key vehicle capabilities. - Develop concept of operations. *FY 2013 Plans:* - Explore the conceptual design of alternative approaches to the UMUV system.			
Title: Structural Logic	-	-	8.000
Description: The Structural Logic program is developing platform structures and frames that can adapt to varying loads and simultaneously exhibit both high stiffness and high damping. This program will demonstrate the utility of negative stiffness structural elements developed under the Multifunctional Materials and Structures program, budgeted in PE 0602715E, Project MBT-01, in the ridged support frames of real world DoD platforms. As the demands on military platforms increase, so does the need for structures to mitigate the shock and vibrations applied by dynamic environments. Today's structures exhibit limited adaptability and typically achieve either extreme stiffness or damping. In military platforms, extremely stiff structures provide high strength, but readily transfer loads to passengers often resulting in serious injury. Conversely, existing damping structures can reduce the load transferred to passengers, but only at the expense of structural strength and integrity. By demonstrating the ability to combine stiffness, damping, and dynamic range in a single structure, the Structural Logic program will enable the design of military platforms with the ability to continually adapt their properties to match the demands of a dynamic environment. The program will transition to the Services. *FY 2013 Plans:* - Initiate the design of a ridged support frame for a platform structure that incorporates arrays of adaptive structural sub-assemblies made up of mechanical programs of tiered negative stiffness structural elements. - Perform final demonstration of the technology in a realistic system.			
Title: Blue Laser for Submarine Laser Communications (SLC)	18.486	6.209	-
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, which will enable duplex communications for the submarine at speeds and depths. Technology developed under SLC will be transitioned to the Navy. *FY 2011 Accomplishments:* - Initiated developments of the laser brassboard modules and Cesium Atomic Line Filter receivers.			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Defense Advanced Research Projects Agency		DATE: February 2012
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 2011	FY 2012	FY 2013
- Tested airborne and submarine-based brassboard transmitters for wavelength, energy per pulse, repetition rate, and beam quality. - Integrated the second gimbal and laser anamorphic zoom; tested with the receiver subsystem in the lab. - Developed the data recording and field calibration systems and the Low Probability of Intercept (LPI) receiver. - Completed demonstration of High Pulse Repetition Rate Blue Laser for Non-Acoustic Anti-Submarine Warfare laser identification detection and ranging applications. - Developed and pressure tested the submarine transmitter canisters, tested receiver canisters and developed fairings and electrical cabling. - Developed the aircraft installation, fabrications, and installed aircraft modifications. - Conducted test planning and laser safety planning and reviews. *FY 2012 Plans:* - Transition adaptive data rate controllers and Cesium Atomic Line Filter to Navy.			
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) addressed this problem by demonstrating a heat distribution system with an integrated thermally-stable non-skid coating. The TMD transitioned to the Navy for integration into amphibious assault ships. *FY 2011 Accomplishments:* - Conducted assessment of thermo physical properties of non-skid coatings and developed thermally resistant non-skid coating. - Completed development, construction, and evaluation of a small-scale, non-skid, coated, passively cooled thermal management system.	4.000	-	-
Title: Tango Bravo *Description:* Based on the results of the DARPA/Navy Submarine Design Study, the Tango Bravo technology evaluation program explored design options for a reduced-size submarine with equivalent capability of the VIRGINIA Class submarine. The implicit goal of this program was to reduce platform infrastructure and, ultimately, the cost of future design and production of submarines. Elements of the Tango Bravo program transitioned to the Navy. *FY 2011 Accomplishments:* - Completed Shaftless Propulsion integrated system testing (in-air, full load motor testing). - Completed Shaftless Propulsion in-water acoustic and endurance testing.	1.000	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Defense Advanced Research Projects Agency		DATE: February 2012
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 2011	FY 2012	FY 2013
- Completed Shaftless Propulsion demonstrator test results analysis and modeling validation/updates.			
Title: Persistent Ocean Surveillance (POS) *Description:* The Persistent Ocean Surveillance (POS) program combined geolocation techniques, such as global positioning systems, with station keeping and intra-sensor communication technologies to provide long-term ocean environment sensing buoys. A range of technologies were considered, including those that rely on the local environment (i.e., wind, ocean waves, solar energy, temperature differentials) for their power; miniature geolocation technologies; and technologies for sensor data storage, transmission, and intra-field communications. The Renewable At-Sea Power program focused on efficient energy capture from the environment in order to achieve capability for fully renewable power at sea. Technology from this program has been made available for transition to the Navy. *FY 2011 Accomplishments:* - Completed design, fabrication, and assembly of instrumented prototype platform. - Integrated power take-off device with instrumented prototype platform. - Conducted at-sea testing of instrumented platform. - Performed modeling and analyses of near-surface vehicle docking concepts.	1.500	-	-
Title: River Eye *Description:* 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. Estimated bathymetry data was obtained from this current data and advanced inverse-circulation modeling. 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 were extended to enable night-time capability, and water depth retrieval algorithms were investigated. *FY 2011 Accomplishments:* - Developed current and bathymetry algorithms for use with infrared (IR) image data, leading to a day/night capability. - Collected IR data on rivers and estuaries for testing and evaluation of the algorithms. - Developed IR sensor payload prototype for a small tactical unmanned air vehicle (TUAV).	4.466	-	-
Accomplishments/Planned Programs Subtotals	41.839	49.704	54.250

C. Other Program Funding Summary ($ in Millions)

  N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2013 Defense Advanced Research Projects Agency		**DATE:** February 2012
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*

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 2013 Defense Advanced Research Projects Agency | | | | | | | | | **DATE:** February 2012 | |

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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
NET-CLS: *CLASSIFIED*	115.471	97.712	114.040	-	114.040	117.880	115.173	124.338	130.531	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 2011	FY 2012	FY 2013
Title: Classified DARPA Program	115.471	97.712	114.040
Description: This project funds Classified DARPA Programs. Details of this submission are classified. **FY 2011 Accomplishments:** Details will be provided under separate cover. **FY 2012 Plans:** Details will be provided under separate cover. **FY 2013 Plans:** Details will be provided under separate cover.			
Accomplishments/Planned Programs Subtotals	115.471	97.712	114.040

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Details will be provided under separate cover.