PE NUMBER: 0603605F
PE TITLE: Advanced Weapons Technology

Exhibit R-2, RDT&E Budget Item Justification

DATE: February 2004

BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

	Cost ($ in Millions)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
	Total Program Element (PE) Cost	71.649	61.221	31.103	29.168	31.667	30.226	30.705	Continuing	Continuing
3150	Advanced Optics Technology	23.168	24.837	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
3151	High Power Solid State Laser Technology	27.972	19.446	15.085	15.601	15.890	16.157	16.413	Continuing	Continuing
3152	High Power Microwave Technology	12.424	8.343	11.504	11.559	13.649	11.910	12.102	Continuing	Continuing
3647	High Energy Laser Technology	8.085	8.595	4.514	2.008	2.128	2.159	2.190	Continuing	Continuing

Note: In FY 2003, space unique tasks in Projects 3150 and 3647 were transferred to PE 0603500F in conjunction with the Space Commission recommendation to consolidate all space unique activities. In FY 2003, this program received $10 million as part of the Iraqi Freedom Fund which is included in the above cost table.

(U) A. Mission Description and Budget Item Justification

This program provides for the development and demonstration of advanced directed energy and optical concepts that are not space unique. In solid state lasers, compact, reliable, relatively high power, cost-effective single devices and arrays of devices are demonstrated. In high power microwaves, technologies such as narrowband and wideband devices and antennas are demonstrated. In high energy lasers, technologies such as high power chemical lasers and beam control technologies are demonstrated.
Note: In FY 2004, Congress added $2.3 million for Geo Light Imaging National Testbed (GLINT), $4.3 million for Mobile Active Targeting Resource for Integrated Experiments (MATRIX), $1.0 million for Advanced Technology for Infrared Countermeasure Component Improvement, $2.5 million for Aerospace Relay Mirror System Demonstration, $8.5 million for Applications of LIDAR to Vehicles with Analysis, $4.0 million for Laser Illuminated Viewing and Ranging Sensor Development, $4.3 million for the Laser Spark Countermeasure Program, $3.4 million for the Low Speed Air Data Sensor for Special Operations Aircraft, $3.25 million for the Texas-New Mexico Sky Survey, and $1.1 million for the Wafer Integrated Semiconductor Laser.
This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

Exhibit R-2, RDT&E Budget Item Justification	DATE February 2004
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology

(U) B. Program Change Summary ($ in Millions)

		FY 2003	FY 2004	FY 2005
(U)	Previous President's Budget	53.381	27.024	30.229
(U)	Current PBR/President's Budget	71.649	61.221	31.103
(U)	Total Adjustments	18.268	34.197	
(U)	Congressional Program Reductions		-0.127	
	Congressional Rescissions		-0.526	
	Congressional Increases		34.850	
	Reprogrammings	18.977		
	SBIR/STTR Transfer	-0.709		
(U)	Significant Program Changes:			
	Not Applicable.			

Exhibit R-2a, RDT&E Project Justification			DATE: February 2004
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology	PROJECT NUMBER AND TITLE: 3150 Advanced Optics Technology	

Cost ($ in Millions)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
3150 Advanced Optics Technology	23.168	24.837	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

Note: In FY 2003, space unique tasks in Project 3150 were transferred to PE 0603500F in conjunction with the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description and Budget Item Justification

This project develops advanced optical technologies for various strategic and tactical beam control applications.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2003	FY 2004	FY 2005
(U) MAJOR THRUST: Civilian salaries.	0.255	0.000	0.000
(U) In FY 2003: This project previously included space unique funding that has been transferred to PE 0603500F, Multi-disciplinary Space Technology. These funds represent the associated civilian salaries that were inadvertently left behind.			
(U) In FY 2004: Not Applicable.			
(U) In FY 2005: Not Applicable.			
(U)			
(U) CONGRESSIONAL ADD: Applications of Lidar to Vehicles with Analysis.	11.379	8.287	0.000
(U) In FY 2003: Explored the utility of an operational Field Laser Demonstrator laser radar integrated with the Advanced Electro-Optical System for deep space metric and space object identification missions, microsatellite tracking, and ballistic missile defense discrimination. Investigated vibrometry, polarimetry, and 3D imaging using laser radars to provide detailed information on satellites. Investigated using laser radars to provide a range of battlefield information such as battle damage assessment and camouflage penetration.			
(U) In FY 2004: Demonstrate tracking ability using the Field Laser Demonstrator's Hi-Class laser radar for deep space metric and space object identification missions, microsatellite tracking, and ballistic missile defense discrimination. Investigate novel concepts for using laser radars to provide detailed information on satellites. Investigate laser radars to provide a range of battlefield information such as battle damage assessment and camouflage penetration. Investigate eye-safe laser radars and airborne demonstrations of laser sensing to battlefield information such as combat identification, battle damage assessment, and camouflage penetration.			
(U) In FY 2005: Not Applicable.			
(U)			
(U) CONGRESSIONAL ADD: Laser Illuminated Viewing and Ranging Sensor Development.	4.155	4.000	0.000
(U) In FY 2003: Developed and demonstrated technologies for eye-safe active laser sensing systems for gathering			

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603605F Advanced Weapons Technology**	PROJECT NUMBER AND TITLE **3150 Advanced Optics Technology**

	battlefield images. Developed advanced sensor technology for eye-safe laser imaging including gated transferred electron bombarded charged coupled devices cameras and laser imaging beam control assemblies.			
(U)	In FY 2004: Develop and demonstrate eye-safe laser sensing technologies for obtaining battlefield intelligence such as target imagery, target identification, and battle damage assessment. Complete development of a gated electron bombarded active pixel sensor mated with an advanced imaging chip. Complete design and delivery of a Laser Illuminated Viewing and Ranging Sensor subsystem (sensor and optics) for integration into an unmanned air vehicle ball turret imaging system.			
(U)	In FY 2005: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Geosynchronous Light Imaging National Testbed.	2.333	2.500	0.000
(U)	In FY 2003: Continued development and integration of hardware for the Geo Light Imaging National Testbed (GLINT) at White Sands Missile Range, New Mexico. Built one heliostat and a partially completed collector. Performed field experiment to collect light from stars.			
(U)	In FY 2004: Evaluate and demonstrate concepts and components for active imaging of space objects with continued development and integration of hardware. Build one heliostat demonstration unit and one mini-receiver. Perform a field experiment to test hardware performance and demonstrate imaging concept under controlled conditions.			
(U)	In FY 2005: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Mobile Active Tracking Resource for Integrated Experiments (MATRIX).	5.046	4.300	0.000
(U)	In FY 2003: Developed a first generation testbed for assessment of future tactical laser beam control/fire control sensors. Evaluated tracking, discrimination, and targeting algorithms for tactical high energy lasers and surveillance/situational awareness missions.			
(U)	In FY 2004: Develop/enhance ground-based and airborne beam control and fire control testbeds to demonstrate various active and passive sensors for high energy laser beam control. Concentrate on beam control and fire control enhancements for the Advanced Tactical Laser, but also support risk reduction decisions for other future laser weapons. Perform ground testing in New Mexico and Hawaii.			
(U)	In FY 2005: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Aerospace Relay Mirror System Demonstration.	0.000	2.500	0.000
(U)	In FY 2003: Not Applicable. Added to PE 0603500F, Multi-Disciplinary Advanced Development Space Technology, in FY 2003.			
(U)	In FY 2004: Acquire initial components and software build to investigate using high altitude relay mirrors to greatly extend the range of various optical systems including high energy laser weapons. Test and integrate components into a laboratory demonstration that will verify scaleable system performance. Determine platform integration costs and			

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT NUMBER AND TITLE 3150 Advanced Optics Technology

identify potential field demonstration options. The cost, applicability, and manufacturability of lightweight telescopes and high energy optics will be researched for future testbed upgrades.

(U) In FY 2005: Not Applicable.

(U)

(U)	CONGRESSIONAL ADD: Texas-New Mexico Sky Survey.	0.000	3.250	0.000

(U) In FY 2003: Not Applicable.

(U) In FY 2004: Develop technologies to enhance the ability to detect, track, and characterize Earth orbiting satellites. Redesign of the prime focus corrector of the Hobby-Eberly Telescope. Complete the optical design for a wide-field search telescope.

(U) In FY 2005: Not Applicable.

(U)	Total Cost	23.168	24.837	0.000

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

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
(U) Related Activities:									
(U) PE 0603444F, Maui Space Surveillance Systems.									
(U) PE 0602102F, Materials.									
(U) PE 0602605F, Directed Energy Technology.									
(U) PE 0603883C, Ballistic Missile Defense Boost Phase Segment.									
(U) PE 0602500F, Multi-Disciplinary Space Technology.									
(U) PE 0603500F, Multi-Disciplinary Advanced Development Space Technology.									
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate									

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT NUMBER AND TITLE 3150 Advanced Optics Technology

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

duplication.

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2004
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology	PROJECT NUMBER AND TITLE: 3151 High Power Solid State Laser Technology	

Cost ($ in Millions)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
3151	High Power Solid State Laser Technology	27.972	19.446	15.085	15.601	15.890	16.157	16.413	Continuing	Continuing
	Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

This project provides revolutionary breakthroughs in compact, robust, and affordable laser system technology for a wide range of military applications requiring small compact laser sources. This is a long-term technology development project with both near-term and long-term payoffs. Near-term goals include developing compact, reliable infrared sources that can be used for a range of applications including night vision systems, landing zone markers, remote sensing, and covert communication systems. Longer-term goals focus on producing compact, significantly higher power sources that could be applied to military weapons-type applications including aircraft self-protection. This project leads the development of, and builds upon, a wide range of commercial advancements. Commercially available solid state lasers are widely used due to their low-cost, small size and weight, high reliability, and high efficiency in converting electricity to laser energy. This project preserves these attractive features while continually scaling output to higher powers and efficiencies and to military application-specific wavelengths. This project is divided into two technology areas. The first area investigates methods to develop low-cost, scalable, high power solid state lasers. This effort builds upon a strong industrial technology base. The second area develops wavelength specific solid state lasers for military applications such as infrared countermeasures.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2003	FY 2004	FY 2005
(U) MAJOR THRUST: Demonstrate scalability of high power solid state laser architectures for tactical directed energy applications such as unmanned aerial vehicle target designators/imagers and next generation weapons/components for applications such as advanced gunship weapons and airborne laser illuminators.	4.759	7.076	8.477

(U) In FY 2003: Participated in the Joint High Power Solid State Laser program to develop and demonstrate multiple approaches for future directed energy, weapons-class electric laser technology at power levels greater than 10 kilowatts, with scalability to 100 kilowatts. Various approaches selected for development and demonstration by the Army, Air Force, High Energy Laser Joint Technology Office.

(U) In FY 2004: As part of the Joint High Power Solid State Laser program, demonstrate 10 kilowatts using a modular approach. Begin design for 25 kilowatt demonstrator laser. Investigate systems-level issues such as weight and volume.

(U) In FY 2005: As part of the Joint High Power Solid State Laser program, demonstrate 25 kilowatts using a modular approach that has scalability to 100 kilowatts. Address systems-level issues such as weight and volume. Investigate systems-level issues such as power and thermal management requirements. Factors such as performance, cost, etc. will be evaluated between the various approaches funded by the Army, Air Force, and High Energy Laser Joint Technology Office.

(U)

Exhibit R-2a, RDT&E Project Justification			DATE February 2004
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603605F Advanced Weapons Technology**	PROJECT NUMBER AND TITLE **3151 High Power Solid State Laser Technology**	

(U)	MAJOR THRUST: Develop and demonstrate high energy laser technologies for airborne tactical applications, including air-to-air and surface-to-air scenarios. Detect and track tactical targets in clutter at long ranges.	0.528	3.613	6.608
(U)	In FY 2003: Addressed technologies including lasers for long-range detection of targets in clutter; high power compact laser scalability; and advanced beam control to compensate for platform vibration, atmospheric jitter, and aero-optic effects. Conducted laser effects testing and completed first phase of the development of a multi-kilowatt solid state laser testbed to determine required energy levels, propagation effects, and beam control requirements for tactical applications such as defeating next generation air-to-air threats.			
(U)	In FY 2004: Investigate technologies such as lasers for long-range detection of targets in clutter; high power compact lasers; and advanced beam control to compensate for platform vibration, atmospheric jitter, and aero-optic effects. Complete laser effects testing using surrogate laser sources. Complete development and begin installation of a multi-kilowatt solid state laser testbed to confirm previous test results at system power levels and wavelengths.			
(U)	In FY 2005: Detect and track tactical targets in clutter at long ranges. Demonstrate scalable high-power compact lasers and advanced beam control to control platform vibration, atmospheric jitter, and aero-optic effects. Complete laser effects testing using a multi-kilowatt laser to determine required energy levels for tactical applications that address defeating next generation air-to-air threats.			
(U)				
(U)	MAJOR THRUST: Develop and demonstrate laser source technologies needed to counter current air-to-air and surface-to-air missile threats.	3.351	3.257	0.000
(U)	In FY 2003: Demonstrated a reliable and compact multispectral (bands I, II, and IV), solid state laser for countering current generation threats to aircraft platforms.			
(U)	In FY 2004: Complete demonstration of a low-cost, reliable, and compact multispectral (bands I, II, and IV), solid state laser brassboard for future integration into large aircraft platforms.			
(U)	In FY 2005: Not Applicable.			
(U)				
(U)	MAJOR THRUST: Develop solid state laser technologies that support enhancing the Battlefield Air Operations kit performance and reducing the weight by replacing separate and independent systems now fielded and incorporating the capabilities into a single unit. Part of this effort was funded from the Iraqi Freedom Fund.	19.334	0.000	0.000
(U)	In FY 2003: Developed solid state laser technologies to support Battlefield Air Operations applications such as target ranging, target designation, and wind measurement. Undertook overall systems integration of the laser components (wind sensor, rangefinder, designator, visible and infrared aim lights) with other modules (optics, geo-location, processor/electronics, power, etc.)			
(U)	In FY 2004: Not Applicable.			
(U)	In FY 2005: Not Applicable.			
(U)				

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603605F Advanced Weapons Technology**	PROJECT NUMBER AND TITLE **3151 High Power Solid State Laser Technology**

(U)	CONGRESSIONAL ADD: Low Speed Air Data Sensor for Special Operations Aircraft.	0.000	3.400	0.000
(U)	In FY 2003: Not Applicable.			
(U)	In FY 2004: Develop fiber optic laser-based data technology that will provide low air speed indications down to zero knots for all fixed wing and rotary aircraft to increase safety operating in and out of landing zones.			
(U)	In FY 2005: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Advanced Technology for Infrared Countermeasures Component Improvement.	0.000	1.000	0.000
(U)	In FY 2003: Not Applicable.			
(U)	In FY 2004: Accelerate the potential deployment of the previously developed mid-infrared semiconductor laser brassboard for infrared countermeasures applications. Initiate a risk reduction effort to investigate the environmental survivability issues for the laser transmitter. Demonstrate that a mid-infrared semiconductor laser transmitter can survive operational military random vibration and temperature environments. A series of rapid design/test iterations shall be conducted on the sub-scale demonstration unit in order to isolate the environmental impact on key subassemblies in the design such as the cryogenic cooling subassembly.			
(U)	In FY 2005: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Wafer Integrated Semiconductor Laser.	0.000	1.100	0.000
(U)	In FY 2003: Not Applicable.			
(U)	In FY 2004: Improve the reliability and lower the cost of high power laser diode arrays. Develop the technology for integrating turning mirrors and micro-lenses onto a laser chip, thus implementing more functions of the laser during the semiconductor manufacturing process.			
(U)	In FY 2005: Not Applicable.			
(U)				
(U)	Total Cost	27.972	19.446	15.085

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

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost

(U) Related Activities:

(U) PE 0602102F, Materials.

(U) PE 0603270F, Electronic Combat Technology.

(U) PE 0602605F, Directed Energy Technology.

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603605F Advanced Weapons Technology**	PROJECT NUMBER AND TITLE **3151 High Power Solid State Laser Technology**

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

This project has been coordinated through the (U) Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2004
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology	PROJECT NUMBER AND TITLE: 3152 High Power Microwave Technology	

Cost ($ in Millions)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
3152 High Power Microwave Technology	12.424	8.343	11.504	11.559	13.649	11.910	12.102	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

This project develops high power microwave (HPM) generation and transmission technologies that support a wide range of Air Force missions such as the potential disruption, degradation, damage, or destruction of an adversary's electronic infrastructure and military capability. These targeted capabilities include local computer and communication systems, as well as large and small air defense and command and control systems. In many cases, this effect can be generated covertly with no collateral structural or human damage. In addition, millimeter wave force protection technologies are developed. It also develops a susceptibility/vulnerability/lethality data base to identify potential vulnerabilities of U.S. systems to HPM threats and to provide a basis for future offensive and defensive weapon system decisions. Representative U.S. and foreign assets are tested to understand real system susceptibilities. Both wideband (wide frequency range) and narrowband (very small frequency range) technologies are being developed.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2003	FY 2004	FY 2005
(U) MAJOR THRUST: Develop and demonstrate HPM technologies to disrupt, degrade, damage, or destroy an adversary's electronic systems.	4.724	3.465	1.324
(U) In FY 2003: Completed a repetitively pulsed gigawatt-class HPM experiment. Conducted wideband field experiments with integrated compact devices to demonstrate effectiveness of wideband HPM for munitions and airborne electronic attack. Conducted initial ground-based, field experiment to demonstrate effectiveness of air-delivered HPM munitions.			
(U) In FY 2004: Demonstrate an integrated repetitively pulsed gigawatt-class HPM breadboard. Conduct wideband field experiments with integrated compact devices to demonstrate effectiveness of wideband HPM for munitions and airborne electronic attack. Conduct additional ground-based, field experiments demonstrating effectiveness of air-delivered HPM munitions. Conduct an integrated wideband concealed weapon identification experiment.			
(U) In FY 2005: Demonstrate pulsed power and narrowband HPM source capability applicable to munitions and airborne concepts. Demonstrate a repetitively pulsed multi-gigawatt-class HPM integration experiment. Demonstrate brassboard wideband concealed weapon identification concept.			
(U)			
(U) MAJOR THRUST: Conduct effects experimentation to expand and refine data library and support susceptibility predictions.	2.270	1.361	0.782
(U) In FY 2003: Applied computer codes to predict HPM coupling to targets and validate code prediction accuracy. Investigated and developed models to quantify the effectiveness of HPM waveforms against electronic targets of interest applicable to munitions or airborne platforms. Refined the ability to calculate probability of kill for			

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT NUMBER AND TITLE 3152 High Power Microwave Technology

representative targets.

(U) In FY 2004: Predict HPM coupling to targets with enhanced computer codes and validate code prediction accuracy. Further refine models to quantify the effectiveness of HPM waveforms against electronic targets of interest applicable to munitions or airborne applications. Enhance the ability to calculate probability of kill for additional representative targets.

(U) In FY 2005: Provide dynamic data library to users and continue effects experimentation to populate and update the data library. Transition computer codes for the prediction of electromagnetic coupling on targets to users. Expand the evaluation and quantification of HPM waveform effectiveness against new and evolving electronic targets of interest. Transition computer codes for calculation of probability-of-kill for representative targets.

(U)

(U) MAJOR THRUST: Develop and evaluate active denial technologies for non-lethal, anti-personnel weapon applications such as ground force protection from a standoff aircraft.	1.967	2.649	4.650

(U) In FY 2003: Investigated the engineering design of next-generation millimeter wave sources for airborne active denial technology. Perform computational physics simulations to analyze capability to validate airborne source design before construction. Analyzed critical technologies for airborne active denial including the use of unique computational simulation.

(U) In FY 2004: Acquire knowledge and capabilities critical for future active denial systems via field support of operation/testing/demonstration of the first ground-based system. Begin the development of millimeter wave source for airborne applications including continuation of interactions with system specific computational physics simulations to validate design before source construction. Improve active denial system specific computational physics simulations capability for millimeter wave sources. Complete conceptual design study for mobile ground-based test stand for future airborne level radiating system demonstration. Update subsystem approaches based on original airborne technical feasibility study. Provide technical expertise and background to external organizations tailoring active denial concepts and capabilities to their needs.

(U) In FY 2005: Provide user support operation/testing/demonstration of first ground-based development spiral product. Develop and evaluate technologies for non-lethal weapons applications. Continue the development of millimeter wave source for airborne applications. Baseline computational physics simulations of millimeter-wave sources against the draft detailed design drawings. Investigate updated subsystem approaches based on the original airborne technical feasibility study. Provide technical expertise and background to external organizations tailoring Active Denial concepts and capabilities to their needs.

(U)

(U) MAJOR THRUST: Develop the technology to integrate HPM devices on aerial platforms and investigate specific target sets of interest.	3.463	0.868	4.748

(U) In FY 2003: Conducted target identification efforts to include individual targets, groups, and clusters. Conducted

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT NUMBER AND TITLE 3152 High Power Microwave Technology

experiments with an HPM source within a new, appropriately sized transverse electromagnetic cell anechoic chamber. Installed and used a trans/twist reflector antenna on the existing anechoic chamber for smaller experiments. Performed integration tests on existing aircraft to define the vehicle integration environment for an HPM device. Obtained hardware and software interface specifications for several aircraft in order to integrate sources on the aircraft. Started integration, thermal control, and target studies for such concepts.

(U) In FY 2004: Continue airborne electronic attack specific target identification efforts for individual targets and group and/or cluster of targets. Conduct additional HPM experiments in the transverse electromagnetic cell anechoic chamber and the upgraded smaller anechoic chamber. Begin investigation of source to aircraft integration issues (e.g., electrical, interface, and thermal control). Define aircraft alterations and source shielding required to mount an HPM source on an aircraft. Begin investigating the feasibility of using a wideband HPM source to geolocate and identify targets of interest and perform battle damage assessment.

(U) In FY 2005: Proceed with target identification efforts to include foreign and domestic and individual, group and cluster targets. Perform target lethality assessments. Maintain and upgrade the test facilities. Investigate source to aircraft integration issues such as electrical, interface, thermal control, (center of) mass, antennas, electromagnetic interference/electromagnetic compatibility, and x-rays. Test determined source shielding requirements for mounting a source on an aircraft. Investigate the feasibility of using ultra-wideband HPM to geolocate and identify targets of interest and perform battle damage assessment.

(U) Total Cost	12.424	8.343	11.504

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

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
(U) Related Activities:									
(U) PE 0602202F, Human Systems Technology.									
(U) PE 0602605F, Directed Energy Technology.									
(U) PE 0603851M, Nonlethal Weapons - Demonstration/Validation.									
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate									

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603605F Advanced Weapons Technology**	PROJECT NUMBER AND TITLE **3152 High Power Microwave Technology**

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

duplication.

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification

DATE: February 2004

BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT NUMBER AND TITLE: 3647 High Energy Laser Technology

Cost ($ in Millions)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
3647 High Energy Laser Technology	8.085	8.595	4.514	2.008	2.128	2.159	2.190	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

Note: In FY 2003, space unique tasks in Project 3647 were transferred to PE 0603500F in conjunction with the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description and Budget Item Justification

This project provides for the development, demonstration, and detailed assessment of non-space unique technologies needed for high energy laser weapons. Near-term focus is on airborne high energy laser missions, although the technology developed for this project is directly applicable to most high energy laser applications. Critical technologies developed and demonstrated include advanced high energy laser devices and laser beam control to efficiently compensate and propagate laser radiation through the atmosphere to a target. Correcting the laser beam for distortions induced by propagation through the turbulent atmosphere is the key technology in most high energy laser applications. Detailed computational models to establish high energy laser weapon effectiveness and target vulnerability are developed.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2003	FY 2004	FY 2005
(U) MAJOR THRUST: Civilian salaries.	1.192	0.000	0.000
(U) In FY 3003: This project previously included space unique efforts which have been transferred to PE 0603500F, Multi-disciplinary Space Advanced Development Technology. These funds represent the associated civilian salaries that were inadvertently left behind.			
(U) In FY 2004: Not Applicable.			
(U) In FY 2005: Not Applicable.			
(U)			
(U) MAJOR THRUST: Develop and demonstrate the technology for scalable, high energy laser devices with improved efficiency for insertion in tactical airborne lasers and other potential weapon applications.	0.781	2.257	2.585
(U) In FY 2003: Evaluated, demonstrated, and enhanced multiple high pressure ejector nozzles performance using modeling and simulation and laboratory nozzle test stand evaluations. Validated performance of laser device components.			
(U) In FY 2004: Demonstrate optimized high pressure ejector nozzles performance for airborne laser systems. Demonstrate advanced iodine generation, iodine injection, and advanced chemical oxygen iodine test sequence utilizing a laboratory test stand. Investigate chemical recirculation on tactical airborne platforms to greatly reduce the amount of chemicals carried onboard the aircraft.			
(U) In FY 2005: Conduct follow-on demonstrations of advanced iodine generation, iodine injection, and advanced chemical oxygen iodine test sequence utilizing the laboratory test stand. Integrate the best iodine generation concept into a laser device to predict overall device-level performance and identify device-level issues. Perform laboratory			

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603605F Advanced Weapons Technology**	PROJECT NUMBER AND TITLE **3647 High Energy Laser Technology**

	demonstrations of closed-cycle chemical approaches for use on tactical airborne platforms.			
(U)				
(U)	MAJOR THRUST: Develop and evaluate beam control and compensation techniques including correcting for atmospheric attenuation and distortion of high energy laser beams propagating from airborne platforms.	3.564	2.038	1.929
(U)	In FY 2003: Completed experimental testing of advanced active tracking and atmospheric compensation concepts. Conduct field testing of advanced beam control architectures against a scaled target. Assessed advanced technology improvements to support Airborne Laser block upgrades. Refined, through modeling and simulation, improved wave front sensors and the two-beacon concept. Transitioned appropriate technology to the Airborne Laser System Program Office.			
(U)	In FY 2004: Demonstrate advanced tracking methods and adaptive optics compensation techniques that double the Strehl ratio (peak laser intensity on target) in stressing atmospheric turbulence environments. Demonstrate, in the field, the performance of various wavefront sensors to maximize the ability to correct for atmospheric disturbances. Complete demonstration and evaluation of the compensated beacon illumination technique. Anchor wave optics propagation code to demonstrated beam control performance. Transition appropriate technology to the Airborne Laser System Program Office.			
(U)	In FY 2005: Complete beam control technology demonstration and transition of these technologies to the Airborne Laser System Program Office.			
(U)				
(U)	MAJOR THRUST: Performed vulnerability assessments on potential high energy laser targets to provide critical design data for laser systems, both to defeat these targets and to understand the potential for collateral damage to other targets in the area.	0.371	0.000	0.000
(U)	In FY 2003: Updated target system response databases for improved predictive avoidance analyses.			
(U)	In FY 2004: Not Applicable.			
(U)	In FY 2005: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Sodium Wavelength Laser.	2.177	0.000	0.000
(U)	In FY 2003: Fabricated brassboard sodium-wavelength laser to be use as mesospheric beacon for adaptive optics systems on large-aperture telescopes to significantly increase atmospheric compensation of laser beams by measuring effects to much higher altitudes. Achieved 21 watts output power and generated magnitude 7.1 mesospheric sodium guidestar. Completed series of field tests and experiments to characterize sodium guidestar radiometry using laser outputs of 1-21 watts, with and without atmospheric compensation. Designed, procured parts, assembled, and tested 50 watt laser.			
(U)	In FY 2004: Not Applicable.			
(U)	In FY 2005: Not Applicable.			

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT NUMBER AND TITLE 3647 High Energy Laser Technology

(U)				
(U)	CONGRESSIONAL ADD: Laser Spark Countermeasure Program.	0.000	4.300	0.000
(U)	In FY 2003: Not Applicable.			
(U)	In FY 2004: Perform laboratory effects tests and modeling to resolve measured differences in the damage threshold of different focal plane arrays and expand the database to include additional pulse length data and at least one additional focal plane array type. Perform laboratory effects testing to extend previous results into the ultra short pulse length regime. Perform and document a countermeasure effectiveness study for selected operational scenarios. Design, fabricate, and use a brass board countermeasure laser system in a field demonstration test to show the effectiveness of the Spark countermeasure (at relatively low power) against both conscan and imaging test assets with a single threat independent pulse format.			
(U)	In FY 2005: Not Applicable.			
(U)	Total Cost	8.085	8.595	4.514

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

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
(U) Related Activities:									
(U) PE 0602605F, Directed Energy Technology.									
(U) PE 0603883C, Ballistic Missile Defense Boost Phase Segment.									
(U) PE 0602500F, Multi-Disciplinary Space Technology.									
(U) PE 0603500F, Multi-Disciplinary Advanced Development Space Technology.									
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.									
(U) The technology efforts in this									

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT NUMBER AND TITLE 3647 High Energy Laser Technology

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

PE that are supporting future enhancements to airborne lasers have been coordinated with the Airborne Laser program office.

(U) D. Acquisition Strategy

Not Applicable.