Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Air Force										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	158.516	134.632	127.637	-	127.637	128.591	125.661	122.320	133.944	Continuing	Continuing
622002: *Electronic Component Technology*	34.952	42.822	31.683	-	31.683	35.161	38.026	38.263	39.054	Continuing	Continuing
622003: *EO Sensors & Countermeasures Tech*	21.215	28.019	23.744	-	23.744	24.415	24.996	21.534	23.692	Continuing	Continuing
624916: *Electromagnetic Tech*	18.590	-	-	-	-	-	-	-	-	Continuing	Continuing
626095: *Sensor Fusion Technology*	28.937	24.517	28.672	-	28.672	26.428	25.445	25.899	29.677	Continuing	Continuing
627622: *RF Sensors & Countermeasures Tech*	54.822	39.274	43.538	-	43.538	42.587	37.194	36.624	41.521	Continuing	Continuing

Note

Note: In FY 2012, the efforts in Project 624916 move from Hanscom AFB, MA, to Wright Patterson AFB, OH, due to Base Realignment and Closure (BRAC) 2005 decisions. The individual efforts from Project 624916 are merged into other existing Projects in this PE.

A. Mission Description and Budget Item Justification

This program develops the technology base for Air Force aerospace sensors and electronic combat. Advances in aerospace sensors are required to increase combat effectiveness by providing anytime, anywhere surveillance, reconnaissance, precision targeting, and electronic warfare capabilities. To achieve this progress, this program pursues simultaneous advances in: 1) generating, controlling, receiving, and processing electronic and photonic signals for radio frequency (RF) sensor aerospace applications; 2) electro-optical (EO) aerospace sensor technologies for a variety of offensive and defensive uses; 3) RF antennas and associated electronics for airborne and space surveillance, together with active and passive EO sensors; 4) technologies to manage and fuse on-board sensor information for timely, comprehensive situational awareness; and 5) technology for reliable, all-weather surveillance, reconnaissance, and precision strike RF sensors and electronic combat systems. This program has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary sensor, electronics, and electronic combat technologies.

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	

B. Program Change Summary ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Previous President's Budget	157.497	134.787	137.101	-	137.101
Current President's Budget	158.516	134.632	127.637	-	127.637
Total Adjustments	1.019	-0.155	-9.464	-	-9.464
• Congressional General Reductions	-	-0.155			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	4.148	-			
• SBIR/STTR Transfer	-1.451	-			
• Other Adjustments	-1.678	-	-9.464	-	-9.464

Change Summary Explanation

FY11: Other Adjustments include -1.678 Congressional General Reductions. Technical adjustment made to Congressional Add for 2.400 to PE 0602102F Materials

Decrease in FY13 is due to higher Department of Defense priorities.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 622002: *Electronic Component Technology*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
622002: *Electronic Component Technology*	34.952	42.822	31.683	-	31.683	35.161	38.026	38.263	39.054	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project focuses on generating, controlling, receiving, and processing electronic signals for RF sensor aerospace applications. The enabling technologies developed under this project will be used for intelligence, surveillance, reconnaissance (ISR), electronic warfare, battlespace access, and precision engagement capabilities. The technologies developed include exploratory device concepts; solid state power devices and amplifiers; low noise and signal control components; photonic components; high-temperature electronics; signal control and distribution; signal processing; multi-function monolithic integrated circuits; high-speed analog-to-digital and digital-to-analog mixed mode integrated circuits; reconfigurable electronics; power distribution; multi-chip modules; and high density packaging and interconnect technologies. This project also designs, develops, fabricates, and evaluates techniques for integrating combinations of these electronic component technologies. The project aims to demonstrate significantly improved military sensors of smaller size, lower weight, lower cost, lower power dissipation, higher reliability, and improved performance. The device and component technology developments under this project are military unique; they are based on Air Force and other Department of Defense weapon systems requirements in the areas of radar, communications, electronic warfare, navigation, and smart weapons.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Major Thrust 1. ***Description:*** Develop, analyze, demonstrate, and perform engineering trade studies for technologies for compact, affordable, multi-function subsystems for aerospace sensors. ***FY 2011 Accomplishments:*** Demonstrated more compact and lightweight RF antennas using emerging materials and designs. ***FY 2012 Plans:*** Complete first demonstrations of higher performance, with reduced size and weight, of advanced sensor front-ends. Develop initial trade space models for advanced sensing and electronic warfare front-ends. Continue development activity for compact and lightweight high-frequency antennas. ***FY 2013 Plans:*** Complete second round of demonstrations. Using engineering trade analysis, start development of optimized sensor system technology previously demonstrated.	9.887	12.450	12.238
Title: Major Thrust 2. ***Description:*** Develop and assess new microelectronic/optoelectronic material, device and fabrication technologies for next generation imaging, precision strike, and battlespace access across all Air Force domains.	11.568	11.444	9.150

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 622002: *Electronic Component Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Fabricated and tested innovative electronic device concepts for wideband, reconfigurable and tunable applications. Conducted efforts to refine and further develop devices. Developed degradation models and validated key failure mechanisms for power transistors. Developed agile/affordable advanced detector arrays with emphasis on combined spectro-polarimetric filtering. Started application development of high-brightness and agile waveform sources for integration into components and subsystems. ***FY 2012 Plans:*** Continue to fabricate and characterize innovative electronic device concepts for wideband, reconfigurable and tunable applications. Demonstrate prototype hardware for agile/affordable advanced detector arrays with emphasis on combined spectro-polarimetric filtering. Continue application development of high-brightness and agile waveform sources for integration into components and subsystems. Investigate and perform analysis for materials/device/circuit trades. ***FY 2013 Plans:*** Develop optimized device concepts for multi-use cyber, sensing, warfare and communication applications. Continue to develop and demonstrate a capability to predict performance versus lifetime in military relevant environments for a large variety of emerging electronic devices. Identify key failure mechanisms for electronic device technologies and their corresponding accelerants and chemistry.			
Title: Major Thrust 3. ***Description:*** Develop, fabricate, and test electronic and optoelectronic devices and techniques to reduce power loss and power consumption for future imaging, electronic warfare, and ISR sensors. ***FY 2011 Accomplishments:*** Refined and transitioned solutions for multi-function electronic and optoelectronic components for imaging and electronic warfare applications. ***FY 2012 Plans:*** Continue to refine and transition solutions for multi-function electronic and optoelectronic components for imaging and electronic warfare applications. Investigate and analyze mixed electronic and optoelectronic functions. ***FY 2013 Plans:*** N/A. Effort terminated due to higher Department of Defense priorities.	6.931	7.939	-
Title: Major Thrust 4. ***Description:*** Develop integrated design, modeling and simulation tools, and integration techniques for complex mixed-signal component development in advanced electronic component technologies.	6.566	5.420	4.576

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602204F: *Aerospace Sensors*	**PROJECT** 622002: *Electronic Component Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Employed design, modeling and simulation tools, and integration techniques for complex mixed-technology (digital, RF, microwave, optical, mechanical) development in both advanced and emerging electronic component technologies. Initiated trade analysis for optimizing microsystem attributes. ***FY 2012 Plans:*** Develop and demonstrate prototypes of complex mixed-technology (digital, RF, microwave, optical, and mechanical) components using both advanced and emerging electronic component technologies. ***FY 2013 Plans:*** Continue demonstration of microsystem prototypes. Refine trade analysis.			
Title: Major Thrust 5. ***Description:*** Design and develop antennas for airborne and space-based surveillance. Develop novel and advanced antennas for lightweight, conformal arrays. ***FY 2011 Accomplishments:*** FY 2011 and prior work reported under Project 4916, Major Thrust # 2; prior to BRAC. ***FY 2012 Plans:*** Integrate new detection algorithm with low-cost seeker hardware. Demonstrate integration and test of new conformal digital beamforming phased array antennas on airborne radar platforms. Develop new hardware to exploit emerging metamaterials for compact radiating sensor applications including conformal array antennas and electronics based upon complex media. Assess the viability of obtaining novel material properties consistent with the demonstration of highly integrated subsystems based upon RF integrated circuit applications to enable small, highly directional antenna element device drivers. ***FY 2013 Plans:*** Develop novel antenna concepts for wideband applications. Integrate and demonstrate lightweight conformal phased array aperture.	-	5.569	5.719
Accomplishments/Planned Programs Subtotals	34.952	42.822	31.683

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
• N/A: *N/A*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 622002: *Electronic Component Technology*

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 622003: *EO Sensors & Countermeasures Tech*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
622003: *EO Sensors & Countermeasures Tech*	21.215	28.019	23.744	-	23.744	24.415	24.996	21.534	23.692	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project determines the technical feasibility of advanced electro-optical aerospace sensor technologies for a variety of offensive and defensive uses. The sensor technologies under development range from the ultraviolet through the infrared portion of the spectrum. Related efforts include improvements in avionics integration, digital processing, analysis tools, and sensor architectures. One of the project's main goals is to improve electro-optical and related technologies for the detection, tracking, and identification of non-cooperative and difficult targets, such as those obscured by camouflage. This project also develops the passive and active imaging sensors and algorithms needed to enable precision targeting in severe weather. These technologies are critical to future aerospace surveillance and targeting. Other project goals include advanced electro-optical threat warning and countermeasures.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Major Thrust 1.	7.831	5.455	10.377
Description: Develop innovative optical sensing technology for non-cooperative detection and identification of airborne and ground-based targets. ***FY 2011 Accomplishments:*** Performed sensor concept demonstrations for long-range target identification using passive and active techniques, including multispectral/polarimetric imaging, vibrometry, 3-D, sparse aperture and synthetic aperture laser radar. Refined techniques for long-range object reconstruction based on either multi-aspect multispectral and polarimetric images or coherent laser radar data, with particular emphasis placed on synthetic and sparse aperture imaging techniques. Conducted signature collection experiments with multispectral/polarimetric imaging systems to assess military utility. Performed proof of concept experiments to assess potential utility. ***FY 2012 Plans:*** Continue sensor concept demonstrations for long-range target identification using passive and active techniques, including multispectral/polarimetric imaging, vibrometry, 3-D, sparse aperture and synthetic aperture laser radar. Extend signature collection experiments and demonstrate techniques for long-range object reconstruction/ shape extraction based on multi-aspect multispectral and polarimetric images and coherent laser radar data. Initiate study of advanced sensing methods for overcoming atmospheric limitations to extended recognition range. Perform field experiments, quantify utility, and develop concepts for airborne experiments of synthetic aperture imaging in the presence of atmospheric turbulence. Develop model-based algorithms for longwave hyperspectral change detection. ***FY 2013 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 622003: *EO Sensors & Countermeasures Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Increase in FY 2013 funding is due to increased emphasis in this effort. Continue sensor concept demonstrations for long-range target identification using innovative passive and active techniques. Perform longwave hyperspectral change detection experiments to assess model-based algorithms. Continue laboratory and begin field demonstrations of agile multifunction waveforms for long-range, combined temporal synthetic aperture and remote vibrometry waveforms. Begin buildup of linear frequency modulation testbed to support long range performance quantification. Continue development of signal processing and automated signature recognition algorithms for remote vibrometry.			
Title: Major Thrust 2. ***Description:*** Develop innovative optical sensing technology to support military operations in dynamic and urban environments. ***FY 2011 Accomplishments:*** Developed techniques for targeting difficult objects in dynamic urban environments. Performed sensor concept demonstrations for difficult target identification and tracking using passive and active infrared techniques. including multispectral/polarimetric imaging, vibrometry, 3-D, sparse aperture and synthetic aperture laser radar. Refined techniques for long range object reconstruction based on either multi-aspect multispectral and polarimetric images. ***FY 2012 Plans:*** Perform hyperspectral phenomenology experiments and initiate trade studies for spectral-aided tracking and relocation of targets. Continue laboratory experiments and begin field demonstrations of holographic aperture imaging for high resolution 2-D and 3-D imaging. Conduct demonstrations of multi-aperture transceivers with wavelength and transmitter location diversity. Continue development of signal processing and automated signature recognition algorithms for remote vibrometry. Continue development of 3-D imaging technologies for urban applications including scaled sensor designs, modeling and simulation and flight test of prototype sensors. Initiate development of wide area and targeting specific processing algorithms. ***FY 2013 Plans:*** Develop processing methods and sensor requirements for spectral-aided tracking and relocation of targets. Conduct tower demonstrations of multi-aperture transceivers with wavelength and transmitter location diversity. Continue development of signal processing and automated signature recognition algorithms for remote vibrometry.	2.582	2.809	0.672
Title: Major Thrust 3. ***Description:*** Develop optical and infrared sensors for airborne and space situational awareness and threat warning. Develop countermeasure technologies for use against infrared and electro-optical guided missile threats. ***FY 2011 Accomplishments:*** Demonstrated integrated beam rider laser, direct tactical, and indirect tactical laser detection sensors supporting proactive infrared countermeasure hand-off goals. Continued assessment of advanced infrared missiles and infrared acquisition sensors.	1.607	7.185	2.758

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 622003: *EO Sensors & Countermeasures Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Continued to develop proactive infrared countermeasures including the detection, discrimination, and defeat of second-generation, infrared, imaging missile seekers and sensors systems. Refined modeling and simulation capability to assess effectiveness of countermeasure techniques across mission concepts of employment. ***FY 2012 Plans:*** Continue the assessment of advanced infrared missiles and infrared acquisition sensors. Continue to develop simulation and hardware-in-the-loop test capability to characterize hardware and evaluate/test countermeasure concepts. Continue development and integration of advanced laser threat detection sensors to demonstrate situational awareness and countermeasure hand-off capabilities. Continue to develop simulation and hardware-in-the-loop test capability to characterize hardware and evaluate/test threat warning and countermeasure concepts. Continue to develop performance requirements for advanced electro-optical and infrared countermeasure concepts across mission concepts of employment. ***FY 2013 Plans:*** Continue the assessment of advanced infrared missiles and infrared acquisition sensors. Develop system requirements for Proactive Infrared Countermeasures (PIRCM) to defeat advance infrared (IR) guided missile and IR acquisition and tracking sensor operating in the near to mid-IR bands. Continue development and integration of advanced missile warning sensors to demonstrate situational awareness and countermeasure hand-off capabilities. Continue developing simulation and hardware-in-the-loop test capability to characterize hardware and evaluate/test threat warning and countermeasure concepts. Perform technology development of laser IRCM hardware suitable in size, weight and performance for fighter and mobility aircraft.			
Title: Major Thrust 4. ***Description:*** Develop optical spectrum transmitter, detector and agile aperture technologies capable of sensing multiple target characteristics for robust non-cooperative target identification and future infrared countermeasure systems. ***FY 2011 Accomplishments:*** Began development of beamsteering technology for long range sparse aperture and compact 3-D laser radar systems. Assessed performance characteristics of beamsteering component technologies based on liquid crystal, microwave electro-mechanical modules (MEMs), and other optical phased array concepts. ***FY 2012 Plans:*** Continue development of beamsteering technology for sparse aperture and compact 3-D laser radar systems. Perform characterization of competing beamsteering component technology concepts. Initiate proof of concept experiments for an agile aperture assembly. Develop design concepts for wideband optical detector arrays suitable for coherent laser radar systems. Define and implement optimized waveforms for laser-based sensing. Continue active and passive sensor phenomenology	9.195	5.060	5.271

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 622003: *EO Sensors & Countermeasures Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
experiments and model development. Demonstrate initial mid-infrared lasing and frequency conversion in waveguide and fiber media to reduce use of coupling optics for improved reliability and reduced cost of laser sources operating in harsh environments. ***FY 2013 Plans:*** Demonstrate high speed and random access optical phased array scanning with photon counting arrays. Demonstrate increased mid-infrared power and efficiency in waveguide and fiber media to reduce use of coupling optics for improved reliability and reduced cost of laser sources operating in harsh environments.			
Title: Major Thrust 5. ***Description:*** Develop and fabricate new semiconductor components, materials and techniques with capability to identify military and urban threats, to provide threat warning, and precisely engage targets in cluttered environments. Develop emerging optoelectronic materials, devices and circuits for next generation EO sensors exploiting advanced operational modes such as plasmonics, metamaterials, non-linear optics and quantum optics. ***FY 2011 Accomplishments:*** Work reported under Project 4916, Major Thrusts # 3 and 4; prior to BRAC. ***FY 2012 Plans:*** Capitalize on performance enhancements by integrating new materials with advanced plasmonic device technology at the macro, micro and nano scales. Applications include: non-cooperative target identification, automatic target recognition (ATR), ultraviolet to infrared threat warning, countermeasures, communications, computing and urban surveillance. ***FY 2013 Plans:*** Develop new semiconductor materials and devices for military-specific applications such as biological agent detection and covert communications, as well as phase-only correlation techniques for ATR.	-	7.510	4.666
Accomplishments/Planned Programs Subtotals	21.215	28.019	23.744

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
• N/A: *N/A*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 622003: *EO Sensors & Countermeasures Tech*

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 624916: *Electromagnetic Tech*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
624916: *Electromagnetic Tech*	18.590	-	-	-	-	-	-	-	-	Continuing	Continuing

Note

Note: In FY 2012, the efforts in Project 624916 move from Hanscom AFB, MA, to Wright Patterson AFB, OH, due to the BRAC 2005 decisions. The individual efforts from Project 624916 are merged into other existing Projects in this PE.

A. Mission Description and Budget Item Justification

This project develops technologies for sensor systems that cover the electromagnetic spectrum from RF to electro-optical. It develops RF antennas and associated electronics for airborne and space-based surveillance. It also investigates radio-frequency scattering phenomenology for applications in ground and air moving target indicators in extremely cluttered environments. The project develops active and passive electro-optical sensors for use in concert with RF sensors. It develops low-cost active sensors that use reliable high-performance solid state components for target detection and identification and missile threat warning. The project also develops passive multi-dimensional sensors to improve battlefield awareness and identify threats at long-range.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Major Thrust 1. ***Description:*** Investigate detection of difficult airborne and ground-based targets in clutter from airborne or space-based surveillance platforms. ***FY 2011 Accomplishments:*** Completed development of analytical and computationally efficient tools for multi-sensor integration for target detection, tracking, and classification in a knowledge-aided framework exploiting physics-based and data dependent electromagnetic models of targets and clutter, as well as waveform diversity and dynamic sensor responses to the evolving problem solution. ***FY 2012 Plans:*** Not Applicable. (Post-BRAC; this work moved to Project 627622; Major Thrust #8) ***FY 2013 Plans:*** N/A	3.466	-	-
Title: Major Thrust 2. ***Description:*** Design and develop antennas for airborne and space-based surveillance. Develop metamaterials for conformal arrays. ***FY 2011 Accomplishments:***	6.106	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 624916: *Electromagnetic Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Integrated new detection algorithm with low-cost seeker hardware. Integrated and tested new conformal digital beamforming phased array antennas on airborne radar platforms. Developed new hardware to exploit emerging metamaterials for compact radiating sensor applications including conformal array antennas and electronics based upon complex media. Assessed the viability of obtaining metamaterial properties consistent with the demonstration of highly integrated subsystems based upon radio frequency integrated circuit applications to enable small, highly directional antenna element device drivers. ***FY 2012 Plans:*** Not Applicable. (Post-BRAC; this work moved to Project 622002; Major Thrust #5) ***FY 2013 Plans:*** N/A			
Title: Major Thrust 3. ***Description:*** Design and develop new electro-optical techniques and components for detecting and identifying concealed targets. ***FY 2011 Accomplishments:*** Developed new quasi-phase matched materials such as Gallium Phosphate and techniques for efficient optical sources in the mid- and long-wave infrared applications. Demonstrated new materials systems to enable conversion from pump wavelengths between 1 and 2 microns. Concluded testing of integrated focal plane arrays. Demonstrated perfect optical absorber using advanced plasmonic operational modes. Demonstrated mid-IR laser source using quasi-phase matched Gallium Arsenide material for infrared countermeasures (IRCM) applications. ***FY 2012 Plans:*** Not Applicable. (Post-BRAC; this work moved to Project 622003; Major Thrust #5) ***FY 2013 Plans:*** N/A	5.371	-	-
Title: Major Thrust 4. ***Description:*** Develop hardware and software for passive multi-dimensional sensing in the thermal infrared spectral wavelength range at high frame rates. ***FY 2011 Accomplishments:***	3.647	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 624916: *Electromagnetic Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Developed electro-optical sensor hardware for detecting chemical, biological, radioactive, nuclear or high explosive weapons using spectral or spectral temporal intelligence. Developed chemical biological stand off detection hardware. Completed spectral temporal sensor demonstration for cueing electro-optical and infrared persistent surveillance sensors. ***FY 2012 Plans:*** Not Applicable. (Post-BRAC; this work moved to BPAC 2003; MT #5) ***FY 2013 Plans:*** N/A			
Accomplishments/Planned Programs Subtotals	18.590	-	-

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
• N/A: *N/A*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 626095: *Sensor Fusion Technology*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
626095: *Sensor Fusion Technology*	28.937	24.517	28.672	-	28.672	26.428	25.445	25.899	29.677	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops the technologies required to perform management and fusion of sensor information for timely, comprehensive situational awareness, automatic target recognition, integrated fire control, and bomb damage assessment. This project determines the feasibility of technologies and concepts for fire control that help to precisely locate, identify, and target airborne and surface targets. The project emphasizes finding reduced signature targets and targets of opportunity. It will enable new covert tactics for successful air-to-air and air-to-surface strikes. This project also develops the technologies required to create trusted autonomic, distributed, collaborative, and self-organizing sensor systems that provide anticipatory and persistent intelligence, surveillance, and reconnaissance (ISR), situational awareness, and decision support for multi-layered sensing. This program provides the technologies for: 1) trusted sensors and trusted sensor systems that will deter reverse engineering and exploitation of our critical hardware and software technology and impede unwanted technology transfer, alteration of system capability, and prevent the development of countermeasures to U.S. systems; 2) collaborative tasking of our own distributed heterogeneous sensor networks across a region and co-opted tasking of both traditional and non-traditional adversary sensors; 3) secure sensor web backbone technologies, sensor web physical topologies, and related protocols to assure reliable trusted sensor interactions; and 4) defining architectures for distributed trusted collaborative heterogeneous sensor systems and semantic sensor networks, developing new methodologies for system of systems sensor engineering and analysis, and new techniques for sensor network situation awareness and predictive analytics.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Major Thrust 1.	6.141	1.723	10.560
Description: Develop automatic target recognition (ATR), sensor management, and sensor fusion technologies for target detection, tracking, and identification in ISR, and combat identification applications. ***FY 2011 Accomplishments:*** Enhanced and assessed physics-based techniques to meet the target detection and identification requirements for intelligence, surveillance, and reconnaissance and combat identification applications. Developed and evaluated automated battle space behavior analysis. Developed and assessed technology that will fuse precision time, position, attitude, and velocity sensor data to enable improved geo-location capabilities for future distributed time and distributed platform sensing. Enhanced multi-sensor, pixel level registration techniques as necessary to support requirements. Assessed and developed capabilities to represent and utilize sensor parameters and errors, along with other uncertainty reference information, for improved fused geo-location accuracy. Conducted research of bio-inspired automatic target recognition technologies and continued to assess and evaluate these techniques for all missions with emphasis on urban applications. Assessed automatic target recognition, sensor management, and sensor fusion algorithms for urban intelligence, surveillance, and reconnaissance from small remotely piloted aircraft (RPA). ***FY 2012 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 626095: *Sensor Fusion Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Enhance and assess physics-based techniques to meet the target detection and identification requirements for intelligence, surveillance, and reconnaissance and combat identification applications. Continue development and evaluation of automated battle space behavior analysis. Continue development and assessment of technology that will fuse precision time, position, attitude, and velocity sensor data to enable improved geo-location capabilities for future distributed time and distributed platform sensing. Enhance multi-sensor, pixel level registration techniques as necessary to support requirements. Continue to assess and develop capabilities to represent and utilize sensor parameters and errors, along with other uncertainty reference information, for improved fused geo-location accuracy. Continue research of bio-inspired automatic target recognition technologies and continue to assess and evaluate these techniques for all missions with emphasis on urban applications. Continue assessment of automatic target recognition, sensor management, and sensor fusion algorithms for urban intelligence, surveillance, and reconnaissance from small RPA. ***FY 2013 Plans:*** Increase in FY 2013 funding is due to increased emphasis in this effort. Enhance and assess physics based techniques to meet the autonomous target detection and identification requirements for intelligence, surveillance, and reconnaissance applications. Enhance multisensor, pixel level registration techniques as necessary to support requirements. Continue to assess and develop capabilities to represent and utilize sensor parameters and errors, along with other uncertainty reference information, for improved fused geo-location accuracy and autonomous sensor, processor, and bandwidth management. Continue research of bio-inspired automatic target recognition technologies and continue to assess and evaluate these techniques for all missions with emphasis on urban applications. Continue assessment in Planning & Direction, Collection, Processing & Exploitation, Analysis & Production, and Dissemination and Experimentation (PCPAD-X) integrative and virtual environments of automatic target recognition, sensor management, and sensor fusion algorithms for urban intelligence, surveillance, and reconnaissance.			
Title: Major Thrust 2. ***Description:*** Develop, evaluate, and demonstrate target signature models to support sensor exploitation algorithm development and testing for reconnaissance and strike mission applications. ***FY 2011 Accomplishments:*** Matured target signature models for signature exploitation of RF sensors, EO multi-spectral systems, and signals intelligence sensors emphasizing one target model for application to all parts of the spectrum. Developed signatures, algorithms, and modeling support for multiple radio-frequency and electro-optical phenomenology automatic target recognition of ground targets. Developed signatures, algorithms, target modeling, and phenomenological modeling of other phenomenological features not previously exploited. Generated synthetic air and ground target signatures with sufficient fidelity to support development and assessment of automatic target recognition in operationally realistic mission environments. Conducted investigation of model-driven spectral signal processing and exploitation techniques. Developed automatic target recognition algorithm-driven RF	7.579	4.240	4.845

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 626095: *Sensor Fusion Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
sensor design, new modes of operation for existing sensors, and signal processing/exploitation for high-diversity data. Initiated measurements and prediction technology to analyze space object signatures in support of space situational awareness. ***FY 2012 Plans:*** Continue to mature target signature models for signature exploitation of RF sensors, EO multi-spectral systems, and signals intelligence sensors emphasizing one target model for application to all parts of the spectrum. Continue to develop signatures, algorithms, and modeling support for multiple radio-frequency and electro-optical phenomenology automatic target recognition of ground targets. Continue the development of signatures, algorithms, target modeling, and phenomenological modeling of other phenomenological features not previously exploited. Continue to generate synthetic air and ground target signatures with sufficient fidelity to support development and assessment of automatic recognition of targets in operationally realistic mission environments. Continue investigation of model-driven spectral signal processing and exploitation techniques. Continue development of automatic target recognition algorithm-driven RF sensor design, new modes of operation for existing sensors, and signal processing/exploitation for high-diversity data. Initiate measurements and prediction technology to analyze space object signatures in support of space situational awareness. ***FY 2013 Plans:*** Continue to mature target signature models for signature exploitation of RF sensors, EO multi-spectral systems, and signals intelligence sensors emphasizing one target model for application to all parts of the spectrum. Continue to develop signatures, algorithms, and modeling support for multiple radio-frequency and electro-optical phenomenology for automated sensor exploitation of ground targets. Continue the development of signatures, target modeling, and phenomenological modeling of other phenomenological features not previously exploited. Continue to generate synthetic air and ground target signatures with sufficient fidelity to support development and assessment of automatic recognition of targets in realistic mission environments. Continue development of automatic target recognition algorithm-driven RF sensor design, new modes of operation for existing sensors, and signal processing/exploitation for high-diversity data.			
Title: Major Thrust 3. ***Description:*** Develop technical methods required for algorithm performance models, performance driven sensing, layered sensing and other sensing and exploitation technologies impacted by automated exploitation capabilities. ***FY 2011 Accomplishments:*** Conducted investigations of sensor exploitation techniques. Developed a capability to model the performance of these technologies. Initiated validation of algorithm performance models. Developed databases and tools required to support performance modeling and assessment. Developed an integrated, unified automatic target recognition methodology building upon the modeling and assessment tools developed. ***FY 2012 Plans:***	10.105	5.611	7.564

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APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 626095: *Sensor Fusion Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Continue investigations of sensor exploitation techniques. Continue development of a capability to model the performance of these technologies. Continue validation of algorithm performance models. Continue development of databases and tools required to support performance modeling and assessment. Continue to enhance development of an integrated, unified automatic target recognition methodology building upon the modeling and assessment tools developed. ***FY 2013 Plans:*** Continue development of a capability to model the performance of sensor exploitation technologies. Continue validation of algorithm performance models to be used in the PCPAD-X integrative and virtual environments. Continue development of databases and tools required to support performance modeling and assessment. Continue to enhance development of an integrated, unified automatic target recognition methodology building upon the modeling and assessment tools developed.			
Title: Major Thrust 4. ***Description:*** Develop, evaluate, and demonstrate methodologies, techniques, and strategies to instill trust in distributed, heterogeneous sensing systems within air, space, and cyber domains. ***FY 2011 Accomplishments:*** Developed new technologies and methodologies for producing adaptive, assured, and trusted architectures for multilayered sensing. Initiated development of advanced trusted sensing services, middleware, and frameworks for multilayered sensing and spectrum warfare. Initiated development of methodologies and techniques for acquisition, aggregation, and portrayal of critical data for sensing network situation awareness. ***FY 2012 Plans:*** Complete development of new technologies and methodologies for producing adaptive, assured, and trusted architectures for multilayered sensing. Continue development of advanced trusted sensing services, methodologies and techniques for acquisition, aggregation, and portrayal of critical data for sensing network situation awareness. Initiate development of methods, tools, and processes to determine and assess vulnerability and mission assurance for complex system-of-systems for spectrum warfare. ***FY 2013 Plans:*** Continue development of advanced trusted sensing services, middleware, and frameworks for multilayered sensing and spectrum warfare. Continue development of methods, tools, and processes to determine and assess vulnerability and mission assurance as a function of system scale in complex system-of-systems. Continue development of methods, tools, and processes to determine and assess vulnerability and mission assurance for complex system-of-systems for spectrum warfare.	2.287	8.374	2.267
Title: Major Thrust 5. ***Description:*** Develop technologies that enable autonomic trusted features in sensor systems to deter reverse engineering and exploitation of critical military hardware and software systems.	1.308	2.558	1.779

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 626095: *Sensor Fusion Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Developed key technologies for trusted sensors for multi-layered ISR sensing systems to assure anti-tamper and software protection of key military capabilities. Assessed and evaluated commercial technologies for application to military trusted systems. Developed autonomic trusted sensor technologies to address self-ware, self-healing, and self-organizing sensor systems. Initiated development of integrated anti-tamper and software protection solutions. Initiate development of key technology experiments to test and demonstrate trusted sensor technologies on military weapon systems. ***FY 2012 Plans:*** Continue development of integrated software protection and anti-tamper systems for multilayered ISR sensing systems and spectrum warfare applications. Continue to develop key technologies for trusted sensors for multi-layered ISR sensing systems to assure anti-tamper and software protection of key military capabilities. Continue development of autonomic trusted sensor technologies to address self-aware, self-healing, and self-organizing sensor systems. Continue to assess and evaluate commercial technologies for application to military trusted systems. Complete development of key technology experiments to demonstrate trusted sensor technologies on military weapon systems. ***FY 2013 Plans:*** Continue development of integrated software protection and anti-tamper systems for multilayered ISR sensing systems and spectrum warfare applications. Continue development of autonomic trusted sensor technologies to address self-aware, self-healing, and self-organizing sensor systems. Initiate development of detect and response mechanism to remedy software and hardware supply chain vulnerabilities. Initiate development of software protection and anti-tamper solutions that integrate universal situational awareness to improve attack monitoring and prediction capabilities.			
Title: Major Thrust 6. ***Description:*** Develop trusted and assured avionics system network and integration technology, physical topologies, and protocols to support multi-layered sensing. ***FY 2011 Accomplishments:*** Continued development of avionics system vulnerability assessment testbed. Continued development and assessment of advanced avionics bus technologies for trusted sensing. Continued analysis to exploit wired and wireless avionics sensor systems and begin analysis of technologies to protect and defend sensor systems. ***FY 2012 Plans:***	1.517	2.011	1.657

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Continue development of avionics system vulnerability assessment testbed. Continue development and assessment of advanced avionics bus technologies for trusted sensing. Continue analysis to exploit wired and wireless avionics sensor systems and analysis of technologies to protect and defend sensor systems. ***FY 2013 Plans:*** Continue development of avionics system vulnerability testbed. Complete development of advanced avionics bus technologies for trusted sensing. Continue analysis to exploit wired and wireless avionics sensor systems and begin analysis of technologies to protect and defend sensor systems. Initiate assessment of susceptibilities of commercial derivative avionics systems.			
Accomplishments/Planned Programs Subtotals	28.937	24.517	28.672

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
• N/A: *N/A*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 627622: *RF Sensors & Countermeasures Tech*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
627622: *RF Sensors & Countermeasures Tech*	54.822	39.274	43.538	-	43.538	42.587	37.194	36.624	41.521	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and assesses affordable, reliable all weather RF sensing and countermeasure concepts for aerospace applications covering the range of RF sensors including communications, navigation, ISR, and radar, both active and passive, across the air, land, sea, space and cyber domains. This project also develops and evaluates technology for ISR sensors, fire control radars, electronic warfare, integrated radar and electronic warfare systems, and offensive information operations systems. It emphasizes the detection and tracking of surface and airborne targets with RF signatures that are difficult to detect due to reduced radar cross sections, concealment and camouflage measures, severe clutter, or heavy jamming. Techniques exploited include the use of multiple RF phenomenologies, multi-dimensional adaptive processing, advanced waveforms and knowledge-aided processing techniques. This project also develops the RF warning and countermeasure technology for advanced electronic warfare and information operations applications. Specifically, it develops techniques and technologies to detect and counter the communications links and sensors of threat air defense systems and hostile command and control networks. The project also exploits emerging technologies and components to provide increased capability for offensive and defensive RF sensors, including radar warning, RF electronic warfare, and electronic intelligence applications.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Major Thrust 1.	3.378	2.319	5.524
Description: Develop hybrid sensor solutions to be responsive to needs and detect difficult targets. Develop jam-resistant time, position, and velocity sensors.			
FY 2011 Accomplishments: Investigated optimal means of tightly coupling networked sensing platforms with their reference systems by leveraging onboard sensor observations as feedback to robustly calibrate the distributed, multi-platform reference. Demonstrated tightly coupled reference system technology both non-real-time and real-time.			
FY 2012 Plans: Develop strategies to optimize reference technologies for distributed sensing missions. Explore alternatives when GPS is degraded or denied. Reduce size, weight, and power of inertial components. Enhance precision of GPS and non-GPS reference technologies.			
FY 2013 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 627622: *RF Sensors & Countermeasures Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Increase in FY 2013 funding is due to an increased emphasis in this efort. Continue to develop strategies to optimize reference technologies for distributed sensing missions. Explore alternatives when GPS is degraded or denied. Continue to reduce size, weight, and power of inertial components, while pursuing near navigation grade performance.			
Title: Major Thrust 2. ***Description:*** Conduct applied research and development for the advancement of passive and active RF sensors; including phenomenology, modeling and simulation, algorithm development, and experimentation. Plan, execute, and maintain state-of-the-art RF sensor research and development facilities. ***FY 2011 Accomplishments:*** Completed standup of Outdoor Range Radar Facility necessitated by BRAC 2005 relocation of Surveillance Facility from Rome, NY, to Wright Patterson Air Force Base, OH. Began upgrading capabilities to support state-of-the-art RF sensing experimentation. Completed installation and checkout of remote 100 foot tower housing passive sensing capability. Began development of adjunct Outdoor Range facility (Distributed Sensing Test Range, (DiSTeR)) in order to perform distributed sensing experiments. Developed an Over-The-Horizon test capability. ***FY 2012 Plans:*** Complete DiSTeR. Continue upgrading Outdoor Range capabilities. Perform RF Sensing experimentation including sidelobe nulling, RF Tomography, and multispectral fusion (RF and EO/IR). Stand up X-Band multi-channel phased array radar capability. Begin establishment of Open System Architecture for Outdoor Range operations. ***FY 2013 Plans:*** Continue research and development in dismount detection, sparse arrays, polarization diversity, RF tomography, MIMO for EP, and Along Track Interferometry (ATI) for GMTI. Continue Outdoor Range experimentation for concept verification and validation. Continue Outdoor Range Open System Architecture refinement and implementation. Establish new measurement capabilities at low (UHF) and high (Ku/Ka) frequency bands.	26.263	16.251	11.282
Title: Major Thrust 3. ***Description:*** Develop active RF sensor solutions to use against difficult-to-detect targets in challenging environments, and advanced RF architectures for open and reconfigurable systems. Enable persistent ISR over wide areas, and detect advanced air and ground targets. ***FY 2011 Accomplishments:***	1.165	1.025	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602204F: *Aerospace Sensors*	PROJECT 627622: *RF Sensors & Countermeasures Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Completed systems engineering and design for reconfigurable array manifold architecture to support multiple radar configurations on a single system. ***FY 2012 Plans:*** Complete development and testing of reconfigurable array manifold and initiate integration with multi-channel receiver for system demonstration. Test reconfigurable architecture against multiple configurations and missions, and utilize active array and manifold in the research of advanced RF waveforms. ***FY 2013 Plans:*** N/A. Effort completed in FY 2012.			
Title: Major Thrust 4. ***Description:*** Develop advanced techniques and prototype passive RF sensors to intercept, collect, locate and track enemy RF sensor systems for ISR of air and ground targets. ***FY 2011 Accomplishments:*** Completed the development of a Passive Techniques Testbed for ground testing of direction finding and geolocation systems. Developed techniques to exploit passive RF phenomena to detect difficult targets. ***FY 2012 Plans:*** Develop requirements for passive millimeter wave RF receivers, antennas and signal processors. ***FY 2013 Plans:*** Develop signal obstacle course to verify tunable RF architecture using dynamic RF signals. This program will utilize in-house facilities, and state-of-art RF hardware deliverables from the Defense Advanced Research Projects Agency and Air Force contracts.	3.838	0.197	1.518
Title: Major Thrust 5. ***Description:*** Develop technology to reduce size, weight, and power of RF sensors. Develop technology to enable affordable upgrades and optimally control RF and multi-intelligence sensors. ***FY 2011 Accomplishments:*** Conducted research and exploration of an adaptable electronic support (ES)/electronic attack (EA) capability, including exploration of the synergy of real-time ES coupled with tailorable EA techniques. ***FY 2012 Plans:*** Initiate research and modeling of distributed and layered electronic	13.675	7.221	5.821

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
warfare (EW) efforts (i.e., multiple jammers or jamming techniques) for spectrum warfare. Explore and analyze a future/on-coming RF-based threat for potential counters and perform initial vulnerability assessment. Research advanced ES concepts. Continue the research and exploration of an adaptable ES/EA capability, including the exploration of the synergy of a real-time ES system coupled with tailorable EA techniques. ***FY 2013 Plans:*** Continue development of distributed and layered EW effects. Continue to explore and analyze future/on-coming RF-based threats for potential counters and perform vulnerability assessments. Continue to research advanced ES concepts. Complete research and exploration of an adaptable ES/EA capability.			
Title: Major Thrust 6. ***Description:*** Develop multi-band and multi-beam forming technologies. Address technologies for antenna array operations in dynamic sensor networks. ***FY 2011 Accomplishments:*** Developed an electronic chassis framework (toolkit) for applying Open Architectures (OA) to Department of Defense (DOD) sensing systems. Developed a W-band solid state power amplifier for wideband satellite communications (SATCOM) applications. ***FY 2012 Plans:*** Further develop an electronic chassis framework (toolkit) for applying OA to DOD sensing systems. Further develop and demonstrate a W-band solid state power amplifier for wideband SATCOM applications. ***FY 2013 Plans:*** Develop RF/EO subsystem concept prototype and begin its development to validate trade space tools. Refine trade space analysis.	5.651	9.206	7.093
Title: Major Thrust 7. ***Description:*** Develop sensor techniques to achieve highly accurate and robust navigation performance for hypersonic air vehicles in prompt global strike applications. ***FY 2011 Accomplishments:*** Completed the design of a RF hardware-in-the-loop testbed to implement hypersonic air vehicle plasma characteristics, platform trajectories, and highly accurate and robust navigation techniques for space-based applications. Demonstrated a constructive	0.852	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
systems engineering model to assess hypersonic navigation techniques in terms of measures of performance and warfighter utility. ***FY 2012 Plans:*** N/A. Effort eliminated in FY12 due to higher AF priorities. ***FY 2013 Plans:*** N/A			
Title: Major Thrust 8. ***Description:*** Investigate detection of difficult airborne and ground-based targets in clutter from airborne or space-based surveillance platforms. ***FY 2011 Accomplishments:*** Work reported under Project 624916, Major Thrust #1; prior to BRAC. ***FY 2012 Plans:*** Develop radar environment models for clutter rejection and multipath mitigation by combining electromagnetic phenomenology, cognitive algorithms and sensor signal processing pertaining to the detection and tracking of small targets in complex clutter and jamming environments for multiple-input and multiple-output (MIMO) sensor network configurations. ***FY 2013 Plans:*** Continue the development of models applicable to MIMO and waveform-diverse systems for multi-sensor networks operating in complex clutter and multi-path environments, and further continue the development of cognitive and phenomenology-based algorithm theory for the detection and classification of difficult targets and dismount activities for persistent and ubiquitous coverage using multi-platform configurations.	-	3.055	2.800
Title: Major Thrust 9. ***Description:*** Develop aerospace platform jamming technologies and techniques to counter advanced radio-frequency (RF)threats associated with current and future aerospace weapons systems. ***FY 2011 Accomplishments:*** N/A ***FY 2012 Plans:*** N/A ***FY 2013 Plans:***	-	-	9.500

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Initiate research on distributed and layered EW effects. Explore and analyze RF-based threats for potential counters and perform vulnerability assessments. Initiate research for advanced EW concepts.			
Accomplishments/Planned Programs Subtotals	54.822	39.274	43.538

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
• N/A: *N/A*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.