Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Office of Secretary Of Defense										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 5: *Development & Demonstration (SDD)*				R-1 ITEM NOMENCLATURE PE 0604709D8Z: *Joint Robotics EMD*							
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	4.720	4.155	2.782	-	2.782	2.564	2.612	2.751	4.150	Continuing	Continuing
609: *Joint Robotics EMD*	4.720	4.155	2.782	-	2.782	2.564	2.612	2.751	4.150	Continuing	Continuing

A. Mission Description and Budget Item Justification

(U) This Program Element (PE) was established in response to Congressional guidance to consolidate DOD robotic programs on unmanned ground systems and related robotic technologies in order to increase focus of the Services' robotic programs on operational requirements. Technologies in the PE support the continued development of technologies in Budget Activity 3 and 4 (PEs 0603711D8Z and 0603709D8Z) for technology transitions and transformations and closing war fighter requirement capability gaps. By exercising its oversight role through a technology advisory board, O-6 Council and Senior Steering Group (Flag level), Joint Ground Robotics applies this PE to enable coordination between the Services and places emphasis on interoperability and commonality among unmanned ground systems. This PE supports the effort to overcome technology barriers in thrust areas of unmanned ground system technologies to include Autonomous & Tactical Behaviors, Manipulation Technologies, Collaborative Operations, Interoperability, Man-portable Unmanned Ground System Technologies, and Technology Transition/ Transformation. The purpose is to further the development and fielding of affordable and effective mobile ground robotic systems, develop and transition technologies necessary to meet evolving user requirements, and serve as a catalyst for insertion of robotic systems and technologies into the force structure. Through application of funds against the thrust areas of unmanned ground system technologies, this PE supports the integration of technologies into representative models or prototype systems in a high fidelity and realistic operating environment and expedites technology transition from the laboratory to operational use. Emphasis is on proving component and subsystem maturity prior to integration in major and complex systems and may involve risk reduction initiatives. Within this PE, funded efforts will continue the delivery of advanced technology needs directed at enhancing the war fighters' capabilities identified during concept development, operational assessments and field feedback of current unmanned systems.

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Office of Secretary Of Defense	DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 5: *Development & Demonstration (SDD)*	**R-1 ITEM NOMENCLATURE** PE 0604709D8Z: *Joint Robotics EMD*

B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	4.720	4.155	3.126	-	3.126
Current President's Budget	4.720	4.155	2.782	-	2.782
Total Adjustments	-	-	-0.344	-	-0.344
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Defense Efficiency - Baseline Review	-	-	-0.028	-	-0.028
• Defense Efficiency - Report, Studies, Board, and Commission	-	-	-0.078	-	-0.078
• Defense Effiiciency - Contractor Staff Support	-	-	-0.234	-	-0.234
• Economic Assumptions	-	-	-0.004	-	-0.004

Change Summary Explanation

Defense Efficiency – Baseline Review. As part of the Department of Defense reform agenda, implements a zero-based review of the organization to align resources to the most critical priorities and eliminate lower priority functions.

Defense Efficiency – Report, Studies, Boards and Commissions. As part of the Department of Defense reform agenda, reflects a reduction in the number and cost of reports, studies, DoD Boards and DoD Commissions below the aggregate level reported in previous budget submission.

Defense Efficiency – Contractor Staff Support. As part of the Department of Defense reform agenda, reduces funds below the aggregate level reported in previous budget submission contracts that augment staff functions.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Office of Secretary Of Defense			DATE: February 2011
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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
609: *Joint Robotics EMD*	4.720	4.155	2.782	-	2.782	2.564	2.612	2.751	4.150	Continuing	Continuing
Quantity of RDT&E Articles											

A. Mission Description and Budget Item Justification

(U) This Program Element (PE) was established in response to Congressional guidance to consolidate DOD robotic programs on unmanned ground systems and related robotic technologies in order to increase focus of the Services' robotic programs on operational requirements. Technologies in the PE support the continued development of technologies in Budget Activity 3 and 4 (PEs 0603711D8Z and 0603709D8Z) for technology transitions and transformations and closing war fighter requirement capability gaps. By exercising its oversight role through a technology advisory board, O-6 Council and Senior Steering Group (Flag level), Joint Ground Robotics applies this PE to enable coordination between the Services and places emphasis on interoperability and commonality among unmanned ground systems. This PE supports the effort to overcome technology barriers in thrust areas of unmanned ground system technologies to include Autonomous & Tactical Behaviors, Manipulation Technologies, Collaborative Operations, Interoperability, Man-portable Unmanned Ground System Technologies, and Technology Transition/ Transformation. The purpose is to further the development and fielding of affordable and effective mobile ground robotic systems, develop and transition technologies necessary to meet evolving user requirements, and serve as a catalyst for insertion of robotic systems and technologies into the force structure. Through application of funds against the thrust areas of unmanned ground system technologies, this PE supports the integration of technologies into representative models or prototype systems in a high fidelity and realistic operating environment and expedites technology transition from the laboratory to operational use. Emphasis is on proving component and subsystem maturity prior to integration in major and complex systems and may involve risk reduction initiatives. Within this PE, funded efforts will continue the delivery of advanced technology needs directed at enhancing the war fighters' capabilities identified during concept development, operational assessments and field feedback of current unmanned systems.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Autonomous and Tactical Behaviors	2.805	2.003	1.731
Description: Development of vehicle onboard intelligence and tactical behaviors for greater autonomy. These technologies will increase the war fighters' ability to accomplish military task with greater effectiveness, while simultaneously reducing their risk to exposure and harm. ***FY 2010 Accomplishments:*** 1) Human Presence Detection (HPD) from a Moving Platform project provided a capability for man-portable unmanned ground vehicles (UGVs). HPD technology is critical for any robotic operation requiring a robot to operate around, respond to, or interact with a human. This project has transitioned from PE0603709D8Z as the TRL level matured. -Began work on semi-ruggedized prototype. -Detected human presence at a minimum range of 20 m at 90 percent detection rate and 5 percent false alarm rate.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
2)Tactical Behaviors for Explosive Ordnance Disposal (EOD) project applied autonomous capabilities to the Man Transportable Robotic Systems (MTRS) that will enable operators to focus their attention primarily on the EOD mission, rather than the vehicle navigation, dramatically decrease the workload on EOD technicians during operations in OIF and OEF, and increasing the efficiency of IED defeat missions. -Conducted payload design reviews for visualization payload. -Received delivery of an advanced visualization payload for the MK1 and/or MK2. -Conducted payload design reviews for autonomy payload. -Received delivery of an autonomy payload for the MK1 and/or MK2. -Tested the payloads in relevant EOD scenarios. -Completed test reports detailing the payloads performance. -Began transition plan in collaboration with PMS-EOD. 3) Remote Check point developed and demonstrated a prototype unmanned ground vehicle (UGV) system with semiautonomous capabilities to support operations at remote security checkpoints. -Began integration of a comprehensive package consisting of Lidar, Robotic Intelligent Kernal (RIK), Fido XT, Sarnoff Iris Recognition, several cameras and an intelligent electronics payload will be integrated with a Talon UGV. QNA / Foster-Miller will integrate two light detection and ranging (lidar) systems onto a Talon with a 3DoF manipulator and use its existing IR cameras and 300:1 PTZ camera. -Began development of software algorithms to detect the head of the occupant(s) using Talon PTZ camera with greater than 90 percent accuracy. -Began development of software and hardware for accurate positioning of the compact iris capture device once the head of the occupant has been located to be integrated into the robotic command and control system. -Began development of platform control behaviors for navigation, positioning, ensuring guarded arm motion, controlling arm movement to inspect interior, exterior and underside, and scanning with Fido by manipulating a camera through the window, under the vehicle or around the exterior. -Began to design user interface for International Component for Unicode (ICU). -Began writing user manual for the robotic system and its components as a famiarilization aid for military personnel to operate and evaluate the prototype system. -Began planning phases of participation in Capstone Demonstration of the sensors integrated Talon UGV system completing mission tasks of a remote checkpoint. 4) Cargo Unmanned Ground Vehicle (UGV) project will assist the Marine Corps War fighting Lab (MCWL) in continuing to evaluate the utility of an UGV to conduct supply distribution by modifying and integrating a robotic vehicle control kit that can			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Office of Secretary Of Defense		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
be applied to current USMC cargo vehicles to determine if emerging robotic technology can be exploited to substitute manned vehicles with un-manned vehicles in order to reduce the exposure of Marines to lethal attacks. This project is also funded by the Marine Corps. -Integrated 1st Medium Tactical Vehicle Replacement (MTVR) Unmanned Ground Vehicle (UGV) concept demonstrator which included the following: Integrated perception sensors, processing hardware, vehicle interfacing hardware, software for interpreting sensor data and user input, software governing vehicle behavior and decision making, and vehicle's communication hardware and software. -Began development and vehicle integration of Operator Control Unit (OCU) which includes: installing OCU hardware and software for communications, user interface, and mission planning on a 2nd MTVR. ***FY 2011 Plans:*** 1) Autonomous Navigation for Small Unmanned Ground Vehicles (ANSU) project is to increase the war fighter's capability by developing, maturing, demonstrating and transferring autonomy technologies that will significantly increase the functional capabilities of small unmanned ground vehicle systems. This project has transitioned from PE0603709D8Z as the TRL level matured. -Demonstrate 3rd generation sensor suite capable of being tightly integrated with host platforms and additional capability of nighttime operations. -Perform night-time operation of the waypoint navigation, retro-traverse, and guarded tele-operation functions. 2) Human Presence Detection (HPD) from a Moving Platform project will provide a capability for man-portable Unmanned Ground Vehicles (UGVs). HPD technology is critical for any robotic operation requiring a robot to operate around, respond to, or interact with a human. Detect human presence at a minimum range of 25 meters at 95 percent detection rate and 3 percent false alarm rate using a semi-rugged prototype from a small-sized vehicle at a military operations on an urban terrain training site. 3) Remote Check point will develop and demonstrate a prototype Unmanned Ground Vehicle (UGV) system with semiautonomous capabilities to support operations at remote security checkpoints. -Complete integration of a comprehensive package consisting of Lidar, Robotic Intelligent Kernal (RIK), Fido XT, Sarnoff Iris Recognition, several cameras and an intelligent electronics payload will be integrated with a Talon UGV. QNA / Foster-Miller will integrate two light detection and ranging (lidar) systems onto a Talon with a 3DoF manipulator and use its existing IR cameras and 300:1 PTZ camera. -Complete development of software algorithms to detect the head occupant(s) using Talon PTZ camera with greater than 90 percent accuracy.			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Office of Secretary Of Defense		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
-Complete development of software and hardware for accurate positioning of the compact iris capture device once the head of the occupant has been located to be integrated into the robotic command and control system. -Complete development of platform control behaviors for navigation, positioning, ensuring guarded arm motion, controlling arm movement to inspect interior, exterior and underside, and scanning with Fido by manipulating a camera through the window, under the vehicle or around the exterior. -Designed user interface for International Component for Unicode (ICU). -Write user manual for the robotic system and its components as a familiarization aid for military personnel to operate and evaluate the prototype system. -Participate in Capstone Demonstration of the sensors integrated Talon UGV system completing mission tasks of a remote checkpoint. 4) Cargo Unmanned Ground Vehicle (UGV) project will assist the Marine Corps War fighting Lab (MCWL) in continuing to evaluate the utility of an Unmanned Ground Vehicle (UGV) to conduct supply distribution by modifying and integrating a robotic vehicle control kit that can be applied to current USMC cargo vehicles to determine if emerging robotic technology can be exploited to substitute manned vehicles with unmanned vehicles in order to reduce the exposure of Marines to lethal attacks. -Test and evaluate first and second vehicle in a Limited Technical Assessment (LTA) and Limited Objective Experiment (LOE). -Install a second autonomous system on a third MTVR. -Train Marines to operate, plan for, and execute convoy operations with the Cargo UGV MTVR concept demonstrator. -Marines will conduct simulated force-on-force tactical Combat Logistics Patrols (CLPs) in an interactive experiment for immediate assessment and refinement of the Concept of Operations and the Tactics (CONOPS), techniques & Procedures (TTPs). -Re-test all CONOPS and TTPs in subsequent simulated combat convoy events. ***FY 2012 Plans:*** 1)Cargo Unmanned Ground Vehicle (UGV) project will assist the Marine Corps Warfighting Lab (MCWL) in continuing to evaluate the utility of an Unmanned Ground Vehicle (UGV) to conduct supply distribution by modifying and integrating a robotic vehicle control kit that can be applied to current USMC cargo vehicles. Project will determine if emerging robotic technology can be exploited to substitute manned vehicles with unmanned vehicles in order to reduce the exposure of Marines to lethal attacks. -Make improvements to autonomous system and the OCU based on lessons learned during LTA 1 and LOE 1 -Conduct LTA 2. -Perform a four week LOE for Marines to assess the net military utility and determine the poetential for deploying for an Extended Evaluation.			
Title: Collaborative Operations	0.975	-	-

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

Description: Integrate communication, mission planning, interface technologies, and advanced intelligence capabilities to support collaborative operations between manned and unmanned systems. Develop and assess several strategies to enhance tele-operation of current Unmanned Ground Vehicles (UGV) and collaborative Unmanned Air Vehicles (UAV) teams. Development of these technologies will enable unmanned systems to support warfighter concepts of operation that are envisioning unmanned systems working in collaboration across domains (air, ground, and maritime) to execute tactical missions and complex military tasks.

FY 2010 Accomplishments:
1) Combat ID for Unmanned Robotic Systems will integrate hardware and software solutions for autonomous detection of friend-or-foe on the battlefield. Identifies people and vehicles from a moving object. By determining if people or objects are friend-or-foe at a standoff range; this technology provides greater protection to the war fighter.
-Designed and built the base sensor head and processing platform.
-Designed and built soldier payload (GPS and RF ranging radio) and sensor calibration and testing.
-Produced sensors and processing boards.
-Produced bench top assembly for initial testing.
-Began work on stereo based People/Vehicle Detection.
-Began work on developing and integrating algorithms for real-time stereo for range estimation, people detection from range and appearance, motion-based people detection and integrated detection and localization.
-Began work on Radio Frequency Ranging based Friend/Foe ID to incorporate dual band mesh radio nodes to provide communication between the robot and soldier payloads.

FY 2011 Plans:
FY 2010 dollars will continue to provide the following FY 2011 planned accomplishments.

1) Combat ID for Unmanned Robotic Systems will integrate hardware and software solutions for autonomous detection of friend-or-foe on the battlefield. Identifies people and vehicles from a moving object. By determining if people or objects are friend-or-foe at a standoff range, this technology provides greater protection to the war fighter.
-Complete work on stereo based People/Vehicle Detection.
-Complete work on developing and integrating algorithms for real-time stereo for range estimation, people detection from range and appearance, motion-based people detection and integrated detection and localization.
-Complete work on Radio Frequency Ranging based Friend/Foe ID to incorporate dual band mesh radio nodes to provide communication between the robot and soldier payloads.
-Complete enhancements and evaluations using Light Detection And Ranging (LIDAR).
-Developing software for interfacing with the LIDAR unit in the enhanced sensor head.

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
-Integrate shape features extracted from the LIDAR data in the people detection module and evaluate the performance of the people detection module with and without the LIDAR data.			
Title: Interoperability	0.433	1.400	0.500
Description: Software algorithms and interface technologies will facilitate sharing of data across unmanned platforms and domains, and with C2 systems as well as interchangeability of mission payloads and unmanned chassis. Such interoperability will enable collaborative operations between manned and unmanned systems as well as among unmanned systems in differing domains. ***FY 2010 Accomplishments:*** 1) Automatic Payload Deployment System (APDS) will develop and build a highly modular, universal payload deployment module. These payloads will be built around a universal, modular payload framework that can accept various payload modules including different radios for network connectivity. This project transitioned from PE 0603709D8Z as the TRL level matured. -Developed and built infrared radiation illuminator payloads. -Developed and built sensor payloads. -Modified the deployed. -Developed base station software module. 2) Robotic Systems Technical and Operational Metrics Correlation project is to improve a program manager or user's ability to objectively assess robotic systems by developing a tool that can predict the mission-specific operational performance from technical measures to within 80 percent. -Collected operational data. -Collected technical data. -Performed correlation and analysis on operational and technical data. -Developed logical extentions to model. -Incorporated model with extentions into software. 3) Robotics Standards Harmonization project will develop and gain approval of the DOD position on robotic standards. The attributes of the resulting harmonized (set of) open standards shall be that they satisfy the needs of all domains; use commercial standards to the greatest extent feasible; be coordinated and integrated such that duplication is eliminated; and evolve over time to meet the changing needs of users and developers. -Completed competition rules and scoring guidelines. -Updated competition interface design documents.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
-Completed domain analysis. -Received and reviewed white paper describing interoperability profiles for harmonization of multiple standards based on domain and mission. -Prepared position document. ***FY 2011 Plans:*** 1) 3D Visualization for EOD Robots project will develop, mature, demonstrate, and transition technologies that will provide the Explosive Ordinance Disposal (EOD) Unmanned Ground Vehicles (UGV) operators with an improved situational awareness and visualization capability for manipulation. The system will provide a high-resolution 3-dimensional model of the object of interest during a mission in near real-time. -Demonstrate generation of a 3 dimensional model of a complex object from sensors on an EOD class UGV that is > 95 percent complete and a max error of < 5 percent within 5 minutes of collecting the data. -Demonstrate the localization of the manipulator relative to the object with an accuracy of 5 percent using the same sensors used to build the model. -Demonstrate the real time localization of the manipulator relative to the object with an accuracy of 3 percent using the same sensors used to build the model. -Demonstrate an application that allows the operator to view the model and the manipulator/robot in its actual position from various perspectives and allows the operator to control the manipulator in an effective manner from the virtual scene. ***FY 2012 Plans:*** Projects for this capability area will be selected by July 2011.			
Title: Man-Portable Intelligence ***FY 2011 Plans:*** Project will be determined in June FY11 ***FY 2012 Plans:*** Projects for this capability area will be selected by 2011.	-	0.280	0.250
Title: Manipulation Technologies ***Description:*** Incorporate existing technologies, enable greater range of robotic manipulation, support the development of mobile manipulation, and improve manipulator performance. Development of these technologies will enable unmanned systems to conduct highly dexterous tasks that today are accomplished manually, but currently place war fighters in extremely vulnerable and dangerous situations.	-	0.286	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2011 Plans: 1) Advanced Hydraulic Actuation will build a high-dexterity robot manipulator based on advanced hydraulic actuators that will significantly extend the mission capabilities over existing ground robotics. Specifically it will be able to easily manipulate objects over 100 pounds, it will be energy efficient, will achieve precise control both in terms of position and force, and will have at least 7 degrees of freedom providing the dexterity for complex tasks. Program transitioned from PE 0603709D8Z as TRL level matured. -Complete bench top testing of the selected manipulator to include workspace, lift, speed, and dexterity. -Complete bench top testing of the hydraulic power supply to include weight and power output based on load, speed, and efficiency. -Complete bench top testing of the hydraulic arm operator control unit. -Demonstrate the viability of the advanced hydraulic actuation manipulator for a medium sized (164 lb) robot. ***FY 2012 Plans:*** 1) Highly Dexterous Manipulator for Explosive Ordinance Disposal (EOD) Operators will develop a Highly Dexterous Manipulator that approaches the dexterity of a human and is targeted for use on a small EOD Unmanned Ground Vehicle (UGV) with a total vehicle weight (including the manipulator) of 164 pounds. The manipulator is to be capable of performing bimanual tasks as required in the Capability Development Document (CDD) for Advanced Explosive Ordnance Disposal Robotic System (AEODRS). The direct benefit to the warfighter is increased performance and capability over the current state-of-the-art which will translate into reduced mission time. Project transitioned from 0603711D8Z as technology readiness level matured. -Complete control system development. -Conduct Human-Machine Interfaces (HMI) Phase II demonstration. -Conduct demonstration. -Complete system integration. -Perform demonstration in relevant environment.			
Title: Technology Transition / Transformation ***Description:*** Facilitate integration of technologies to ongoing programs: exploit best features of past and ongoing efforts, e.g., interface technologies (Human Robot Interaction) and autonomous operations. Robotics technologies are being matured with the express intent of transitioning them out of the laboratory to either development programs of record, licensing to industry to foster COTS solutions, or integration onto fielded systems. ***FY 2010 Accomplishments:*** Funding will be utilized to assist in transition or transformation of the following but not limited to: 1)Tactical Behaviors for Explosive Ordinance Disposal (EOD) Robots	0.507	0.186	0.301

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
2)Automatic Payload Deployment System (APDS) ***FY 2011 Plans:*** Funding will be utilized to assist in transition or transformation of the following but not limited to: 1) Autonomous Navigation for Small Unmanned Ground Vehicles (UGVs) 2)Human Presense and Detection 3)Man-Portable ISR Robot 4)Remote Check point 5)* Advanced Hydraulic Actuator * 3D Visualization for EOD Robots ***FY 2012 Plans:*** 1) Highly Dexterous Manipulation for EOD Operators 2)Cargo Unmanned Ground Vehicles 3)Long Range Vision for Obstacle Detection			
Accomplishments/Planned Programs Subtotals	4.720	4.155	2.782

C. Other Program Funding Summary ($ in Millions)

Line Item	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
• 0603709D8Z: *Joint Robotics Program*	15.072	9.727	11.129		11.129	11.259	10.704	10.403	10.978	Continuing	Continuing
• 0603711D8Z: *Joint Robotics Program/Autonomous Systems*	10.289	8.791	9.710		9.710	10.071	10.281	10.520	10.857	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

1. Technologies to be funded & developed are reviewed by Joint Capability Area focused working groups and the Joint Staff Functional Capabilities Boards to determine progress, transition plans, and relevance of each project.
2. Project plans are submitted, evaluated and analyzed by the Joint Robotics Ground Enterprise (JGRE) management and technical staff for risk and progress.
3. Project progress toward goals and milestones is assessed during mid-year and end-of-year reviews.

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4. Technologies developed by the JGRE are tracked and documented using the DOD Technical Readiness Level (TRL) scale for developing TRL 3 or 4 technologies to TRL 6 and adhering to the integrated baselines with regard to cost and schedule.

Exhibit R-4, RDT&E Schedule Profile: PB 2012 Office of Secretary Of Defense		DATE: February 2011
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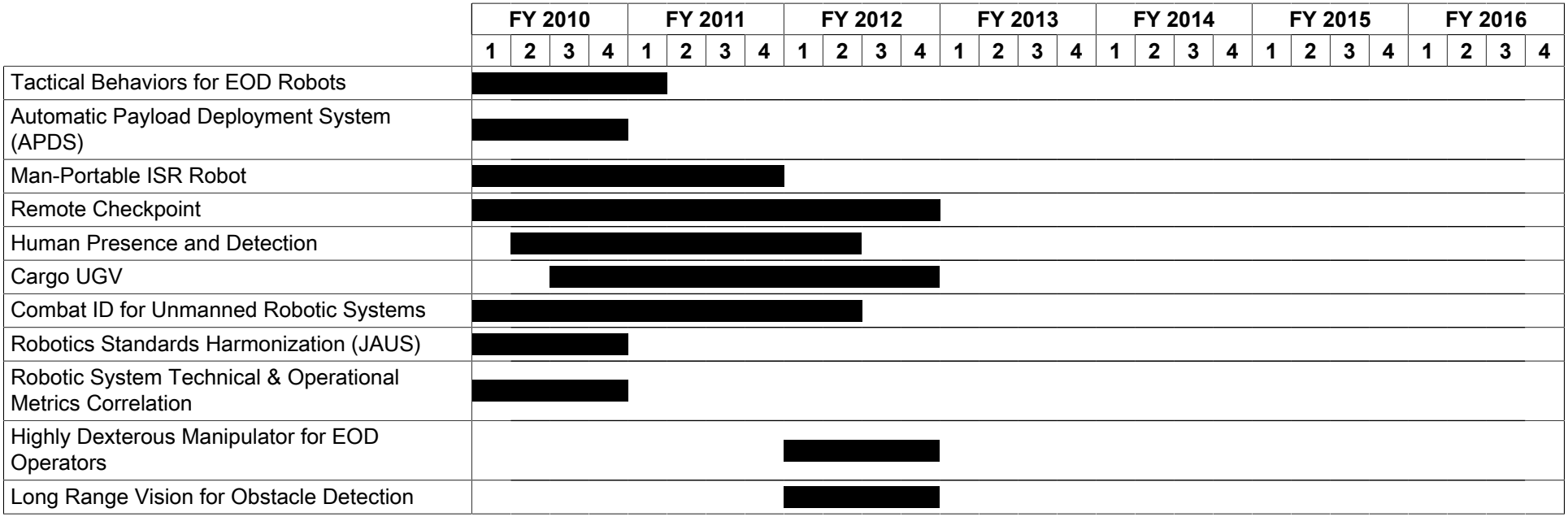

Exhibit R-4A, RDT&E Schedule Details: PB 2012 Office of Secretary Of Defense		DATE: February 2011
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Schedule Details

	Start		End	
Events	Quarter	Year	Quarter	Year
Tactical Behaviors for EOD Robots	1	2010	1	2011
Automatic Payload Deployment System (APDS)	1	2010	4	2010
Man-Portable ISR Robot	1	2010	4	2011
Remote Checkpoint	1	2010	4	2012
Human Presence and Detection	2	2010	2	2012
Cargo UGV	3	2010	4	2012
Combat ID for Unmanned Robotic Systems	1	2010	2	2012
Robotics Standards Harmonization (JAUS)	1	2010	4	2010
Robotic System Technical & Operational Metrics Correlation	1	2010	4	2010
Highly Dexterous Manipulator for EOD Operators	1	2012	4	2012
Long Range Vision for Obstacle Detection	1	2012	4	2012