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 3: *Advanced Technology Development (ATD)*				R-1 ITEM NOMENCLATURE PE 0603901C: *DIRECTED ENERGY RESEARCH*							
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	-	98.688	96.329	-	96.329	91.953	93.134	92.304	95.003	Continuing	Continuing
MD69: *Directed Energy Research*	-	95.398	92.643	-	92.643	88.390	89.325	88.764	91.371	Continuing	Continuing
MD40: *Program-Wide Support*	-	3.290	3.686	-	3.686	3.563	3.809	3.540	3.632	Continuing	Continuing

Note

In FY11 the Boost Defense program transitioned from a weapon system development program to a science and technology program; therefore the associated funding transferred to the Directed Energy Research program element, 0603901C in FY11.

A. Mission Description and Budget Item Justification

The Missile Defense Agency (MDA) will conduct research into the transmission and control of directed energy through and above the atmosphere. The research will include investigation of multiple high energy laser technologies, characterization of the atmosphere as it relates to directed energy propagation, improving beam control, and improving modeling and simulation. A main objective of the program is to anchor beam propagation models for both the Air Force and Missile Defense applications as well as testing the operation and lethality of lasers in the atmosphere. The agency will work with the Director of Defense Research and Engineering and High Energy Laser Joint Technology Office in a systems engineering based strategy for the research, development, test and evaluation of high energy laser technologies.

In FY 2011, the agency will pursue additional directed energy technologies for testing and use against projected threats while continuing to seek opportunities to integrate concepts into the aircraft laser test platform for experimentation. An advanced missile defense technology development program is part of the MDA strategy to develop emerging and maturing technologies.

The Directed Energy Research contributions to the Combatant Commanders Prioritized Capabilities List include:

- Engage and re-engage a threat to include simple and advanced air and cruise missiles, Short Range Ballistic Missiles (SRBM), Medium Range Ballistic Missiles (MRBM), Intermediate Range Ballistic Missiles (IRBM) and Intercontinental Ballistic Missiles (ICBM)

The primary goals of the Directed Energy Research Program are to: perform lethality demonstrations using additional target types, improve acquisition, tracking and pointing; collect data from boundary-layer turbulence; develop advanced adaptive optics; control and mitigate contamination; compensate for thermal blooming; and explore and develop Diode Pumped Alkali Laser System (DPALS). DPALS technology offers a path forward to high efficiency, electrically-driven, compact, light-weight High Energy Lasers (HEL); advanced technologies that address future threats. The successful completion of DPALS would open the door to a game-changing laser technology that promises to greatly enhance the utility of high power lasers for missions of interest to MDA and DoD. MDA plans to measure DPALS progress using Knowledge Points (KP).

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 3: *Advanced Technology Development (ATD)*	**R-1 ITEM NOMENCLATURE** PE 0603901C: *DIRECTED ENERGY RESEARCH*

- KP1 is a low power continuous operation DPALS that MDA plans to demonstrate in the second quarter of FY 2011
- KP2 is a medium power continuous operation DPALS that MDA plans to demonstrate in the second quarter of FY 2011

B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	-	98.688	101.371	-	101.371
Current President's Budget	-	98.688	96.329	-	96.329
Total Adjustments	-	-	-5.042	-	-5.042
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Other Adjustment Detail	-	-	-5.042	-	-5.042

Change Summary Explanation

The FY 2012 $5.042 million dollar decrease is the result of MDA programmatic changes.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Missile Defense Agency			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603901C: *DIRECTED ENERGY RESEARCH*	PROJECT MD69: *Directed Energy Research*	

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
MD69: *Directed Energy Research*	-	95.398	92.643	-	92.643	88.390	89.325	88.764	91.371	Continuing	Continuing

A. Mission Description and Budget Item Justification

Following the planned Airborne Laser Test Bed (ALTB) testing in FY 2010, the Director of Defense Research and Engineering determined the ALTB aircraft is cost effective as a science and technology test bed for high power laser research and development. The agency will maintain the ALTB aircraft as a test bed for flight and ground tests to characterize lethality, high energy laser beam propagation, anchor system models for both Air Force and Missile Defense applications and a Diode Pumped Alkali Laser System (DPALS) and other directed energy tests. MDA will also test the operation and lethality of lasers in the atmosphere. The Airborne Laser Test Bed (ALTB) aircraft has two laser mounts and optical beam paths on the aircraft. The Chemical Oxygen Iodine Laser (COIL) occupies one mount while the Surrogate High Energy Laser (sHEL) occupies the other. The sHEL bench can be replaced with other high efficiency, electrically-pumped laser systems; advanced technologies that the program is currently investigating. MDA will place new laser systems, such as DPALS, on the mount formerly used for the sHEL.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Directed Energy Research	-	95.398	92.643
Description: See Description Below			
FY 2010 Accomplishments: Funding for these FY2010 accomplishments are reported in prior year budget project WX19, Airborne Laser Capability Development, in Program Element 0603883C, Boost Defense Segment ($167,608) -Completed ALTB Technology Demonstrator lethal demonstration - This demonstrated ALTB capability to negate a threat representative boosting ballistic missile (completed Feb 10) -Conducted additional lethal demonstration events through 4th Quarter of FY 2010 to further evaluate geometries and ranges of the current ALTB configuration, followed by system characterization, support, and development activities -Closed out technology demonstrator development contract (closeout of contractual requirements) -Completed engagement against a Low Power Missile Alternative Range Target Instrument (MARTI) - validated and characterized Low Power (using the Surrogate High Energy laser) ALTB performance against boosting targets -Demonstrated High Energy Laser (HEL) performance Internal/External on the Aircraft in Flight - demonstrated functionality of the optical system with the HEL on the aircraft in flight -Completed engagement against a High Power Missile Alternative Range Target Instrument (MARTI) - validated and characterized High Power (using High Energy Laser) ALTB performance against boosting targets Maintained ALTB chemical operations and initiated post lethal demonstration ground test program to further characterize performance:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Missile Defense Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603901C: *DIRECTED ENERGY RESEARCH*	PROJECT MD69: *Directed Energy Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
-Completed High Energy Laser power tuning/optimization testing, for increases in High Energy Laser power to provide a longer range kill capability -Completed wavefront analysis to provide a longer range kill capability -Completed Beam Control/Fire Control adjustments to improve jitter and pointing accuracy in order to engage ballistic missiles at greater range Conducted sustainment activities to maintain ALTB: -Sustained the ALTB (Laser, Beam Control/Fire Control, and Battle Management subsystems) -Provided Quality Safety and Mission Assurance (QSMA) operations to ensure compliance with requirements for design, test, manufacturing, quality, safety and reliability -Continued implementation of ALTB program security requirements -Published Adversary Data Package Addenda reflecting intelligence assessment updates -Produced and updated threat data to support demonstration of ALTB capability to destroy a boosting missile flight -Explored beam propagation to anchor models and simulations for both Air Force and Missile Defense applications Industrial Base: -Continued development of advanced optics, coatings, and substrates to enable higher power/increased reliability laser operations -Maintained optics testing capabilities while testing new optics, materials, and coatings to maintain ready spares/aircraft availability -Continued improvements to bulkhead window production capability to enable higher power/longer and safer High Energy Laser (HEL) operations Combined Test Force: -Planned for and supported ALTB maintenance activities -Planned for and supported ground and flight test activities for the ALTB Characterization and Capability Demonstration phase: system characterization and adjunct missions -Evaluated the propagation and lethality of lasers in the atmosphere -Created and presented safety documents to the test wing safety review boards Lethality and Survivability:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Missile Defense Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603901C: *DIRECTED ENERGY RESEARCH*	PROJECT MD69: *Directed Energy Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
-Continued intelligence, lethality data collection, assessments and evaluation Diagnostics/Instrumentation: -Ensured dedicated Airborne Diagnostic Target (ADT) was available for use during additional flight tests in FY 2010 ***FY 2011 Plans:*** -MDA will transition the Airborne Laser Test Bed (ALTB) aircraft to a national test platform for testing advanced directed energy technologies for missile defense -Working with Director of Defense Research and Engineering and the High Energy Laser Joint Technology Office, we will use the aircraft platform in flight and ground tests to characterize high-energy laser beam propagation -Characterize the effects of atmospheric propagation, boundary layer and jitter effects with varying engagement geometries -Field test data for model validation and verification -Test platform for integrated laser weapon system demonstrations -Anchor models for airborne directed energy assets -Investigate advanced technologies to increase efficiency of beam control -Investigate software algorithms for improvements to beam control and fire control -With the Joint Technology Office, apply directed energy technologies against current threats -Develop and experiment with diode-pumped gas lasers, fiber lasers, solid state and advanced high-power laser optics -Investigate lethality, counter-counter measures, beam propagation, modeling, laser beam combining, and additional innovative areas -Conduct analysis of alternatives to select out-year directed energy investments ***FY 2012 Plans:*** -MDA will continue to use the Airborne Laser Test Bed as a national test platform for testing advanced directed energy technologies for the Department of Defense (DoD) -Continue to use the aircraft in flight and ground tests to characterize laser beam propagation and effects -Continue to characterize the effects of atmospheric propagation, boundary layer and jitter effects for additional engagement scenarios -Collect field test data for model validation and verification			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Missile Defense Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603901C: *DIRECTED ENERGY RESEARCH*	PROJECT MD69: *Directed Energy Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
-Conduct experiments for integrated laser weapon system demonstration against additional DoD targets -Mature models for airborne directed energy assets -Continue investigating technologies to improve beam control capabilities -Implement software algorithms for improvements to beam control and fire control -Continue to explore and develop directed energy technologies for use against current and future threats. The program will continue developing Diode Pumped Alkali Lasers (DPALs) and demonstrate laser power scaling in a series of knowledge point demonstrations. -Conduct power scaling experiments with diode-pumped gas lasers, fiber and solid state lasers and advanced high-power laser optics -Complete knowledge point demonstration - characterize DPALs breadboard power and thermal systems -Continue investigating lethality, countermeasures, beam propagation, modeling, laser beam combining as well as investigate additional innovative areas -The successful completion of these knowledge point demonstrations would open the door to a new type of laser technology that promises to greatly enhance the utility of high power lasers for missions of interest to MDA and DoD			
Accomplishments/Planned Programs Subtotals	-	95.398	92.643

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• 0603175C: *Ballistic Missile Defense Technology*	164.670	132.220	75.003		75.003	103.844	111.712	164.378	170.851	Continuing	Continuing
• 0603883C: *Ballistic Missile Defense Boost Defense Segment*	172.419	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	172.419
• 0603888C: *Ballistic Missile Defense Test and Targets*	737.863	1,113.425	1,071.039		1,071.039	898.680	790.906	787.113	878.215	Continuing	Continuing

D. Acquisition Strategy

MDA`s fiscal year FY 2012 budget submission reflects an emphasis on boost phase research and development. A main objective of the Airborne Laser Test Bed (ALTB) is to anchor beam propagation models for both Air Force and Missile Defense applications as well as testing the operation and lethality of lasers in the atmosphere. The acquisition strategy to conduct this technology development effort consists of three pillars. First, leverage the technical expertise of National Laboratories, Federally Funded Research and Development Centers and University Applied Research Centers. Second, continue to leverage relevant existing

Exhibit R-2A, RDT&E Project Justification: PB 2012 Missile Defense Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603901C: *DIRECTED ENERGY RESEARCH*	PROJECT MD69: *Directed Energy Research*

contracts within limits of the Competition and Contracting Act (CICA) taking into account contractor past performance, scope, ceiling and period of performance. The existing Airborne Laser Test Bed (ALTB) prime contract will continue but with a focus on reducing the level of support required as a Science and Technology (S&T) test bed. The program will identify activities that will transition from the contractor in order to maximize efficiencies and ensure ALTB program affordability. This transition of functions supports the Air Force industrial base and other Air Force high energy laser programs. Third, for new technology initiatives, seek industry solutions via the Advanced Technology Broad Agency Announcement for competitive procurements.

E. Performance Metrics

NA

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APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603901C: *DIRECTED ENERGY RESEARCH*	PROJECT MD40: *Program-Wide Support*	

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: *Program-Wide Support*	-	3.290	3.686	-	3.686	3.563	3.809	3.540	3.632	Continuing	Continuing

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 for this PE did not exist in Program Wide Support in FY2010.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Civilian Salaries and Support	-	3.290	3.686
Description: See Description Below ***FY 2010 Accomplishments:*** The Budget Project for this PE did not exist in Program Wide Support in FY2010 ***FY 2011 Plans:*** See Paragraph A, Mission Description and budget item justification ***FY 2012 Plans:*** See Paragraph A, Mission Description and budget item justification			
Accomplishments/Planned Programs Subtotals	-	3.290	3.686

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2012 Missile Defense Agency		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	**R-1 ITEM NOMENCLATURE** PE 0603901C: *DIRECTED ENERGY RESEARCH*	**PROJECT** MD40: *Program-Wide Support*

E. Performance Metrics

NA