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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Missile Defense Agency **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY
 0400: *Research, Development, Test & Evaluation, Defense-Wide*
 BA 4: *Advanced Component Development & Prototypes (ACD&P)*

R-1 ITEM NOMENCLATURE
 PE 0604884C: *AIRBORNE INFRARED (ABIR)*

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	-	111.671	46.877	-	46.877	49.948	49.173	33.035	34.249	Continuing	Continuing
MD67: <i>Airborne Infrared (ABIR)</i>	-	111.671	44.956	-	44.956	47.856	46.967	31.622	32.789	Continuing	Continuing
MD40: <i>Program-Wide Support</i>	-	-	1.921	-	1.921	2.092	2.206	1.413	1.460	Continuing	Continuing

A. Mission Description and Budget Item Justification

To support regional Ballistic Missile Defense, the Agency is developing ability to defeat enemy raids and early ballistic missile tracking to enable early intercepts. This will allow the Ballistic Missile Defense System (BMDS) to evaluate interceptor performance and then reengage if necessary. Since March 2009, the Airborne Sensors program office, in conjunction with the Office of the Secretary of Defense, the Air Force and the Navy demonstrated that sensors integrated on remotely piloted aircraft can provide a forward, mobile sensor for the Ballistic Missile Defense System.

System modeling has also shown that inclusion of airborne sensor increases the tracking potential of our TPY-2 radars by 100%. With airborne sensors as part of the architecture, it relieves our TPY-2 radars from their search requirement, making them much more efficient in their tracking and handling large raids. We have constructed a campaign to define the qualities the sensor will need and how to best integrate it into our Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance architectures to enable early tracking and intercepts.

We are conducting a series of ground and flight tests through FY 2013. These demonstrations incrementally prove the key functions of an airborne infrared sensor in the Ballistic Missile Defense System; acquisition of a threat based on a cue from overhead persistent infrared satellites; tracking of a threat throughout its flight; tracking threats' flight path using airborne sensors; fusing multiple tracks with sufficient accuracy and timeliness to launch an interceptor missile; and transmitting data through our prototype Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance network to the shooter. We are also pursuing technology development of an advanced sensor as a spiral development.

The Agency is working closely with the United States Air Force to maximize the potential of remotely piloted vehicles. The Agency is developing sensor and pod prototypes and the Air Force is developing the remotely piloted vehicles.

At the end of this campaign, we will have hardware, software, and knowledge for the Department to make decisions to add this mission to the existing remotely piloted vehicle force:

- Calibrated sensors with improved inertial measurement units

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0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 4: <i>Advanced Component Development & Prototypes (ACD&P)</i>	PE 0604884C: <i>AIRBORNE INFRARED (ABIR)</i>

- Ballistic Missile Defense mission sensor software suite
- Airborne processors for sensor control
- On-board recorders
- Type 1 National Security Administration certified encryption systems (for both line of sight and beyond line of sight communications)
- Pod integrating sensors, sensor control units, communications, and encryption systems

Contributions to Combatant Commanders Achievable Capabilities List:

- Search and monitor airspace
- Cue following advisory air and missile systems launch
- Track items of interest continuously
- Classify, identify, characterize, and discriminate
- Conduct effects assessment

Goals:

- Develop and test sensor prototypes and leverage Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance network to integrate with the operational layers of the Ballistic Missile Defense to provide precise early missile track information with sufficient accuracy and timeliness
- Demonstrate the ability of airborne sensors to close the Aegis fire control loop for early intercept of regional ballistic missiles
- Demonstrate the ability of airborne sensors during raid scenarios to track ballistic missiles to augment TPY-2 radars
- Deliver knowledge to enable acquisition decisions to procure and field an operational system
- Demonstrate airborne sensor discrimination

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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	-	111.671	103.636	-	103.636
Current President's Budget	-	111.671	46.877	-	46.877
Total Adjustments	-	-	-56.759	-	-56.759
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Other Adjustment Detail	-	-	-56.759	-	-56.759

Change Summary Explanation

The FY 2012 \$56.759 million dollar decrease in this program element is the result of MDA programmatic changes and \$1.825 million in efficiency savings.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Missile Defense Agency **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 4: <i>Advanced Component Development & Prototypes (ACD&P)</i>	R-1 ITEM NOMENCLATURE PE 0604884C: <i>AIRBORNE INFRARED (ABIR)</i>	PROJECT MD67: <i>Airborne Infrared (ABIR)</i>
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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
MD67: <i>Airborne Infrared (ABIR)</i>	-	111.671	44.956	-	44.956	47.856	46.967	31.622	32.789	Continuing	Continuing
Quantity of RDT&E Articles	0	1	1		1	0	0	0	0		

A. Mission Description and Budget Item Justification

Tracking large enemy ballistic missile raids with airborne sensors forward in the theater gives us a tremendous ability to decrease the time between the enemy's launch and our first track. This increases our battle space by hundreds of seconds and gives us the ability to shoot, look, and then shoot again. This improves our ability to successfully engage the enemy threat and defeat it.

Massachusetts Institute of Technology Lincoln Laboratory and the Joint Integrated Air and Missile Defense Organization released an Alternatives Assessment study that concluded airborne sensors integrated on remotely piloted vehicles are technically feasible and cost effective. In this study, we selected the Multi-spectral Targeting Sensor due to its proven performance in an operational environment. We can put the Multi-spectral Targeting Sensor in a pod without integrating into a specific platform. They will have two color, medium and long wave bands we need to single out the enemy's threat vehicles from decoys. We are also developing advanced sensors technology. The United States Air Force conducted a platform assessment and selected the MQ-9 Reaper for our campaign.

Last year we proved promising sensitivity, pointing, and timely delivery of tracking information from great distances on several targets of opportunity that included Intercontinental Ballistic Missiles and tactical missiles. Results of these tests include the ability to: track first and second stage booster separation; track dim targets; and pass real time object sighting messages to the ground stations. The success of these tests prove forward based airborne sensors can be an effective component of the Ballistic Missile Defense System by using the tremendously promising sensitivity and precision pointing to track ballistic missiles of all ranges from great distances.

The Missile Defense Agency, with Massachusetts Institute of Technology Lincoln Laboratory and industry partners are developing an airborne processor which will control sensor pointing, sensor tasking, and formation of object sighting messages both for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance network and our Aegis shooters. Additionally, the Combatant Commanders are developing a concept of operations for adding this mission to the Nation's remotely piloted vehicle fleet.

We are executing a campaign that leverages previously unexploited platforms and sensors through a series of knowledge points culminating in 2013. We will achieve these knowledge points through experiments leveraging existing Ballistic Missile Defense System test events and other targets of opportunity. These knowledge points include measuring sensor performance, target auto tracking, large raid handling capacity, secure communications, accuracy and timeliness to close the fire control loop for early intercept of regional ballistic missile engagements.

Our campaign progresses from models and simulations to ground and flight tests to incrementally verify and validate functionality. Our graduation exercise will occur in 2013. We have planned three experiments for this graduation exercise. The first will demonstrate Aegis' s ability to launch on tracks from this sensor and close their fire control loop. The second will use multiple wavebands of the sensor to extract target features and transmit to command and control nodes to enhance overall ballistic

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missile defense discrimination. The third will demonstrate our ability to handle a large raid of enemy missiles. In parallel, we will develop an advanced sensor as a spiral development to the infrared technology.

Near-term knowledge gained from airborne sensors requirements development and experimentation is directly applicable to air launched hit to kill operations concepts, detection, tracking, and early threat classification. Synergies result from sensor characterization, sensor control algorithms, track generation and processing, and communication paths.

We use a robust modeling and simulation process where we rapidly develop, low-fidelity models and update with high-fidelity models as our airborne sensor matures. Our models are added to a Ballistic Missile Defense System level modeling and simulation environment including other Ballistic Missile Defense System elements to develop a simulation tool suite that rapidly integrates models from diverse sensor projects. This tool suite facilitates trades studies and analyses at the system level to assess future Aegis missile engagement performance.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2010	FY 2011	FY 2012
<p>Title: ABIR</p> <p style="text-align: right;">Articles:</p> <p>Description: See Description Below</p> <p>FY 2010 Accomplishments: Funding for these FY 2010 accomplishments is reported in prior year budget project WX25 (\$54,795).</p> <p>Airborne sensors activities were funded out of multiple program elements from within the Missile Defense Agency portfolio in FY10.</p> <ul style="list-style-type: none"> -Completed alternatives analysis -Executed five risk reduction tests: demonstrated sensor pointing performance, real-time closed loop tracking, and post mission data fusion -Developed program plan and functional allocations -Completed systems concept review -Delivered two infrared sensors -Completed one sensor and two airborne processor software builds; two modeling and simulation builds <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> -Modify sensors -Deliver software for software and hardware in the loop experiments -Deliver software modifications for sensor control -Deliver system engineering modeling and simulation drops 	<p>-</p> <p>0</p>	<p>105.671</p> <p>1</p>	<p>44.956</p> <p>1</p>

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APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 4: <i>Advanced Component Development & Prototypes (ACD&P)</i>	R-1 ITEM NOMENCLATURE PE 0604884C: <i>AIRBORNE INFRARED (ABIR)</i>	PROJECT MD67: <i>Airborne Infrared (ABIR)</i>			
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2010	FY 2011	FY 2012	
<ul style="list-style-type: none"> -Test with Reaper ground control station and platform -Demonstrate sensor field of regard -Demonstrate sensor performance -Demonstrate target auto tracking functionality -Demonstrate 3-dimensional tracking performance -Demonstrate multiple target tracking functionality -Demonstrate software functionality in hardware in the loop testing -Demonstrate airborne sensors risk reduction abilities for Ballistic Missile Defense System and targets of opportunity flight testing -Simulate launch on remote with Aegis weapon system <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> -Demonstrate external cue to the remotely piloted aircraft -Demonstrate sensor performance on remotely piloted aircraft -Demonstrate off-board field of view sensor management -Demonstrate timely and accurate track deliveries -Demonstrate multi-band discrimination capabilities -Complete measure of sensor performance and aircraft integration knowledge point -Complete air launched hit to kill analysis of alternatives -Deliver and test in our integrated modeling and simulation environment -Demonstrate advanced sensor component technology 					
<p>Title: ABIR Fielding</p> <p>Description: See Description Below</p> <p>FY 2010 Accomplishments: Not Applicable</p> <p>FY 2011 Plans: Site planning and associated designs.</p> <p>FY 2012 Plans: Not Applicable</p>		Articles:	- 0	6.000 0	- 0
Accomplishments/Planned Programs Subtotals		-	111.671	44.956	

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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• 0603175C: <i>Ballistic Missile Defense Technology</i>	164.670	132.220	75.003		75.003	103.844	111.712	164.378	170.851	Continuing	Continuing
• 0603884C: <i>Ballistic Missile Defense Sensors</i>	544.352	454.859	222.374		222.374	357.271	336.514	318.321	348.944	Continuing	Continuing

D. Acquisition Strategy

The Agency is developing and integrating sensor performance. The Air Force is developing and managing the remotely piloted vehicles onto which this system will be integrated.

The acquisition strategy consists of three focus areas. First, leverage the technical expertise of Federally Funded Research and Development Centers and University Applied Research Centers. Second, continue to leverage relevant Office of the Secretary of Defense, Navy, Air Force and Agency contracts within the limits of Competition and Contracting Act taking into account contractor past performance, scope, ceiling and period of performance. Third, seek industry solutions via the Advanced Technology Broad Agency Announcement.

E. Performance Metrics

NA

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2012 Missile Defense Agency **DATE:** February 2011

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Product Development (\$ in Millions)				FY 2011		FY 2012 Base		FY 2012 OCO		FY 2012 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Total Prior Years Cost	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
ABIR Airborne Infrared Sensors MD67	SS/BOA	Raytheon:McKinney, TX	-	57.800	Oct 2010	-		-		-	0.000	57.800	57.800
ABIR Air Vehicle MD67	C/CPFF	General Atomics:Poway, CA	-	-		9.761	Oct 2011	-		9.761	Continuing	Continuing	Continuing
ABIR Sensor Development MD67	C/CPFF	Raytheon:McKinney, TX	-	-		6.000	Oct 2011	-		6.000	Continuing	Continuing	Continuing
ABIR Algorithms and software builds; processor hardware; advanced sensor MD67	FFRDC	Massachusetts Institute of Technology Lincoln Lab:Lexington, MA	-	-		9.573	Oct 2011	-		9.573	Continuing	Continuing	Continuing
ABIR Software builds; requirements and processor hardware MD67	C/CPFF	Raytheon:McKinney, TX	-	-		3.000	Oct 2011	-		3.000	Continuing	Continuing	Continuing
ABIR Sensor Characterization MD67	C/CPFF	Arnold Engineering Development Center:Arnold Air Force Base, TN	-	-		1.250	Oct 2011	-		1.250	Continuing	Continuing	Continuing
ABIR Sensor Characterization - 20111175175798 MD67	C/CPFF	Space Dynamic Lab:Logan, UT	-	-		1.750	Oct 2011	-		1.750	Continuing	Continuing	Continuing
Subtotal			-	57.800		31.334		-		31.334			

Support (\$ in Millions)				FY 2011		FY 2012 Base		FY 2012 OCO		FY 2012 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Total Prior Years Cost	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
ABIR Research MD67	MIPR	Massachusetts Institute of Technology Lincoln Lab:Lexington, MA	-	20.971	Oct 2010	-		-		-	0.000	20.971	20.971
ABIR Fielding Planning & Design MD67	C/CPFF	Wyle:El Segundo, CA	-	6.000		-		-		-	0.000	6.000	6.000
Subtotal			-	26.971		-		-		-	0.000	26.971	26.971

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2012 Missile Defense Agency **DATE:** February 2011

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Test and Evaluation (\$ in Millions)				FY 2011		FY 2012 Base		FY 2012 OCO		FY 2012 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Total Prior Years Cost	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
ABIR Testing MD67	SS/BOA	Raytheon:General Atomics	-	21.200	Oct 2010	-		-		-	32.100	53.300	53.300
ABIR System Test and Evaluation MD67	C/CPFF	Raytheon:General Atomics	-	-		7.922	Oct 2011	-		7.922	Continuing	Continuing	Continuing
Subtotal			-	21.200		7.922		-		7.922			

Remarks

Management Services (\$ in Millions)				FY 2011		FY 2012 Base		FY 2012 OCO		FY 2012 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Total Prior Years Cost	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
ABIR Program Management MD67	Allot	Missile Defense Agency Civilians:Missile Defense Agency	-	5.700	Oct 2010	-		-		-	0.000	5.700	5.700
ABIR Program Management - 20111175280134 MD67	Allot	Missile Defense Agency:Air Force/ Other Government Agency's	-	-		5.700	Oct 2011	-		5.700	Continuing	Continuing	Continuing
Subtotal			-	5.700		5.700		-		5.700			

	Total Prior Years Cost	FY 2011		FY 2012 Base		FY 2012 OCO		FY 2012 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals		-	111.671		44.956		-	44.956			

Remarks

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Exhibit R-4, RDT&E Schedule Profile: PB 2012 Missile Defense Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 4: <i>Advanced Component Development & Prototypes (ACD&P)</i>	R-1 ITEM NOMENCLATURE PE 0604884C: <i>AIRBORNE INFRARED (ABIR)</i>	PROJECT MD67: <i>Airborne Infrared (ABIR)</i>

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Exhibit R-4A, RDT&E Schedule Details: PB 2012 Missile Defense Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 4: <i>Advanced Component Development & Prototypes (ACD&P)</i>	R-1 ITEM NOMENCLATURE PE 0604884C: <i>AIRBORNE INFRARED (ABIR)</i>	PROJECT MD67: <i>Airborne Infrared (ABIR)</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Measure ability to close the AEGIS BMD fire control loop using airborne sensors	4	2011	4	2011
Measure 2-color discrimination of airborne sensors	3	2012	3	2012
Measure raid handling capability of airborne sensors	2	2013	2	2013
Deliver final airborne processor software load	1	2013	1	2013
Test with Reaper ground control station and platform	1	2011	1	2011
Deliver final sensor software load	1	2013	1	2013
Deliver final airborne processor hardware	1	2012	1	2012
Measure advanced sensor spiral discrimination improvements	3	2014	3	2014
Measure advanced sensor spiral raid handling improvements	4	2014	4	2014
Operations concept experiments Phase 1	4	2014	4	2014
Operations concept experiments Phase 2	4	2015	4	2015
Operations concept experiments Phase 3	4	2016	4	2016

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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
MD40: <i>Program-Wide Support</i>	-	-	1.921	-	1.921	2.092	2.206	1.413	1.460	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0		0	0	0	0	0		

A. Mission Description and Budget Item Justification

Program-Wide Support (PWS) contains non-headquarters management costs in support of MDA functions and activities across the entire Ballistic Missile Defense System (BMDS). Includes Government Civilians, Advisory and Assistance Services, and Federally Funded Research and Development Contracts (FFRDC) providing integrity and oversight of the BMDS as well as supporting MDA in enabling the development and evaluation of technologies that will respond to the changing threat. Other costs included provide facility capabilities for MDA Executing Agent locations (with the exception of Federal Office Building 2 after FY 2011), such as physical and technical security, legal services, travel and agency training, office and equipment leases, rents and utilities, data and unified communications support, supplies and maintenance, and similar operating expenses. Also includes legal settlements, and foreign currency fluctuations on a limited number of foreign contracts. In keeping with congressional intent, PWS is allocated among the PEs on a pro-rata basis and therefore fluctuates by year based on the total MDA budget and the individual PE's budget amount.

The budget project did not exist in program wide support in FY2010.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2010	FY 2011	FY 2012
Title: Civilian Salaries and Support	-	-	1.921
Articles:	0	0	0
Description: See Description Below			
FY 2010 Accomplishments: The budget project did not exist in program wide support in FY2010.			
FY 2011 Plans: The budget project did not exist in program wide support in FY2010.			
FY 2012 Plans: See paragraph A, Mission Description and Budget Item Justification			
Accomplishments/Planned Programs Subtotals	-	-	1.921

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C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

NA