| Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Air Force | | | | | | | | | | DATE: April 2013 | |

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	PE 0603203F: *Advanced Aerospace Sensors*

COST ($ in Millions)	All Prior Years	FY 2012	FY 2013#	FY 2014 Base	FY 2014 OCO##	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	119.227	37.657	30.579	-	30.579	29.808	29.496	33.641	33.433	Continuing	Continuing
63665A: *Advanced Aerospace Sensors Technology*	-	34.705	16.269	16.649	-	16.649	12.809	14.900	14.609	15.245	Continuing	Continuing
6369DF: *Target Attack and Recognition Technology*	-	84.522	21.388	13.930	-	13.930	16.999	14.596	19.032	18.188	Continuing	Continuing

\# FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

\#\# The FY 2014 OCO Request will be submitted at a later date

A. Mission Description and Budget Item Justification

Divided into two broad project areas, this program develops technologies to enable the continued superiority of sensors from aerospace platforms. The first project develops and demonstrates advanced technologies for electro-optical sensors, radar sensors and electronic counter-countermeasures, and components and algorithms. The second project develops and demonstrates radio frequency (RF)and electro-optical (EO)sensors for detecting, locating, and targeting airborne, fixed, and time-critical mobile ground targets obscured by natural or man-made means. Together, the projects in this program develop the means to find, fix, target, track, and engage air and ground targets anytime, anywhere, and in any weather. This program has been coordinated through the the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new sensor and electronic combat system developments that have military utility and address warfighter needs.

B. Program Change Summary ($ in Millions)

	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	121.666	37.657	31.366	-	31.366
Current President's Budget	119.227	37.657	30.579	-	30.579
Total Adjustments	-2.439	0.000	-0.787	-	-0.787
• Congressional General Reductions	-	0.000			
• Congressional Directed Reductions	-	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	-	0.000			
• Congressional Directed Transfers	-	0.000			
• Reprogrammings	-1.573	0.000			
• SBIR/STTR Transfer	-0.866	0.000			
• Other Adjustments	0.000	0.000	-0.787	-	-0.787

Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Air Force		**DATE:** April 2013	
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*		**R-1 ITEM NOMENCLATURE** PE 0603203F: *Advanced Aerospace Sensors*	
Congressional Add Details ($ in Millions, and Includes General Reductions)		**FY 2012**	**FY 2013**
Project: 63665A: *Advanced Aerospace Sensors Technology*			
Congressional Add: *Program Increase*		10.000	-
	Congressional Add Subtotals for Project: 63665A	10.000	0.000
Project: 6369DF: *Target Attack and Recognition Technology*			
Congressional Add: *Blue Devil 1*		58.600	-
	Congressional Add Subtotals for Project: 6369DF	58.600	0.000
	Congressional Add Totals for all Projects	68.600	0.000

Change Summary Explanation

Reprogrammed for specific projects in accordance with Section 219 of the Duncan Hunter National Defense Authorization Act for Fiscal Year (FY) 2009, as amended by Section 2801 of the National Defense Authorization Act for FY 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force										DATE: April 2013	

APPROPRIATION/BUDGET ACTIVITY
3600: *Research, Development, Test & Evaluation, Air Force*
BA 3: *Advanced Technology Development (ATD)*

R-1 ITEM NOMENCLATURE
PE 0603203F: *Advanced Aerospace Sensors*

PROJECT
63665A: *Advanced Aerospace Sensors Technology*

COST ($ in Millions)	All Prior Years	FY 2012	FY 2013#	FY 2014 Base	FY 2014 OCO ##	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
63665A: *Advanced Aerospace Sensors Technology*	-	34.705	16.269	16.649	-	16.649	12.809	14.900	14.609	15.245	Continuing	Continuing

FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012
The FY 2014 OCO Request will be submitted at a later date

A. Mission Description and Budget Item Justification

This project develops and demonstrates aerospace sensor and processing technologies for intelligence, surveillance, reconnaissance (ISR), target, and attack radar applications in both manned and unmanned platforms, including electro-optical sensors and electronic counter-countermeasures for radars. It provides aerospace platforms with the capability to precisely detect, track, and target both airborne (conventional and low radar cross-section) and ground-based, high-value, time-critical targets in adverse clutter and jamming environments. Project activities include developing multi-function radio-frequency systems including radar and electronic warfare technology. Desired warfighting capabilities include the ability to detect concealed targets in difficult background conditions.

B. Accomplishments/Planned Programs ($ in Millions)

	FY 2012	FY 2013	FY 2014
Title: Integrated Navigation Technologies	5.963	1.621	4.500

Description: Develop and demonstrate technologies to provide precision position and timing information to enable distributed, layered sensing on air and space vehicles in Global Positioning System (GPS) degraded/denied environments. Develop technologies to maximize positional accuracy, timing accuracy, and exploitation techniques to improve offensive and defensive combat capabilities. Simulate, develop, and demonstrate integrated navigation warfare technologies, to establish and maintain a military advantage in satellite-based navigation.

FY 2012 Accomplishments:
Developed strategies to optimize reference technologies for distributed sensing missions. Explored alternatives when GPS is degraded or denied. Reduced size, weight, and power of inertial components. Enhanced precision of GPS and non-GPS reference technologies. Developed reference optimization components necessary to support bi-static and multi-static radar technologies. Evaluated progress and determined next spiral requirements.

FY 2013 Plans:
Continue to develop strategies to optimize reference technologies for distributed sensing missions. Maintain/enhance performance while reducing size, weight, and power. Continue development of reference optimization components necessary to support bi-static and multi-static radar technologies.

FY 2014 Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Develop technologies to preserve position, navigation, and timing (PNT) avilability, including augmentation technologies for GPS in the event of outage, and advanced technologies that do not rely on GPS. Explore integration of GPS with precise inertial measurement units (IMUs) and augmentation using geo-referenced imagery. Collaborate with Space Vehicles Directorate to develop advanced, low-drift IMUs involving novel measurement techniques.			
Title: Persistent Sensing in Contested Environment Technologies *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 2012 Accomplishments:* Initiated test and evaluation of dismount radar detection back end and algorithms in conjunction with the outdoor range. Initiated persistent multiple intelligence (multi-INT) sources layered sensing demonstration. Developed modular RF backend (demonstration of open systems architecture) for combined radar and signals intelligence (SIGINT) processing for eventual integration into the outdoor range. Provided systems engineering for development of integrated sensor for high altitude ISR. Initiated support and risk reduction efforts for a high altitude radar flight demonstration. *FY 2013 Plans:* Complete development of modular RF backend (demonstration of open systems architecture) for combined radar and SIGINT processing and integrate into the outdoor range. Continue development and testing of a wide area staring radar. *FY 2014 Plans:* Complete modular RF backend demonstration for combined radar and SIGINT. Continue research and development of a wide area staring radar, and begin development of staring rader RF testbed. Initiate research and development in next generation active RF sensing for contested spectrum environments, including investigation of the limits of active RF sensing with an emphasis on contested and denied environments.	14.337	8.844	4.000
Title: Passive RF Sensing Technologies *Description:* Develop advanced techniques and prototype passive RF sensors to intercept, collect, locate and track enemy RF sensor systems for intelligence, reconnaissance and surveillance of air and ground targets. *FY 2012 Accomplishments:*	3.246	3.675	4.149

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603203F: *Advanced Aerospace Sensors*	PROJECT 63665A: *Advanced Aerospace Sensors Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Completed system engineering and performed initial flight test of multistatic radar using existing aperture and receiver components. Collected flight data for small RPA direction finding and geolocation system, processed data using multiple algorithms. Demonstrated advanced electromagnetic methods for detecting difficult targets. ***FY 2013 Plans:*** Complete flight test data collection of passive multistatic radar process data and develop algorithms for future multistatic radar systems. ***FY 2014 Plans:*** Initiate research for creating passive RF sensing testbed for use in indoor and outdoor range laboratories. Initiate advanced exploration and investigation of the limits of passive RF sensing with an emphasis on innovative passive techniques for operations in contested and denied environments. Develop advanced techniques for the exploitation of active RF emitters utilizing passive RF sensing techniques. Conduct research and development of passive RF sensors including phenomenology, modeling and simulation, algorithm development and experimentation.			
Title: Long Range Sensing Technologies ***Description:*** Develop radio frequency (RF) and electro-optical (EO) sensor technology to detect, locate, and identify air and ground targets at long ranges, including those that are low-observable, or use deception or camouflage. ***FY 2012 Accomplishments:*** Performed concept validation and signature utility experiments for long-range synthetic aperture laser radar imaging. Conducted laboratory and field experiments for mitigating primary risk areas associated with synthetic aperture laser radar imaging from airborne platforms. Initiated development of master oscillator technology. ***FY 2013 Plans:*** Refine performance and signature models to validated requirements and concept of operations for long range synthetic aperture laser radar imaging. Continue laboratory and field experiments for mitigating primary risk areas associated with synthetic aperture laser radar imaging from airborne platforms. ***FY 2014 Plans:*** Initiate development of advanced active and passive electro-optical sensing technologies for surveillance and reconnaissance at standoff ranges in contested environments. Continue develop of long range temporal synthetic aperture ladar system. Demonstrate high power, high coherence transmitter and receiver array. Initiate ground and flight test plans for aircraft integration. Develop transceiver hardware for ground based imaging of satellite in geosyncronous orbit. Initiate test and	0.744	2.129	4.000

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		**DATE:** April 2013
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
characterization of mercury-cadmium-teluride on silicone focal plane. Initiate design and prototyping of passive infrared imaging system for enhanced range infrared target recognition and full motion video.			
Title: Dynamic Target Technologies	0.415	0.000	0.000
Description: Develop electro-optical sensing technologies for surveillance, tracking, and identification of dynamic targets in urban areas from manned and unmanned platforms. *FY 2012 Accomplishments:* Conducted concept demonstration experiments for exploiting infrared persistent surveillance imagery to detect, track, and characterize targets in urban areas. Performed utility assessment experiments to quantify system performance, analyzed human perception performance, and developed image processing techniques. Conducted proof-of-concept development of large format infrared camera technology for distributed airborne surveillance. *FY 2013 Plans:* Effort terminated due to higher DoD priorities. *FY 2014 Plans:* N/A			
Accomplishments/Planned Programs Subtotals	24.705	16.269	16.649

	FY 2012	FY 2013
Congressional Add: Program Increase	10.000	-
FY 2012 Accomplishments: Conducted Congressionally-directed effort for Program Increase.		
Congressional Adds Subtotals	10.000	0.000

C. Other Program Funding Summary ($ in Millions)
  N/A
Remarks

D. Acquisition Strategy
  N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2014 Air Force		**DATE:** April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	**R-1 ITEM NOMENCLATURE** PE 0603203F: *Advanced Aerospace Sensors*	**PROJECT** 63665A: *Advanced Aerospace Sensors Technology*

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 2014 Air Force											DATE: April 2013	

| APPROPRIATION/BUDGET ACTIVITY
3600: *Research, Development, Test & Evaluation, Air Force*
BA 3: *Advanced Technology Development (ATD)* | | | | R-1 ITEM NOMENCLATURE
PE 0603203F: *Advanced Aerospace Sensors* | | | | PROJECT
6369DF: *Target Attack and Recognition Technology* | | | | |

COST ($ in Millions)	All Prior Years	FY 2012	FY 2013#	FY 2014 Base	FY 2014 OCO ##	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
6369DF: *Target Attack and Recognition Technology*	-	84.522	21.388	13.930	-	13.930	16.999	14.596	19.032	18.188	Continuing	Continuing

FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

The FY 2014 OCO Request will be submitted at a later date

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced technologies for attack management, fire control, and target identification and recognition. This includes developing and demonstrating integrated and cooperative fire control techniques to provide for adverse-weather precision air strikes against multiple targets per pass and at maximum weapon launch ranges. Specific fire control technologies under development include attack management, sensor fusion, automated decision aids, advanced tracking for low radar cross section threats, and targeting using both on-board and off-board sensor information. This project also evaluates targeting techniques to support theater missile defense efforts in surveillance and attack. These fire control technologies will provide force multiplication and reduce warfighter exposure to hostile fire. This project also develops and demonstrates target identification and recognition technologies for positive, high confidence cueing, recognition, and identification of airborne and ground-based, high-value, time-critical targets at longer ranges than are currently possible. The goal is to apply these technologies to tactical air-to-air and air-to-surface weapon systems so they are able to operate in all weather conditions, during day or night, and in high-threat, multiple target environments. Model-based vision algorithms and target signature development techniques are the key to target identification and recognition. This project is maturing these technologies in partnership with the Defense Advanced Research Projects Agency and evaluating the techniques to support theater missile defense efforts in surveillance and attack. Fire control and recognition technologies developed and demonstrated in this project are high leverage efforts, providing for significant advancements in operational capabilities largely through software improvements readily transitionable to new and existing weapon systems.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Title: Automatic Target Recognition *Description:* Develop and demonstrate an automatic target recognition capability integrated with advanced geo-registration techniques and innovative change detection algorithms. *FY 2012 Accomplishments:* Conducted assessment and enhancement of technology supporting time-critical targeting systems for Planning & Direction, Collection, Processing & Exploitation, Analysis & Production, and Dissemination (PCPAD)Experimentation. Conducted spiral development and validation of synthetic data generation capability critically needed to augment collected research, development, and operational data sets. Enhanced the Air Force automatic target recognition test and evaluation facility and datasets as required to support enhanced PCPAD capabilities. *FY 2013 Plans:*	4.809	0.516	0.000

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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2012**	**FY 2013**	**FY 2014**
Complete development of enhancements to automatic target recognition, automatic target cueing, geo-registration, and change detection technology to meet warfighter needs. Complete assessment and enhancement of technology supporting time-critical targeting systems in automatic target recognition. Complete development and validation of synthetic data generation capability critically needed to augment collected research, development, and operational data sets. Enhance the Air Force automatic target recognition test and evaluation facility and data sets as required to support enhanced time-critical targeting capabilities. Complete development and assessment of time-critical targeting and advanced target tracking technologies required to meet warfighter requirements. *FY 2014 Plans:* Effort moved to Thrust 4 in this Project to better align efforts.			
Title: Integrated Sensor Targeting Technologies *Description:* Develop an advanced suite of sensors with automatic target recognition, fusion, and target tracking, all working in concert to provide a high-confidence identification capability. *FY 2012 Accomplishments:* Identified candidate technologies to address deficiencies to improve aimpoint tracking, electro-optical automatic target recognition, synthetic aperture radar automatic target recognition, and the multi-sensor fusion algorithms. Predicted performance of the integrated technologies and system. Enhanced phenomenological modeling, target, and scenario databases and exploitation tools necessary to support technology development. Assessed maturity of applicable technology. *FY 2013 Plans:* Continue to identify candidate technologies to address deficiencies to improve electro-optical automatic target recognition, synthetic aperture radar automatic target recognition, and multi-sensor fusion algorithms. *FY 2014 Plans:* Continue identification of new candidate technologies to address deficiencies to improve electro-optical automatic target recognition, synthetic aperture radar automatic target recognition and the multi-sensor fusion algorithms for both PCPAD and combat identification applications in contested and denied environments. Enhance phenomenological modeling, target and scenario databases and exploitation tools necessary to address contested and denied environments. Continue development of PCPAD capabilities for non-contested environments.	6.247	3.042	2.700
Title: Air-to-Ground Identification Technologies *Description:* Develop an "identify friend, foe, or neutral" air-to-ground capability using cooperative and non-cooperative identification techniques.	0.988	0.000	0.000

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
FY 2012 Accomplishments: Developed physics-based signature exploitation, modeling methods, and signal processing for feature-based recognition and fusion and applied these methods to sensor design to enable performance-based sensing. Developed an integrated radar sensor signature exploitation and signal processing analysis capability for recognition applications including staring radar,combat identification (CID), space situational awareness (SSA), measurement and signatures intelligene (MASINT), and ISR applications. Developed efficient methods for collecting and processing radar sensor data for recognition. Developed methods to analyze salient features to aid in the prediction, analysis, and processing capability as a function of sensor design parameters for performance-driven sensing. Developed a loosely coupled capability for multi-sensor measurement, processing, modeling, and analysis methods to support target recognition database development efforts and MASINT applications. *FY 2013 Plans:* Effort terminated due to higher DoD priorities. *FY 2014 Plans:* N/A			
Title: Multi-Sensor Target Recognition *Description:* Develop and assess multi-sensor automatic target recognition for intelligence, surveillance, reconnaissance, strike, and weapon systems. *FY 2012 Accomplishments:* Completed assessment of multi-sensor automatic exploitation algorithms in non contested environments. Initiated development of new automatic target recognition fusion algorithm to overcome shortfalls. Assessed technology supporting intelligence, surveillance, and reconnaissance systems. Continued development of an automatic target recognition fusion sensor data exploitation capability utilizing analysis and experimentation of data independence and interdependence of features to support development of an optimum data fusion exploitation capability. *FY 2013 Plans:* Initiate technology assessment of intelligence, surveillance and reconnaissance systems in anti-access/area denial environments. Analyze unique technology requirements for new automatic target recognition fusion algorithms to address anti-access/area denial environments. Initiate research in exploitation algorithms supporting Planning, Collection, Processing, Analysis and Dissemination (PCPAD). Continue development of fusion algorithm for automatic target recognition and exploitation in non-contested environments. *FY 2014 Plans:*	4.832	7.807	6.500

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Continue assessment of technology supporting intelligence, surveillance and reconnaissance systems in contested anti-access/area denial environments. Continue development of new automatic target recognition fusion research to address technology gaps. Initiate research in development and assessment of multi-sensor automatic target recognition specifically for strike. Initiate spiral development of sensor exploitation algorithms of multi-sensor automatic target recognition systems supporting PCPAD.			
Title: Wide-Angle, Continuously-Staring Technologies *Description:* Develop wide angle, continuous staring, multi-sensor/wavelength sensing and automated exploitation technology to detect, track, and identify targets over large areas at low sensor update rates. *FY 2012 Accomplishments:* Developed, integrated, and tested the next spiral engineering model of the multi-sensor, multi-wavelength wide-angle, continuously-staring capability building upon the technologies developed during the previous demonstration. Integrated, demonstrated, and tested the enhanced wide angle, continuously-staring component technologies via a combination of exercises and scientific analyses. Conducted spiral development of wide angle, continuous staring exploitation algorithms, phenomenological modeling, target, and scenario databases necessary to support transition to the warfighter. *FY 2013 Plans:* Develop, integrate, and test the next spiral engineering model of the multi-sensor, multi-wavelength wide-angle, continuously-staring capability building upon the technologies developed during the previous demonstration. Continue to integrate, demonstrate, and test the enhanced wide angle, continuously-staring component technologies via a combination of exercises and scientific analyses. Continue spiral development of wide angle, continuous staring exploitation algorithms, phenomenological modeling, target, and scenario databases necessary to support transition to the warfighter. *FY 2014 Plans:* Initiate development of continuously-staring capability in contested and denied environments building upon the previous technologies developed for non-contested environments. Integrate, demonstrate and evaluate the enhanced wide angle, continuously-staring component technologies in contested and denied environments. Continue spiral development of wide angle, continuous staring exploitation algorithms, phenomenological modeling, target and scenario databases necessary to support transition to the warfighter.	3.815	6.225	4.730
Title: RF Persistent Sensing Technologies *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 2012 Accomplishments:*	5.231	3.798	0.000

Exhibit R-2A, **RDT&E Project Justification:** PB 2014 Air Force		**DATE:** April 2013
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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2012**	**FY 2013**	**FY 2014**
Conducted systems engineering and initiated development of dual-band wide-angle, continuously staring hardware and identifed platform integration.			
FY 2013 Plans: Complete development of dual-band system, and integrate on to identified platform.			
FY 2014 Plans: N/A. This effort completes in FY13.			
Accomplishments/Planned Programs Subtotals	25.922	21.388	13.930

	FY 2012	**FY 2013**
Congressional Add: Blue Devil 1	58.600	-
FY 2012 Accomplishments: Supported Blue Devil 1 operations in theater.		
Congressional Adds Subtotals	58.600	0.000

C. Other Program Funding Summary ($ in Millions)

   N/A

Remarks

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.