Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602605F: *DIRECTED ENERGY TECHNOLOGY*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	102.906	103.596	111.156	-	111.156	117.496	121.197	124.272	126.586	Continuing	Continuing
624866: *Lasers & Imaging Technology*	72.450	77.821	84.402	-	84.402	87.813	90.647	93.324	95.029	Continuing	Continuing
624867: *Advanced Weapons & Survivability Technology*	30.456	25.775	26.754	-	26.754	29.683	30.550	30.948	31.557	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program covers research in directed energy (DE) technologies, primarily laser devices, optical beam control, and high power microwaves. In laser devices, this research includes moderate to high power laser devices that are applicable to a wide range of applications. In beam control, this research includes optical technologies to propagate lasers beams from a device and to provide ground-based optical space situational awareness. In high power microwaves, this research examines technologies for applications such as counter-electronics and non-lethal weapons. Vulnerability/lethality assessments are conducted for representative DE technologies. Research into other advanced non-conventional weapons will be conducted. Efforts in this program have 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 technologies.

B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	105.231	103.596	112.629	-	112.629
Current President's Budget	102.906	103.596	111.156	-	111.156
Total Adjustments	-2.325	-	-1.473	-	-1.473
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.307	-			
• Other Adjustments	-0.018	-	-1.473	-	-1.473

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602605F: *DIRECTED ENERGY TECHNOLOGY*	PROJECT 624866: *Lasers & Imaging Technology*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
624866: *Lasers & Imaging Technology*	72.450	77.821	84.402	-	84.402	87.813	90.647	93.324	95.029	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project explores the technical feasibility of moderate to high power lasers, including beam control, for applications such as aircraft protection, force protection, and precision engagement. This project investigates the effects of laser weapons. Research in ground based optical space situational awareness is conducted.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1. ***Description:*** Develop high energy laser device technologies for Air Force applications. ***FY 2010 Accomplishments:*** Developed technologies, incorporating joint service and agency technology advances, to support the design of a weapon-class electric laser demonstrator for inclusion on a large aircraft. Enhanced design of laser sources for aircraft self-protection and refined system packaging. Improved laser nozzle and generator designs to enhance performance of chemical oxygen-iodine lasers. Demonstrated initial diode-pumped atomic laser concept scaling capability. ***FY 2011 Plans:*** Test laser components and subsystems incorporating advances for thermal management. Ruggedize laser sources for aircraft self-protection and improve system packaging. Demonstrate operation of a flowing diode-pumped alkaline laser. Conduct damage/vulnerability tests against real and simulated systems. ***FY 2012 Base Plans:*** Conduct research supporting design and fabrication of weapons-class laser components, including hybrid and fiber lasers, for potential inclusion on an aircraft. Develop, design, and test selected components and subsystems for an electric laser weapon demonstrator on a large aircraft. Develop advanced electrically-powered laser concepts. ***FY 2012 OCO Plans:***	33.811	36.044	36.807	-	36.807
Title: Major Thrust 2.	13.347	14.401	17.173	-	17.173

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602605F: *DIRECTED ENERGY TECHNOLOGY*	PROJECT 624866: *Lasers & Imaging Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Description: Develop and demonstrate optical laser beam control technologies including atmospheric compensation and pointing and tracking. Demonstrate the integration of optical beam control technologies with laser device technologies. ***FY 2010 Accomplishments:*** Demonstrated in the laboratory selected atmospheric compensation concepts for laboratory long horizontal path propagation. Began laboratory testing of major subsystems for the tactical relay mirror demonstrator. Completed component research and modeling and simulation efforts supporting the joint Air Force/Defense Advanced Research Projects Agency (AF/DARPA) field demonstration of a high power solid state laser with a beam control system. ***FY 2011 Plans:*** Upgrade horizontal propagation compensation concepts for field demonstrations. Begin tactical relay mirror demonstrations at low power. Conduct spin-off laser communications research focused on ultra-high data rate, free-space, secure communications including atmospheric signal degradation. ***FY 2012 Base Plans:*** Conduct laboratory testing on horizontal propagation compensation concepts and begin planning for field testing. Complete tactical relay mirror demonstrations at low and high power. Demonstrate a high power solid state laser with a beam control system on the ground. ***FY 2012 OCO Plans:***					
Title: Major Thrust 3. ***Description:*** Develop advanced, long-range, optical technologies that support ground-based optical space situational awareness. ***FY 2010 Accomplishments:*** Completed system tests of second-generation sodium beacon adaptive optics system on 3.5 meter telescope. Performed demonstrations of compensated imaging and detection of very dim objects at visible and near-infrared wavelengths. Investigated passive and active imaging techniques and demonstrated imaging and non-imaging space-object identification techniques. ***FY 2011 Plans:***	25.292	27.376	30.422	-	30.422

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602605F: *DIRECTED ENERGY TECHNOLOGY*	PROJECT 624866: *Lasers & Imaging Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Assess capabilities of second-generation sodium beacon adaptive optics system on 3.5 meter telescope at visible and near-infrared wavelengths. Develop and refine technologies to advance space situational awareness. ***FY 2012 Base Plans:*** Conduct research, including data analysis, and demonstrate compensated imaging and detection of very dim objects at visible and near-infrared wavelengths using advanced adaptive optics systems at Starfire Optical Range and Maui Space Surveillance Systems site. Integrate and test technologies to advance ground-based optical space situational awareness. ***FY 2012 OCO Plans:***					
Accomplishments/Planned Programs Subtotals	72.450	77.821	84.402	-	84.402

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
• Activity Not Provided: *Title Not Provided*	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 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602605F: *DIRECTED ENERGY TECHNOLOGY*	PROJECT 624867: *Advanced Weapons & Survivability Technology*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
624867: *Advanced Weapons & Survivability Technology*	30.456	25.775	26.754	-	26.754	29.683	30.550	30.948	31.557	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project explores high power microwave (HPM) and other non-conventional/innovative weapon concepts such as disruption, degradation, and damage of electronic infrastructure and non-lethal anti-personal. This research will allow effects to be covert with no collateral structural or human damage. This project also investigates the effects of HPM weapons and HPM mitigation technologies.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1. ***Description:*** Investigate technologies for HPM components. Investigate HPM and other unconventional weapon concepts using innovative technologies. ***FY 2010 Accomplishments:*** Developed and evaluated components of the narrowband HPM aerial demonstrator including electromagnetic interference/electromagnetic capability. Conducted laboratory experiments using new types of HPM waveforms for counter-electronics applications. Designed hardware to generate high energy density plasmas, based on experimental validation, for applications such as countering weapons of mass destruction. ***FY 2011 Plans:*** Refine HPM devices and antennas to reduce size/increase effectiveness. Investigate state-of-the-art energy storage components. ***FY 2012 Base Plans:*** Investigate technologies to enhance standoff capabilities of HPM components used for electronic attack. Conduct high energy density plasma experiments. ***FY 2012 OCO Plans:***	15.346	10.922	20.285	-	20.285
Title: Major Thrust 2. ***Description:*** Assess the effects/lethality of HPM technologies. Develop and apply sophisticated models to enhance the development of HPM and related technology. Investigate technologies to counter the effects of HPM.	5.853	6.241	6.469	-	6.469

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602605F: *DIRECTED ENERGY TECHNOLOGY*	PROJECT 624867: *Advanced Weapons & Survivability Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
FY 2010 Accomplishments: Expanded modeling capabilities to include accurate prediction of effects with significantly reduced number of inputs. Developed effects mitigation technologies. Combined multiple HPM-related models for end-to-end simulation and design efforts. Completed infrastructure updates to enable representative effects testing to cover all HPM frequencies currently of interest. ***FY 2011 Plans:*** Apply advances in target effect prediction to a suite of HPM-related codes. Demonstrate mitigation efforts applicable to Air Force and other U.S. government systems. Refine models for use in HPM system development. ***FY 2012 Base Plans:*** Investigate mitigation effects of HPM on U.S. systems of interest including modern tactical aircraft components. Update models based on latest experimental HPM data. ***FY 2012 OCO Plans:***					
Title: Major Thrust 3. ***Description:*** Investigate advanced technologies that support force protection tactical applications, including non-lethal counter-personnel applications from an airborne platform. ***FY 2010 Accomplishments:*** Completed design for test stand that will allow full power non-lethal millimeter-wave device testing at power suitable for airborne applications. Updated advanced modeling codes that incorporate ability to model harmonic sources and began harmonic source development. Evaluated source and thermal subsystem options for next-generation non-lethal systems. ***FY 2011 Plans:*** Develop technologies leading to an FY 2013 ground demonstration of key Active Denial components for airborne applications. Perform full-powered, long-pulse, high duty-cycle testing of the 2.5 megawatt gyrotron source. Develop alternative use applications for Active Denial technologies. ***FY 2012 Base Plans:*** This thrust has been temporarily zeroed due to higher Air Force priorities. ***FY 2012 OCO Plans:***	9.257	8.612	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Accomplishments/Planned Programs Subtotals	30.456	25.775	26.754	-	26.754

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
• Activity Not Provided: *Title Not Provided*	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.