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 0603767E: *SENSOR 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	226.953	205.032	271.802	-	271.802	237.238	246.905	255.322	265.481	Continuing	Continuing
SEN-01: *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*	33.951	37.053	40.212	-	40.212	47.897	60.564	62.965	77.965	Continuing	Continuing
SEN-02: *SENSORS AND PROCESSING SYSTEMS*	117.041	77.903	77.669	-	77.669	73.717	77.913	78.971	78.971	Continuing	Continuing
SEN-03: *EXPLOITATION SYSTEMS*	24.582	63.420	88.674	-	88.674	69.407	62.407	62.013	72.013	Continuing	Continuing
SEN-CLS: *CLASSIFIED*	51.379	26.656	65.247	-	65.247	46.217	46.021	51.373	36.532	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Sensors Technology program element is budgeted in the Advanced Technology Development Budget Activity because it funds sensor efforts that will improve the accuracy and timeliness of our surveillance and targeting systems for improved battlefield awareness, strike capability and battle damage assessment.

The Surveillance and Countermeasures Technology project will exploit recent advances in multispectral target phenomenology, signal processing, low-power high-performance computing and low-cost microelectronics to develop advanced surveillance and targeting systems. Timely surveillance of enemy territory under all weather conditions is critical to providing our forces with tactical information needed to succeed in future wars. Additionally, this project encompasses several advanced technologies related to the development of techniques to counter advanced battlefield threats.

The Sensors and Processing Systems project develops and demonstrates the advanced sensor processing technologies and systems necessary for the intelligence surveillance and reconnaissance (ISR) mission. The project is primarily driven by four needs: 1) providing day-night ISR capabilities against the entire range of potential targets; 2) countering camouflage, concealment and deception of mobile ground targets; 3) detecting and identifying objects of interest/targets across wide geographic areas in near real-time; and 4) enabling reliable identification, precision fire control, tracking, timely engagement and accurate battle damage assessment of ground targets.

The Exploitation Systems project develops algorithms, software, and information processing systems to extract information from massive intelligence, surveillance, and reconnaissance (ISR) datasets. In particular, it develops new technologies for detection and discrimination of targets from clutter, classification and fingerprinting of high value targets, localization and tracking over wide areas, and threat network identification and analysis.

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B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	222.866	205.032	251.805	-	251.805
Current President's Budget	226.953	205.032	271.802	-	271.802
Total Adjustments	4.087	-	19.997	-	19.997
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	9.999	-			
• SBIR/STTR Transfer	-5.912	-			
• TotalOtherAdjustments	-	-	19.997	-	19.997

Change Summary Explanation

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

FY 2012: Increase reflects repricing of sensor data exploitation technologies and the classified programs, offset by reductions for Defense Efficiencies for contractor staff support and classified programs.

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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
SEN-01: *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*	33.951	37.053	40.212	-	40.212	47.897	60.564	62.965	77.965	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds sensor efforts that will improve the accuracy and timeliness of our surveillance and targeting systems for improved battlefield awareness, strike capability, and battle damage assessment. Timely surveillance of enemy territory under all weather conditions is critical to providing our forces with the tactical information needed to succeed in future wars. This operational surveillance capability must continue to perform during enemy efforts to deny and deceive the sensor systems, and operate, at times, in a clandestine manner. This project will exploit recent advances in multispectral target phenomenology, signal processing, low-power high-performance computing, and low-cost microelectronics to develop advanced surveillance and targeting systems. In addition, this project encompasses several advanced technologies related to the development of techniques to counter advanced battlefield threats.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Combat Laser Infrared Countermeasure (IRCM) Preemptive Survivability System (CLIPSS)	2.000	4.995	6.000

Description: The Combat Laser Infrared Countermeasure (IRCM) Preemptive Survivability System (CLIPSS) will enable air dominance at low altitude and at night against infrared missile threats. Man portable air defense (MANPAD) systems, guided air defense missile systems, and advanced search and track systems, will be addressed with the development of advanced infrared countermeasures. CLIPPS will leverage the systems and focal plane array (FPA) technologies developed in the near and mid-wave infrared (NMIR), and potentially the long-wave infrared (LWIR) bands of the optical spectrum and the directed infrared countermeasures capabilities currently in the field. CLIPSS will provide a near-term demonstration and transition of the advanced capabilities and serve as a pathfinder for the transition to the Services. The primary technical obstacles are the continued development and integration of high sensitivity infrared Focal Plane Array (FPA) and multi-frequency laser technologies into compact, efficient packages for demanding IRCM environments. The real-time processing of the data over wide-fields-of view to rapidly cue countermeasures poses significant systems integration challenges and will be addressed by this demonstration. CLIPSS technology is planned to transition to the Services.

FY 2010 Accomplishments:
- Completed laboratory and outdoor testing of small-format 128x128 NMIR FPA in a compact camera/cryo-cooler package.
- Completed first fabrication run of large format 256x256 NMIR FPAs.

FY 2011 Plans:
- Complete testing of 256x256 NMIR FPAs to guide the final design/ fabrication phase.

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Complete design and initiate fabrication of airborne NMIR breadboard data collection system based on these large-format arrays. - Initiate design and modeling of CLIPSS integrated IRCM pod-based demonstration system. - Initiate key optical technology development to support detailed design objectives. - Complete testing of small-format LWIR FPAs and initiate design and fabrication of lower power dissipation, large-format LWIR coherent arrays. ***FY 2012 Plans:*** - Complete fabrication of NMIR breadboard flight system and initiate flight test - results to guide the detailed design of the integrated CLIPSS pod. - Complete critical design of the CLIPSS pod using breadboard results and key component performance measurements and then initiate subsystem fabrication. - Complete testing of first large-format LWIR arrays and initiate bench testing.			
Title: Adaptable Navigation Systems (ANS)* ***Description:*** * Formerly Robust Surface Navigation. The Adaptable Navigation Systems (ANS) program (previously funded under PE 0603768E, Project GT-01) will provide the U.S. warfighter with the ability to navigate effectively in all environments, including when Global Positioning System (GPS) is unavailable due to hostile action (e.g. jamming) or blockage by structures and foliage. The ANS approach relies on two major technology innovations. The first is the use of Signals of Opportunity (SoOp) from a variety of ground, air, and space-based sources. These will be received on the Services' forthcoming software-defined radios and use specially tailored algorithms to determine position. The second technology innovation allows SoOp-based position information to be combined with inertial and other sensors to enable flexible navigation systems that can be reconfigured in the field to support any platform or environment. While component technology for positioning, navigation, and timing is advancing rapidly (in the form of MEMS devices, clocks, and new aiding sensors), real-time integration and reconfiguration of these components is not possible given today's navigation filters and centralized processing architectures, which are inherently fragile to change. Recent advances in mathematics, data abstraction, and network architectures could enable "plug-and-play" integration of both existing and future navigation components to allow real-time integration and reconfiguration of navigation systems. If successful, major improvements in navigation accuracy and system cost could also be realized. Early transition partners would include all Services, with emphasis on platforms and users that must operate in multiple environments. ***FY 2011 Plans:*** - Develop non-form-fit prototype ANS system.	-	10.000	17.512

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Demonstrate ANS prototype system in urban canyons and inside buildings. - Conduct field tests and demonstrate the functional ANS prototype in user-selected environments such as forested, jungle and open environments, and for airborne platforms. - Validate performance prediction models from previous phases for use in mission planning tools. - Identify candidate filter, sensor, and architecture designs to enable plug-and-play all environment precision navigation and timing. - Quantify the required performance including accuracy and reconfiguration robustness to enable plug-and-play all environment precision navigation and timing. ***FY 2012 Plans:*** - Evaluate candidate filter, sensor, and architecture design for plug-and-play system. - Conduct tests to compare plug-and-play navigation system performance with existing state-of-the-art. - Develop system specification for platform-specific form factor of ANS reference stations. - Demonstrate SoOp-based ranging and navigation. - Develop and demonstrate through-the-earth communications for navigation (surface-to-subsurface communications).			
Title: Strategically Hardened Facility Defeat ***Description:*** Building upon the success of technology developed under the Counter Underground Facilities program, the Strategically Hardened Facility Defeat program leveraged recent advances in earth-penetrating technologies for full defeat of strategically hardened targets at depths inaccessible to traditional earth penetrating weapons. Technology developed under this program is available for transition to the Defense Threat Reduction Agency (DTRA). ***FY 2010 Accomplishments:*** - Designed and initiated development of deployable system with advanced penetration and navigation capabilities. - Demonstrated several subsystems and technologies for autonomous earth penetrating system.	1.000	-	-
Title: Airborne Tomography using Active Electromagnetics (ATAEM) ***Description:*** The Airborne Tomography using Active Electromagnetics (ATAEM) program investigated approaches to develop an active electromagnetic (EM) system for airborne imaging of subsurface structures, such as underground facilities (UGFs) or perimeter-breaching tunnels. The ATAEM system goal was to illuminate the ground with electromagnetic energy and interpret resulting distortions of the electric and magnetic fields to detect and characterize surreptitious structures. The ATAEM program investigated the component technologies, including EM illumination sources, noise-isolated sensor payloads and signal processing. Results of the ATAEM program are available for transition to the U.S. Army, U.S. Marine Corps, and U.S. Special Operations Command.	1.000	-	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: - Completed independent analysis of Phase I data collected by Fort Hood.			
Title: Adaptable, Low Cost Sensors ***Description:*** The objective of the Adaptable, Low Cost Sensor program is to leverage commercial technology and commercial manufacturing techniques with antenna technologies developed in PE 0602716E, Project ELT-01 to significantly reduce the cost of sensors and sensor systems. Military sensors are currently developed as unique designs that fully integrate mission-specific hardware required for sensing, with all of the other non-mission specific capabilities, including sensors (e.g., GPS), processing, memory storage and communications into a single device. Not only does this approach significantly increase the cost of the device, it makes changing requirements extremely difficult and the upgrading of any specific component impossible. However, significant advances have been made in the capabilities of commercial equipment for almost all of those non-mission capabilities, mostly driven by the smart phone industry. This makes it possible to create a mission-independent, designed-to-cost "commercial smart core" that can be combined with an applique of mission-specific hardware to provide the overall sensing capability. Because the core can be upgraded independently of any particular mission, sensors can make use of the advances and decreasing cost that is inherent in commercial technology. Because commercial technology can be used in the core, commercial development and manufacturing techniques can also be leveraged, further improving the cost and development time of sensor systems. In addition, this program will enable effective distributed sensor systems that were previously infeasible due to high cost of individual sensors. This program will transition to the Services. ***FY 2012 Plans:*** - Manufacture initial version of commercial smart core. - Identify candidate sensors for ground and airborne demonstrations and quantify the required performance, including adaptability. - Define objectives for distributed sensor systems (ground and UAV) and quantify performance against traditional, non-distributed systems. - Develop a distributed ground sensor system using smart core. - Develop smart core re-usable software and ground mission software. - Define objectives for ground system field test and plan field test activities.	-	-	16.700
Title: Rescue Transponder (RT) ***Description:*** Building upon technologies developed in other sensor programs, the Rescue Transponder (RT) program investigated the use of a unique localization and tracking technology to provide a very low probability of detection (LPD) call for help signal. The system used a wideband radio frequency signal with low power and extremely low duty cycle. The program	2.150	1.000	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
developed a small, rugged transponder that provides a call for help to friendly forces. The RT system operates over ranges that enable rescue forces or surveillance systems to receive its signals. It supports accurate localization by rescue forces, and permits transmission of identifying, authenticating, and status information. The RT technology is transitioning to the U.S. Marine Corps. ***FY 2010 Accomplishments:*** - Developed advanced prototypes with self-calibration and non-synchronization tag capabilities to simplify operations. - Developed design for a miniaturized light-weight receive prototype to support expeditionary operations. - Initiated effort to miniaturize receiver, extend tag battery life, and execute field experiments to validate performance. ***FY 2011 Plans:*** - Complete development and deliver miniaturized receivers and extended-life tags to U.S. Marine Corps. - Complete transition to U.S. Marine Corps.			
Title: Visibuilding ***Description:*** The Visibuilding program is developing technologies and systems for new building surveillance capabilities to detect personnel within buildings, determine building layouts, and locate weapons caches within buildings. This program is developing techniques to inject and recover probing radar waveforms and unravel the complicated multipath in the return signals to enable the mapping and characterization of building interiors. Radar signals are being used to image static structures directly. Doppler processing of radar signals is also being exploited to find, identify, and perform feature-aided tracking of moving personnel within a building and allow mapping of building pathways and stairways by monitoring traffic through buildings. Multipath and propagation effects are modeled and iteratively compared with hypotheses of building structures to provide 3-D building maps and large concentrations of metal materials like weapons. Other sensing modalities and component technologies are concurrently being investigated that offer the possibility of providing complementary information about the layout of large buildings as well as their associated underground areas. Component pieces will transition to the Army's Program Executive Office (PEO) Intelligence, Electronic Warfare & Sensors (IEWS) and U.S. Special Operations Command. ***FY 2010 Accomplishments:*** - Developed system design for a radar-based system to meet metric for determining floor plan and insurgent tracks within 30 minutes. - Developed radar design and processing techniques to mitigate radar clutter experienced in realistic urban environments (e.g. from furniture). - Developed and modeled performance of multiple alternative sensing approaches. ***FY 2011 Plans:***	16.572	10.184	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Complete demonstrations of low-latency, radar-based prototype system and quantify ability to determine building layout and track insurgents within furnished multi-story buildings. - Identify validated alternative sensing modalities for continued development. - Transition radar-based system to U.S. Army and U.S. Special Operations Command.			
Title: Low-Altitude Airborne Sensor System (LAASS) ***Description:*** The Low-Altitude Airborne Sensor System (LAASS) program is developing an airborne sensor system to find and characterize underground facilities (UGFs) used to shield and protect strategic and tactical activities. This includes command and control, weapons storage, manufacture of weapons of mass destruction (WMD) and tunnel networks that breach secure borders and perimeters. By passively capturing emissions associated with underground facility presence and operations, and doing so using airborne sensors (acoustic, electromagnetic, gravity gradiometry), LAASS can significantly increase our ability to seek out underground facilities and map out their vulnerabilities and backbone structure. LAASS technologies are planned to transition to Northern Command, Southern Command, Strategic Command, or Defense Threat Reduction Agency. ***FY 2010 Accomplishments:*** - Developed algorithm concepts and operational Concept of Operations (CONOPS) for the confident detection of tunnels in the presence of geologic structures that can degrade false alarm performance. - Developed integrated system architecture and model to conduct system and subsystem performance predictions. - Completed design of gravity gradiometry sensor suite and performed major technology design trades. - Explored the performance gains achievable by fusing additional technologies to mitigate false alarms. ***FY 2011 Plans:*** - Validate, through modeling and laboratory tests, that the system design, component gravity gradiometry sensor technologies, and supporting subsystems successfully meet system requirements and detection performance. - Document expected performance of system concept (sensor, installation, processing, CONOPS). - Develop high-risk, critical-path components (e.g. sensor and sensor isolation). - Validate that high-risk components can be fabricated and meet required system specifications for detection performance. - Generate system design (preliminary and critical) for capability on tactical platform. - Conduct multi-modal fusion study to validate clutter rejection and tunnel detection improvement.	2.973	4.331	-
Title: Sferic-Based Underground Geo-positioning (S-BUG) ***Description:*** The Lightning Based (Sferic) Underground Geo-positioning program will address the challenges presented when navigating and tracking within underground structures, both manmade and natural, by exploiting the abundance and long propagation range of naturally occurring global lightning events. As conceived, surface receivers at known locations will	8.256	6.543	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
compare time difference of arrival of very low frequency (VLF) sferic events and employ super-resolution correlation techniques to accurately determine the VLF source locations. Any subsurface receiver will also detect the sferics, and real time or post-mission correlation with the surface data will enable geo-location of the subsurface receiver. Exploitation of naturally-occurring, nondeniable signals has the potential to significantly reduce logistical requirements and increase operational standoff by orders of magnitude (1000+ km). Transition to U.S. Special Operations Command (SOCOM) and the U.S. Army is anticipated. ***FY 2010 Accomplishments:*** - Validated S-BUG system concept by demonstrating non-real time geolocation of an above-ground user in the field. - Demonstrated through-the-earth (TTE) correlation of sferic signals. - Initiated design of prototype hardware for subsurface receivers and processors and TTE communications. ***FY 2011 Plans:*** - Complete design of prototype hardware for subsurface receivers and processors and TTE communications. - Build and test prototype hardware (receiver and processors) for sferic-based geopositioning and navigation. - Demonstrate above ground to below ground TTE communications for navigation (surface-to-subsurface communications) and scenarios.			
Accomplishments/Planned Programs Subtotals	33.951	37.053	40.212

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.

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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
SEN-02: *SENSORS AND PROCESSING SYSTEMS*	117.041	77.903	77.669	-	77.669	73.717	77.913	78.971	78.971	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Sensors and Processing Systems project develops and demonstrates the advanced sensor and processing technologies and systems necessary for the intelligence, surveillance, and reconnaissance (ISR) missions. Future battlefields will continue to be populated with targets that use mobility and concealment as key survival tactics, and high-value targets will range from specific individual insurgents and vehicles to groups of individuals and large platforms such as mobile missile launchers and artillery. The Sensors and Processing Systems project is primarily driven by four needs: (a) providing day-night ISR capabilities against the entire range of potential targets; (b) countering camouflage, concealment and deception of mobile ground targets; (c) detecting and identifying objects of interest/targets across wide geographic areas in near-real-time; and (d) enabling reliable identification, precision fire control tracking, timely engagement and accurate battle damage assessment of ground targets. The Sensors and Processing Systems project develops and demonstrates technologies and system concepts that combine novel approaches to sensing with emerging sensor technologies and advanced sensor and image processing algorithms, software, and hardware to enable comprehensive knowledge of the battlespace and detection, identification, tracking, engagement and battle damage assessment for high-value targets in all weather conditions and combat environments.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Wide Area Video Surveillance	25.000	16.000	16.850
Description: The Wide Area Video Surveillance program is developing advanced electro-optical and infrared sensor technologies to enable persistent, wide-area, day-night video surveillance. Specific examples of these technologies includes: gigapixel focal plane arrays; advanced digital signal processors for giga-pixel image formation; advanced image processing algorithms for real-time detection, identification, and tracking of elusive and deceptive military targets; and advanced optics, telescopes and gimbals for high-resolution image capture. The Wide Area Video Surveillance program integrates these technologies in proof-of-concept prototypes for demonstration on military platforms including large and small, manned and unmanned aerial vehicles. Wide Area Video Surveillance technologies are planned for transition to the U.S. Air Force. Efforts in this program include: - The Autonomous Real-time Ground Ubiquitous Surveillance - Imaging System (ARGUS-IS) program is developing an airborne sensor system that provides persistent, real-time, high-resolution, wide-area video surveillance. ARGUS-IS will provide the warfighter with a minimum of 65 "Predator like" video windows across the field of view. Each video window is electronically steerable and independent of the others. ARGUS-IS can also provide a global moving target indicator for vehicle size objects across the entire field of view. ARGUS-IS is comprised of three major subsystems: (1) a Gigapixel Sensor Subsystem (GSS) which consists of a set of four telescopes and is mounted in a 3-axis stabilized gimbal; (2) an Airborne Processing Subsystem (APS) which takes raw pixels from the GSS and performs all required processing; and (3) a ground processing subsystem which			

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

provides the interface to the user and records down-linked imagery. A Memorandum of Agreement (MOA) for the transition of ARGUS-IS from DARPA to the U.S. Air Force has been executed, and technologies are transitioning to the U.S. Air Force and U.S. Army.

- The Autonomous Real-time Ground Ubiquitous Surveillance - Infrared (ARGUS-IR) program is developing an airborne sensor system that provides a persistent, real-time, high-resolution, wide-area night video surveillance capability. ARGUS-IR uses an advanced infrared (IR) focal plane array (FPA) sensor. The nighttime persistent capability provided by ARGUS-IR combined with the daytime capability provided by ARGUS-IS enables 24-hour day/night surveillance. ARGUS-IR's wide-area, high-update-rate, high-resolution imaging capability will enable detection and tracking of dismounts as well as vehicles. ARGUS-IR will utilize the signal/image processor developed as part of ARGUS-IS, enabling ARGUS-IS and ARGUS-IR to be combined into a common pod. ARGUS-IR must overcome a number of demanding technical challenges related to the IR FPA and size, weight, and power constraints for the IR sensor. A transition plan is being developed with the U.S. Air Force.

FY 2010 Accomplishments:

Autonomous Real-time Ground Ubiquitous Surveillance - Imaging System (ARGUS-IS)
- Completed the build and delivery of sensor and airborne processing systems for the U.S. Air Force.
- Integrated the sensor and airborne processing systems into a compatible pod.
- Integrated the ARGUS-IS pod with the target platform.
- Conducted flight tests to validate the video windows and video tracking functionality.

Autonomous Real-time Ground Ubiquitous Surveillance - Infrared (ARGUS-IR)
- Performed initial design studies for the IR sensor and airborne processing system.
- Performed analysis for the pod/fairing and gimbal layout.
- Initiated data link software design and development efforts.

FY 2011 Plans:

Autonomous Real-time Ground Ubiquitous Surveillance - Infrared (ARGUS-IR)
- Build the IR FPAs.
- Complete the development and build of the optics for the IR sensor.
- Complete software and firmware development.
- Complete development of the airborne processing system hardware.

FY 2012 Plans:

Autonomous Real-time Ground Ubiquitous Surveillance - Infrared (ARGUS-IR)

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Integrate the IR sensor into the gimbal. - Integrate the IR sensor and airborne processing system into a pod. - Conduct IR sensor system and airborne processing system qualification and air worthiness testing. - Conduct initial flight testing on a manned platform.			
Title: Military Imaging and Surveillance Technology (MIST)*	8.894	11.540	35.819
Description: *Formerly Super-Resolution Vision System (SRVS) The Military Imaging and Surveillance Technology (MIST) program will develop a fundamentally new optical ISR capability that can provide high-resolution 3-D images that will be sufficient to locate and identify a target at much longer ranges than is possible with existing optical systems. Several prototype optical surveillance and observation systems will be developed that will: (1) demonstrate probabilities of recognition and identification at distances sufficient to allow stand-off engagement; (2) overcome atmospheric turbulence, which now limits the ability of high-resolution optics; and (3) increase target identification confidence to reduce fratricide and/or collateral damage. The program will develop and integrate the necessary component technologies including high-energy pulsed lasers, receiver telescopes that have a field of view and depth of field that obviates the need for steering or focusing the optical system, computational imaging algorithms to improve system resolution, and data exploitation and analysis tools. Advances in laser systems, digital imagers, and novel image processing algorithms will be leveraged to result in the reduction of the overall size, weight and power of imaging systems to allow for soldier portable and UAV platform integration. MIST will also continue to integrate technologies developed under the Crosswind Sensor System for Snipers (C-WINS) and the Dynamic Image Gunsight Optics (DInGO) efforts. MIST will develop an optical rifle scope that enables a soldier, with minimal training, to shoot a firearm with marksman accuracy at range while also enhancing the capability for close quarters combat. The MIST program will transition the developed rifle-scope to the Army, Marines, and Special Operations Forces. The optical ISR technology will transition to the Air Force and SOCOM. ***FY 2010 Accomplishments:*** - Conducted field testing of initial SRVS spotting-scope prototype. - Completed Preliminary Design Review level designs for the DiNGO rifle-scope that allow for a hands-free variable zoom and ballistic correction capabilities. - Identified system designs for several compact, high-resolution 3-D imaging ISR systems that enable 3-D optical images to be taken at long range.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Completed the initial designs for a compact, high-energy, pulsed laser system. - Began prototype development of a high-energy, pulsed fiber laser. ***FY 2011 Plans:*** - Begin prototype development of the DiNGO rifle-scope that will allow for retrofit upgrade. - Conduct laboratory demonstration of a high-energy pulsed fiber laser subsystem that is phase-locked to an external reference. - Demonstrate a high-energy pulsed fiber laser, with output power that can be scaled well above fundamental limitations of existing fiber laser systems. - Complete the Preliminary Design Review level design for MIST 3-D imaging systems. - Commence integration of subsystems for laboratory demonstration of MIST 3-D imaging systems to assess new imaging techniques and image processing algorithms. - Complete real-time hardware implementation of advanced image processing algorithms and system integration. ***FY 2012 Plans:*** - Complete development and packaging of a high-power pulsed fiber laser system with a SWaP that is suitable for integration on a small or persistent airborne platform. - Complete development of the DiNGO rifle-scope prototype. - Complete field testing of the prototype scopes in conjunction with the transition partner. - Complete a Critical Design Review level design for the MIST 3-D imaging system. - Complete a laboratory demonstration of a breadboard system capable of achieving the final program MIST 3-D imaging performance goals for a single target range. - Begin integrating the high peak power pulsed laser technology to increase the operating distance of the MIST 3-D imaging effort.			
Title: Multifunction RF* ***Description:*** *Formerly Sandblaster The Multifunction RF program developed a helicopter pilot performance enhancement system for landing in degraded visual environments (DVE) such as dust clouds. This program addressed this important operational challenge in a Blackhawk platform environment, in four distinct areas: (1) Advanced flight controls which enable the helicopter to auto-land at a pilot-selected landing point; (2) See-through sensing based on a forward-looking 3-D W-band radar, which enables the pilot to see through the dust and select a safe landing point; (3) A powerful fusion engine which combines map and obstacle database knowledge with real-time radar data to construct a full current assessment of landing zone hazards; and (4) An enhanced, synthetic vision display	1.000	2.500	6.500

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
to present real-time landing zone information to the pilot in the most useful manner, combined with all necessary aircraft-state symbology needed to complete a safe landing. Beyond landing aids in DVE, RF-based sensors can also be used for additional situational awareness, such as near ground obstacle avoidance, air-to-air collision avoidance, targeting/fire control, as well as many other combat support activities. Building on advancements made with RF sensors under this program, the Multifunction RF program will seek to eliminate many redundant RF elements of current independently-developed systems for landing in DVEs, terrain avoidance, obstacle avoidance, and targeting/fire control. This will reduce the overall weight, power usage, cost, and profusion of exterior antennas on military aircraft, thus enabling greater mission capability with reduced vehicle system integration burden. Transition is planned to the Services. ***FY 2010 Accomplishments:*** - Commenced design of lighter-weight-tailored systems to enable landing in DVEs, for use on Department of Defense (DoD) operational helicopters. ***FY 2011 Plans:*** - Continue design and development of lighter weight DVE systems. - Begin design and development of advanced high frequency multifunction radar. - Commence planning for the integration of a multifunction RF system on helicopter platforms. ***FY 2012 Plans:*** - Complete testing and transition of lighter weight DVE systems for use on DoD operational helicopters. - Complete development and laboratory testing of key subsystem technologies for multifunction RF waveforms and arrays. - Prototype and initiate testing of multifunction RF sensor capabilities.			
Title: Advanced Airborne Optical Sensing ***Description:*** The Advanced Airborne Optical Sensing program develops electro-optical and infrared sensors and processing technologies for aerial platforms. Significant challenges arise as the result of two warfighting trends. First, the ever-changing mix of airborne platforms now includes a greater number of smaller UAVs. Second, the target set is increasingly challenging and now includes vehicles and individual dismounts that operate under foliage and in urban canyons, using camouflage, obscurants, and other means of concealment. In response to these challenges, the Advanced Airborne Optical Sensing program brings recent advances in optical, electro-optical, photonic and other technologies to airborne optical sensing systems. Specific examples of these technologies include: embedded image processors tailored to real-time detection, identification, and tracking of military targets; advanced laser radar technologies; hyper-spectral sensing technologies; flash detection and underwater object detection; advanced digital signal processing to support onboard image reconstruction, atmospheric correction, and system calibration; and	23.131	12.618	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
adaptive optics techniques, such as deformable mirrors and liquid crystal spatial light modulators. The program extends these technologies and makes them practical for airborne surveillance systems. Efforts in this program include: - The Standoff Precision ID in 3-D (SPI 3-D) program is developing an affordable sensor package capable of high-resolution 3-D imaging for confirmatory target ID at long ranges, as well as full field of view (FOV) ranging to support precise geolocation of targets. The program includes a series of ground-based and airborne demonstrations of SPI 3-D capabilities including: (1) high range resolution 3-D imaging; (2) full FOV range to pixel determination; (3) multiple frame-to-frame registration of imagery; and (4) GPS-based cueing from search systems. A demonstration will be performed to illustrate SPI 3-D compatibility with operational ISR systems such as the joint-service LITENING pod or Multi-spectral Targeting System (MTS) turrets and to support transition to the USAF in FY 2012. The program will also produce high speed, ultra sensitive photodetectors for systems requiring operation at very low photon counts. This will support long range sensors that can detect highly obscured targets under canopy/camouflage as well as very wide-area searches for submerged targets including sea mines and semi-submerged mobile vessels. - The HALOE (High Altitude Lidar Operations Experiment) program will demonstrate, in an operational environment, the full capability of a 3-D imaging system. The HALOE system will provide support for current and emerging warfighter needs by delivering high-resolution, wide-area 3-D lidar imagery data in the OCONUS environment. This system provides the unprecedented capability to collect accurate, high resolution 3-D data over wide areas, to support a wide range of high-value applications, including detailed mission planning, vertical obstruction detection, helicopter landing zone analysis, and imagery geolocation. The pathway to accomplish this goal includes improving the robustness and reliability of the sensor, conducting demonstrations, and training with CONUS flight tests leading to OCONUS operational experimentation in partnership with the Army. HALOE successfully completed the CONUS flight testing phase and has deployed OCONUS to address current and emerging needs of U.S. forces under the direction of commanders in theater. The HALOE system is planned to transition to the Army upon completion of the DARPA operations experiment. - The Spatially Processed Image Detection and Ranging (SPIDAR) program will demonstrate coherent imaging methods that will form a large, effective optical aperture from a set of smaller, lighter telescopes providing for very high-resolution 3-D and 2-D ladar imagery of distant targets with a compact system configuration. This capability is very well suited for long-range engagements from airborne or space-based platforms and could significantly enhance the current synthetic aperture imaging approaches by providing the desired cross-range resolution along the axis perpendicular to the direction of travel. This capability is also applicable on a small scale to provide very-high resolution imagery in a compact configuration for long-range target ID beyond the			

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

range of conventional imaging methods limited by diameter of the primary receiver aperture. The gain in size, weight, and power over more conventional lidar implementations will be assessed and demonstrated. Additionally, suitable missions and platforms for the technology will be identified. SPIDAR technologies will be transitioned to the U.S. Air Force.

- The Tactical Aircraft to Increase Long Wave Infrared Nighttime Detection (TAILWIND) program will develop and demonstrate a system for collecting and processing IR data operating as a framing sensor. The system will accept long wave infrared and color camera images permitting day/night reconnaissance for real-time target detection and tracking. The resulting sensor and processing system will decrease the time required to focus the sensor operator's attention on relevant targets. The TAILWIND system is planned for transition to the U.S. Army.

FY 2010 Accomplishments:

Standoff Precision ID in 3-D (SPI 3-D)
- Initiated fabrication of miniaturized components and initiated integration into the demonstration system.
- Performed initial design studies for a Geiger-mode Avalanche Photodiode (GmADP) array-based sensor that provides robust under-canopy, high-resolution real-time 3-D video and imagery using selective range gate processing.

High Altitude Lidar Operations Experiment (HALOE)
- Completed the refurbishment of the 3-D imager and verified system functionality with a series of CONUS flight tests.
- Completed deployment preparation for OCONUS flight operations, to include performance assessment and verification, team training, and flight planning.

Spatially Processed Image Detection and Ranging (SPIDAR)
- Developed plan to support ground-based demonstration of spatially synthesized apertures to support models of long-range system performance.
- Initiated design of the ground-based demonstration system.

Tactical Aircraft to Increase Long Wave Infrared Nighttime Detection (TAILWIND)
- Completed preliminary design of infrared and color sensor package.
- Developed parallel processing, compression, and image exploitation algorithms.
- Developed passive infrared exploitation technologies.

FY 2011 Plans:

Standoff Precision ID in 3-D (SPI 3-D)
- Complete integration of miniaturized components into the demonstration system.

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Conduct airborne demonstration of the metric sensing and 3-D imaging on a manned aircraft supporting transition to U.S. Air Force. - Design and implement target detection, identification, and tracking algorithms in high-performance signal processing hardware architectures. - Develop promising technologies identified for use for air platform to air target identification and location. High Altitude Lidar Operations Experiment (HALOE) - Deploy OCONUS and conduct flight operations. - Transition HALOE system upon the completion of the DARPA flight series. - Initiate the design and development of a compact configuration of HALOE that could be integrated with military unmanned and manned platforms. - Explore additional applications for the high performance LIDAR components embedded within the HALOE system. Spatially Processed Image Detection and Ranging (SPIDAR) - Initiate development of mountain-to-ground multi-aperture system outdoor demonstration to validate system modeling. Tactical Aircraft to Increase Long Wave Infrared Nighttime Detection (TAILWIND) - Complete final design of infrared and color sensor package. - Provide custom image products to multiple soldiers via adaptive processing and dissemination techniques. - Construct a 3-D model of the scene on the fly from the optical imagery.			
Title: NetTrack ***Description:*** The NetTrack Program is developing feature-aided tracking technologies to enable airborne surveillance radars to maintain track on moving high value targets (HVTs) in traffic and cluttered environments. Ground moving target indicator (GMTI) radars provide excellent potential for tracking HVTs because they operate in all weather and at long ranges. However, maintaining target tracks is very challenging because obscuration and close target spacing make it difficult to associate radar kinematic measurements over time. To address this challenge, NetTrack is developing feature aided tracking technology that automatically collects and exploits target high range resolution (HRR) radar measurements. Specific NetTrack technologies include signal processing to generate HRR measurements from raw radar returns, feature extraction and matching to exploit HRR measurements, multiple hypothesis tracking to associate measurements to tracks and estimate target location and velocity, and sensor resource management to automatically select optimum radar mode parameters and timing sequences. A Memorandum of Agreement (MOA) has been established for transition of NetTrack to the Navy Advanced Airborne Sensor which is a follow-on to the Navy Littoral Surveillance Radar System.	7.890	2.000	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: - Demonstrated NetTrack capabilities in real-time on an operational radar platform. - Initiated plans for Operational Utility Assessment. ***FY 2011 Plans:*** - Complete demonstration of NetTrack capabilities. - Study extensions of the NetTrack capabilities to the maritime environment. - Complete the Operational Utility Assessment. - Transition to the Navy Advanced Airborne Sensor program.			
Title: Large Area Coverage Search-while-Track and Engage (LACOSTE) ***Description:*** The Large Area Coverage Search-while-Track and Engage (LACOSTE) program enables persistent, tactical-grade ground-moving target indicator (GMTI) capability in dense urban areas. Wide-area continuous tracking of moving vehicles requires very small coverage gaps, small resolution cells, and target separation and identification features. The ideal sensor has the area coverage rates of GMTI radar and the resolution/identification capabilities of an electro-optical infrared system. The LACOSTE program will provide wide area surveillance, simultaneous tracking, and target engagement with electro-optical and infrared sensors for tactical GMTI operations. The program is developing a sensor with a very wide field of regard, and a wide instantaneous field of view (FOV) that is rapidly scanned in a search-while-track mode, tracking up to thousands of targets in an urban area. Additionally, the LACOSTE sensor will provide next-generation precision tracking to enable engagement on a large number of targets in dense urban areas within that same field of regard with minimal penalty on the search-mode area coverage rate. The program is also developing a rapid "zoom" capability for target identification that enables feature-aided tracking through dense target environments, plus sufficient target identification for separating like-targets when back-tracking a particular target via the historical track data. The LACOSTE technology is planned for transition to the U.S. Air Force and the U.S. Army at the conclusion of the program. ***FY 2010 Accomplishments:*** - Manufactured and tested full-scale components. - Performed system integration and laboratory testing. - Demonstrated performance (sensitivity, resolution, and tracking) via tower testing. ***FY 2011 Plans:*** - Conduct demonstration of sensitivity, resolution, and tracking.	12.460	2.110	-
Title: Crosswind Sensor System for Snipers (C-WINS) and Dynamic Image Gunsight Optics (DInGO)	6.000	5.000	-

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

Description: The Crosswind Sensor System for Snipers (C-WINS) program provided optical techniques to correct for crosswinds on ballistic objects. The C-WINS program developed a novel weapon mounted optical correction sighting system for various rifles and machine guns. An eye-safe laser and a high speed camera record motion of eddies in the atmosphere to measure the wind profile that will be used to provide ballistic correction. The system provides offset corrections to the shooter for compensating the aim point affected by the crosswind. Key parameters of interest are: a) bullet hit points less than the target size at any range up to weapons effective range; b) down range profiling up to weapons effective range; c) ranging accuracy sufficient to provide elevation correction; d) automatic ballistic correction; e) day/night operation; and f) no setup or calibration. Additional capabilities could include: increased effective ranges for a wide range of weapons; eye safe ranging; increased ID range during day and night; and shimmer compensation. Smaller size, weight, and power (SWAP) and increased engagement range are additional objectives for FY 2010. This program will transition to the U.S. Army and Marines.

Leveraging technologies developed under the Crosswind Sensor System for Snipers (C-WINS) program, the Dynamic Image Gunsight Optics (DInGO) program will develop an optical scope that enables a soldier, with minimal training, to shoot a firearm with marksman accuracy. The ability to engage targets at range with a conventional firearm is currently limited by user training rather than the accuracy of the weapon. The technology developed under this program line will enhance a soldier's ability to observe and engage targets at range as well as enhance the capability for close quarters combat. Technical achievements under other programs in this PE/Project provide the basis for radically new approaches to optical scopes, dynamic imaging systems, and low-power video analytics. By extending the capability of combat optics, DInGO enables a soldier to operate at the limit of the system performance with reduced training requirements. DInGO technology will integrate with the Military Imaging and Surveillance Technology (MIST) program (in this PE/Project). Transition to the Army is anticipated.

FY 2010 Accomplishments:
Crosswind Sensor System for Snipers (C-WINS)
- Reduced size, weight and power and increased effective engagement range.
- Completed transition to Marine Corps, Rapid Equipment Force (REF), Night Vision Lab (NVL) and PEO Soldier/Army.

Dynamic Image Gunsight Optics (DInGO)
- Performed major system design trades.
- Developed a system design for a combat-rifle scope that can be used for close quarters combat as well as to engage targets at distance.
- Validated key technology components.

FY 2011 Plans:
Dynamic Image Gunsight Optics (DInGO)

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Fabricate a fieldable prototype system for user testing.			
Title: Advanced Electronic Warfare* ***Description:*** *Formerly Precision Electronic Warfare (PreEW) The Advanced Electronic Warfare program will develop a system that enables highly precise communications jamming. This program will develop and demonstrate robust, low cost, small size, weight, and power (SWAP) distributed electronic warfare (EW) platforms to allow the warfighter to disrupt and impede an adversary's communication network. The program uses an array of nodes that have synchronized clocks to enable the signal from each node to be aligned so that the carrier and phase are focused on the desired location. The effect will be to place the desired energy on the specific target area while not affecting the non-target area. The node is planned to contain localization, network, synchronization, and jamming processing and communication in a low-cost, easily deployable package. Key technology challenges include oscillator synchronization, accurate pointing, and energy focusing to impact quality of service of intended target. The program is planned for transition to the Services. ***FY 2010 Accomplishments:*** - Initiated design and developed precision clock synchronization techniques for evaluation and selection for static scenarios. - Developed beamforming and inter-mode communication architecture. - Validated design to demonstrate ability for small SWAP. - Performed simulations to validate clock synchronization, precision pointing, and precision jamming capabilities. ***FY 2011 Plans:*** - Conduct initial field experiments using multiple pole-mounted payloads to validate the ability to synchronize and direct energy to an area of interest and extract measurements of performance. - Conduct advanced experiments with improvements in distributed precision clock synchronization and initial multi-node over the air demonstrations with fixed nodes.	13.000	10.000	-
Title: Behavioral Learning for Adaptive Electronic Warfare (BLADE)* ***Description:*** *Previously part of Advanced Electronic Warfare The Behavioral Learning for Adaptive Electronic Warfare (BLADE) program will develop the capability to jam adaptive and rapidly evolving radio frequency (RF) threats in tactical environments and at tactically-relevant timescales. This will change the paradigm for responding to evolving threats from lab-based manual development to an adaptive in-the-field systems approach. When an unknown or advanced RF threat appears, BLADE networked nodes will dynamically characterize the emitter, synthesize an effective countering technique, and evaluate jamming effectiveness by iteratively probing, learning, and adapting to the threat. An	-	14.000	18.500

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
optimization process will tailor near-real-time responses to specific threats, producing a countermeasure waveform that maximizes jam effectiveness while minimizing the required jamming resources. Thus BLADE will enable the rapid defeat of new RF threats and provide the warfighter with real-time feedback on jam effectiveness. The program is planned for transition to the Services. ***FY 2011 Plans:*** - Develop and evaluate techniques for the detection and characterization of known and unknown threats using adaptive threshold detection and open-set signal classification. - Create techniques for jam waveform generation via learning and active probing techniques. - Develop approaches for battle damage assessment to determine jam effectiveness through observation of changes in threat behavior. ***FY 2012 Plans:*** - Conduct non-real time testing in a laboratory environment demonstrating detection and proper characterization of known and unknown signals with sufficient fidelity to validate the program concept. - In non-real time, generate and optimize jamming waveforms using detection and characterization with probing and learning techniques. - Conduct non-real time battle damage assessment performance validation via laboratory testing. - Begin end-to-end system development for real-time open-air operational-like demonstrations.			
Title: Precision Inertial Navigation Systems High Dynamic Range Atom Sensors and Systems (PINS HiDRA)	-	2.135	-
Description: Precision Inertial Navigation Systems High Dynamic Range Atom Sensors and Systems (PINS HiDRA) will develop an integrated cold atom-based inertial measurement unit (IMU) suitable for use on a wide range of military platforms. The program will build on the work of the Precision Inertial Navigation Systems (PINS) program (funded in PE 0603768E, Project GT-01) to dramatically increase the dynamic range of the sensors, thereby enabling operation on aircraft and missiles. Extensive system integration and miniaturization will reduce system size, weight, and power, while increasing navigation performance as measured against currently fielded aircraft inertial navigation systems. Key technology challenges include high-brightness atom sources, innovative atom interferometer measurement schemes that function in high-dynamic environments, and high g-tolerant laser stabilization schemes. The PINS HiDRA program will focus on transition to the Services. ***FY 2011 Plans:*** - Design system microcontroller and compact laser and optomechanics frame. - Develop computer models for atom sensor operation under high dynamic input and predict navigation performance under relevant sensor configuration.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Validate sub-system technology selections and incorporate into full six degree-of-freedom inertial sensor design.			
Title: Network Centric Sensing and Engagement ***Description:*** The Network Centric Sensing and Engagement program developed technology and tools to support small unit situational awareness, rapid targeting, and precision engagement in highly-networked environments. Network-centric sensing acknowledges a group of sensors as a system and leverages networked intercommunication to enable system performance superior to that of uncoordinated individual sensors. The program uses organic reconnaissance, surveillance and target acquisition data to update tactical users and planners over multiple echelons with critical environmental and operational information. Required technology advances include: sensor-to-sensor communications, multi-sensor management, sensor system georegistration, real-time data fusion, advanced tracking, and network-centric sensor operational modes. Technologies will transition to small tactical units in irregular operations. ***FY 2010 Accomplishments:*** - Evaluated the effect of combining multiple semi-autonomous organic sensor updates and novel display technologies on situation assessment for rapid military riverine operations.	3.426	-	-
Title: Advanced Radar Sensor Technology ***Description:*** The Advanced Radar Sensor Technology thrust developed radar systems technology to provide significant improvements in our ability to detect, identify, and track surface targets. Program efforts focused on exploiting emergent and novel RF sensing technology and phenomenology. Key elements were advancements in ultra-wide band, bistatics, UHF/VHF, emitter location and direction-finding, polarimetric change detection, tomographic imaging, space-time adaptive processing and other advanced signal processing, advanced Ground Moving Target Indicator (GMTI) techniques, and foliage, building, and ground-penetrating radar phenomenology. Technologies were developed for use on Navy, Army, and Air Force current and emerging platforms, including small and micro UAVs, with emphasis on the most stressing military radar sensor challenges. Programs in this thrust include: - The Next Generation RF Antenna System program developed and demonstrated a light-weight wide-band RF antenna that enables high gain over a broad frequency range and signal detection at extended ranges. - The Airborne Passive Direction Finding with a Tactical Vector Sensor (ATVS) program developed and demonstrated a compact, lightweight, airborne, real-time, tactical emitter detection and location system suitable for tactical UAVs.	6.396	-	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- The Efficient Digitization of Element Signals program exploited new and emerging techniques in signal coding and compressive sensing to allow large, element-count, radio frequency (RF) arrays to be digitally sampled using small numbers of receivers. ***FY 2010 Accomplishments:*** Next Generation RF Antenna System - Designed a novel antenna element with superior gain and bandwidth. - Validated design using electromagnetic modeling. Airborne Passive Direction Finding with a Tactical Vector Sensor (ATVS) - Developed prototype ATVS antenna, installed on a Shadow UAV, and measured RF performance characteristics in an outdoor range. Efficient Digitization of Element Signals - Demonstrated the potential to reduce data imaging requirements without significant performance degradation for synthetic aperture arrays. - Demonstrated that random sensor array performance and compressive sensing theory are related and that it is possible to quantify certain parameters of anticipated array performance.			
Title: Sensor Tape ***Description:*** The Sensor Tape program developed and demonstrated a low-cost, one-time-use, low-power, band-aid size, adhesive-applied blast dosimeter that records accumulative blast effects for integration into combat medical care. Significant technical obstacles that were overcome include achieving adequate switching frequencies, packaging, print-on ink technologies and production costs. Sensor Tape is transitioning to the Air Force and Army. ***FY 2010 Accomplishments:*** - Demonstrated web-printing process for sensors, printed electronics and memory components. - Fabricated prototype sensor tapes. - Demonstrated sensor tape performance in field test.	2.282	-	-
Title: Short Wave Infrared through Fog and Clouds (SWIF) ***Description:*** The Short Wave Infrared through Fog and Clouds (SWIF) program developed and demonstrated advanced signal processing and optical imaging technology to allow detection of collision and grounding threats in fog and clouds at useful ranges (day or night), which substantially degrade performance in precision handling operations. Humans are able to operate	7.562	-	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
successfully with sensor assistance, but situational awareness significantly degrades. Successful development of this technology has restored this situational awareness to tactically relevant distance and time scales. Significant technical obstacles that needed to be overcome included development of an ultra-short pulse laser with sufficient bandwidth and fast enough pulse rise time to create transient-like propagation characteristics in an aerosol cloud, distributed active sources, and advanced filtering techniques. Technologies are transitioning to the U.S. military. ***FY 2010 Accomplishments:*** - Manufactured test articles. - Distributed obscurant chamber testing and performed system validation.			
Accomplishments/Planned Programs Subtotals	117.041	77.903	77.669

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 0603767E: *SENSOR TECHNOLOGY*	PROJECT SEN-03: *EXPLOITATION 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
SEN-03: *EXPLOITATION SYSTEMS*	24.582	63.420	88.674	-	88.674	69.407	62.407	62.013	72.013	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Exploitation Systems project develops algorithms, software, and information processing systems to extract information from massive intelligence, surveillance, and reconnaissance (ISR) datasets. In particular, it develops new technologies for detection and discrimination of targets from clutter, classification and fingerprinting of high value targets, localization and tracking over wide areas, and threat network identification and analysis. Efforts will focus on difficult ISR environments, for example (a) urban environments with extensive building obscuration, large volumes of civilian traffic, and feature-rich terrain, (b) mountain environments with highly variable terrain elevation, complex local and regional threat networks, and predominantly dismounted adversaries, and (c) jungle environments with targets under heavy canopy, animals and other sources of clutter masking human activity, and widely dispersed threat activities. The resulting technology will enable operators to more effectively use ISR data in the execution of wide area search, border and road monitoring, high value target tracking, overwatch, and other missions.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Wide Area Network Detection (WAND)*	8.000	10.000	20.874

Description: *Formerly Target Identification.

The Wide Area Network Detection (WAND) program is developing methods to detect, characterize, and identify targets from both imaging and other sensors, including national, theater, and organic sensors. Critical performance metrics are timeliness, accuracy, error rates, and interpretation workload. The program addresses the challenges of target identification, acquisition, tracking and denial in difficult environments. The technologies will apply advanced signal processing, sensor fusion, and platform control to leverage advances in sensor capabilities. Transition is planned to the Air Force and Army.

FY 2010 Accomplishments:
- Designed and analyzed performance of new sensing approaches for target detection and performed limited field testing.
- Developed concepts of employment and an overall system architecture, and validated with potential transition customers.

FY 2011 Plans:
- Develop sensor processing, mount on surrogate platforms, and collect data in realistic operating environments.
- Validate concepts of employment, and test overall system via modeling and simulation.

FY 2012 Plans:
- Perform initial field tests of system in realistic operating environment.

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 0603767E: *SENSOR TECHNOLOGY*	PROJECT SEN-03: *EXPLOITATION SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Verify performance under extended operating conditions via simulation.			
Title: Multi-Sensor Exploitation	8.000	6.900	10.595

Description: The Multi-Sensor Exploitation program provides multi-sensor exploitation capabilities enabling missions such as overwatch, border surveillance, high value target tracking, and threat network detection using mixes of imaging, radar, signals, human intelligence, and other sources. Key challenges in the first two missions include real-time and wide area dismount and vehicle target detection, discrimination, tracking, and pattern of life analysis. Key challenges in the third mission include tracking through periods of obscuration and confusion in environments in which existing sensors and methods are not able to provide high quality signature data. Key challenges in the fourth mission include discriminating threats from large volumes of civilian clutter and determining the behavior patterns of and relationships between those threats. The Multi-sensor Exploitation program will develop new target tracking methods for wide area motion imaging sensors enabling long duration tracking of vehicles and dismounts through the development of new target dynamic modeling methods, new processing methods tailored to dismounts, and new methods for signature aided tracking. Scalable stochastic modeling and inference techniques will yield improved situation awareness and assessment for wide-area EO/IR motion imaging, radar, and multi-sensor exploitation applications in settings where large numbers of interacting entities engaged in complex activities are observed over long periods of time. Techniques intended for use in riverine and maritime environments, where extremist and criminal groups threaten political stability, trade routes, and free commerce, must quickly map navigable tributary systems, rapidly detect and identify threats, and monitor their activity. The program will develop new methods for automatically correlating different sources of information to identify threats, estimate threat networks, and analyze behavioral patterns. The program will include a focus on integrated human and machine processing to better take advantage of the strengths of each. Potential transition partners include the U.S. Navy, Air Force, and Army as well as USAFRICOM, USSOUTHCOM, USSOCOM and Intelligence agencies.

FY 2010 Accomplishments:
- Created new methods for tracking targets in urban environments leveraging dynamic models motivated by traffic flow theory.
- Executed multisensor data collections for high value target tracking, overwatch, road and border monitoring, and other scenarios.

FY 2011 Plans:
- Evaluate and optimize techniques and software for tracking targets in dense target environments.
- Continue execution of multisensor data collections against a broader mission set.

FY 2012 Plans:
- Demonstrate flow-based tracker improvements using instrumented data and in-theater data.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
- Develop stochastic models that capture complex spatial, temporal, and relational structures, while enabling efficient computations for learning, inference, and prediction. - Formulate and evaluate approaches for ISR information fusion across air, river banks, water surface, water column, and river bottom. - Develop techniques for dealing with riverine and maritime challenges such as turbidity, multi-path reflection, sea clutter, and high clutter density.			
Title: Foliage Penetrating Radar Planning and Exploitation ***Description:*** The Foliage Penetrating Radar Planning and Exploitation program will complete final Forester FOPEN radar demonstrations and provide further exploitation capabilities to find dismounted targets in densely forested terrain. Current foliage penetrating radar systems provide an important capability for detecting dismount targets under foliage, but the systems also detect animals, moving water, blowing trees, and other scene clutter moving under or in the foliage that makes situation assessment manpower and radar resource intensive. Further, Doppler signature data that experiments indicate may enable improved automated discrimination of dismount targets from other detections is not currently exploited. Finally, no planning tools are available for optimizing and dynamically replanning collection assets to improve imaging geometries and detectability. This program will provide capabilities to address these issues by exploiting Doppler signature data, automating temporal processing approaches currently used, and automating terrain, weather, and on-line exploitation data to enable planning and dynamic replanning. The result will be significantly improved capability for finding and localizing targets under foliage. The program will transition to USSOUTHCOM and USSOCOM. ***FY 2010 Accomplishments:*** - Developed overall processing architecture for integration of exploitation modules. ***FY 2011 Plans:*** - Formulate, evaluate, and optimize algorithms for mitigating detections in radar systems due to non-living objects in motion and confusion between humans and animals. - Formulate, evaluate, and optimize algorithms for assessment of group-state activity level sufficient to assist an operator in assessment of the group's intent. ***FY 2012 Plans:*** - Refine algorithms for mitigating false detections and assessing group state and activity. - Optimize and transition algorithms to operational FOPEN systems.	5.500	7.500	7.000
Title: Insight*	-	37.195	50.205

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: *Previously part of Multi-Sensor Exploitation. The Insight program builds on the successes of a number of programs, including POSSE, HART, and TTNT, which demonstrated the value and importance of multi-INT sensor fusion when prosecuting time-critical targets in challenging environments. Insight will develop new capabilities for automated exploitation and collection management. Insight will emphasize several areas, including model-based correlation, adversary behavior modeling, and threat network analysis tools to automatically combine data across sources and manage uncertainty; collection management tools to identify collection opportunities and enable efficient use of multi-INT sensors and platforms across missions; and tools to integrate human and machine processing, including visualization, hypothesis manipulation, and distributed social intelligence. Insight development activities will leverage virtual and physical testbed environments. The virtual testbed will enable testing against extended operating conditions and evaluation of alternative concepts of operation, and the physical testbed will enable live-fly testing with current and next generation sensing and processing systems. Insight technologies will transition to the Air Force and Army. ***FY 2011 Plans:*** - Design and begin development of multi-INT correlation, behavior modeling, and threat network analysis tools. - Perform initial testing on collected datasets. - Develop concepts of operation to realize the benefits of multi-INT fusion. - Begin design of collection management tools and design metrics for evaluating collection management efficiency. - Develop initial implementation of virtual testbed integrating Insight-collected data with existing Government data sources. ***FY 2012 Plans:*** - Baseline exploitation, collection management, and user interaction techniques against user validated scenarios. - Demonstrate virtual environment for baseline testing of system scalability and alternative concept of operations analysis. - Populate development database with collected data to support rapid prototyping of innovative exploitation, collection management, and other analytic tools. - Evaluate fusion and control techniques in the virtual testbed. - Perform a limited field test with operational users.			
Title: Persistent Operations Surface Surveillance and Engagement (POSSE) ***Description:*** The Persistent Operations Surface Surveillance and Engagement (POSSE) program is developing the capability to integrate sensor input from multiple modalities to find indications of insurgent activities. Combined with dynamically updated information from soldiers on the ground, POSSE will enable near-real-time generation of the evidence necessary for further investigation or interdiction. POSSE experiments are conducted at the National Training Center (NTC) with realistic role players	3.082	1.825	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Defense Advanced Research Projects Agency		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
emulating typical residential, commercial and light industrial activity. Within this environment, insurgent activity is simulated by qualified experts using the latest and most complete intelligence available. Measurements include precision collections of insurgent activities, as well as the realistic surrounding background clutter of typical civilian activity. Results will inform future experiments, lead to specifications for future sensor design, and provide insights into how to integrate other narrow and wide area sensors into an integrated approach to countering insurgencies. Transition is planned for U.S. Army Intelligence and Security Command. ***FY 2010 Accomplishments:*** - Concluded the Chemical Detection Experiment series and analyzed results. - Examined the feasibility of new sensor designs based on experimental results. ***FY 2011 Plans:*** - Refine sensors specific to close-in insurgent activity detection. - Demonstrate new insurgent activity detection techniques in field exercises at the National Training Center.			
Accomplishments/Planned Programs Subtotals	24.582	63.420	88.674

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 0603767E: *SENSOR TECHNOLOGY*	PROJECT SEN-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
SEN-CLS: *CLASSIFIED*	51.379	26.656	65.247	-	65.247	46.217	46.021	51.373	36.532	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	51.379	26.656	65.247
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	51.379	26.656	65.247

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Details will be provided under separate cover.