RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

	COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	60,729	53,381	27,024	30,229	29,246	31,732	30,239	30,658	Continuing	TBD
3150	Advanced Optics Technology	21,547	23,803	0	0	0	0	0	0	Continuing	TBD
3151	High Power Solid State Laser Technology	5,002	8,638	14,241	15,125	15,643	15,923	16,164	16,388	Continuing	TBD
3152	High Power Microwave Technology	7,478	12,670	8,414	11,534	11,590	13,677	11,915	12,083	Continuing	TBD
3647	High Energy Laser Technology	26,702	8,270	4,369	3,570	2,013	2,132	2,160	2,187	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

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. FY 2003 funding reflects Congressional adds.

(U) A. Mission Description

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 2003, Congress added $3 million for Geo Light Imaging National Testbed (GLINT), $2.2 million for sodium wavelength laser, $115 million for the Field Laser Demonstration (FLD) Upgrades, and $5.1 million for Mobile Active Targeting Resource for Integrated Experiments (MATRIX).

(U) B. Budget Activity Justification

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.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology

(U) C. Program Change Summary ($ in Thousands)

		FY 2002	FY 2003	FY 2004	Total Cost
(U)	Previous President's Budget	66,905	28,271	32,420	
(U)	Appropriated Value	67,558	54,271		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-653	-573		
	b. Small Business Innovative Research	-1,533			
	c. Omnibus or Other Above Threshold Reprogram		-317		
	d. Below Threshold Reprogram	-1,338			
	e. Rescissions	-3,305			
(U)	Adjustments to Budget Years Since FY 2003 PBR			-5,396	
(U)	Current Budget Submit/FY 2004 PBR	60,729	53,381	27,024	TBD

(U) Significant Program Changes:

The reduction in FY 2004 reflects a reallocation of funding to higher priority Air Force programs. Additionally there were significant Congressional adds in FY 2002 and FY 2003.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT: 3150

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
3150 Advanced Optics Technology	21,547	23,803	0	0	0	0	0	0	Continuing	

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

This project develops advanced optical technologies for various strategic and tactical beam control applications and for locating, identifying, and analyzing distant and dim objects such as geosynchronous orbit satellites.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $489 Developed technologies to support a space relay mirror system. These technologies include beam control; beam acquisition, tracking, and pointing; dual line of sight pointing; and beam stabilization. Developed engineering model of space-based relay mirrors.

(U) $6,215 Developed technologies for an aerospace (airborne) relay mirror testbed. Developed and enhanced techniques for dual line of sight pointing from two separate telescopes. Developed/integrated subscale hardware to provide risk reduction for a full-scale relay mirror system. Developed an optical payload to perform beam characterization and clean-up. Tailored and integrated point ahead beacon technology for this application.

(U) $6,803 Developed technologies for active imaging of geosynchronous space objects. Continued development and integration of hardware for the Geo Light Imaging National Testbed (GLINT) at White Sands Missile Range, NM. Developed/tested operating procedures and software for passive identification of satellites in support of GLINT experiments.

(U) $8,040 Continued to explore 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. Continued technology development with the objective of providing compact, remote sensing systems for integration onboard unmanned aerial platforms for a variety of battlefield surveillance mission applications.

(U) $21,547 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $255 This project previously included space unique funding which has been transferred to PE 0603500F, Multi-disciplinary Space Technology. These funds represent the civilian salaries for the work effort transferred.

(U) $11,379 Continue to explore the utility of an operational Field Laser Demonstrator laser radar integrated with the Advanced Electro-Optical System for

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT 3150

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

deep space metric and space object identification missions, microsatellite tracking, and ballistic missile defense discrimination. Investigate vibromerty, polarmetry, and 3D imaging 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.

(U) $2,968 Developed technologies for active imaging of geosynchronous space objects. Continued development and integration of hardware for the Geo Light Imaging National Testbed (GLINT) at White Sands Missile Range, NM. Build three heliostats and a compact collector. Perform field experiment to collect light from satellite in geosynchronous orbit.

(U) $4,155 Develop a Laser Illuminated Viewing and Ranging sensor for use on an unmanned air vehicle. Develop and demonstrate technologies for eye-safe active laser sensing systems for gathering battlefield images. Develop advanced sensor technology for eye-safe laser imaging including gated transferred electron bombarded charged coupled devices cameras and laser imaging beam control assemblies.

(U) $5,046 Develop the Mobile Active Targeting Resource for Integrated Experiments. Develop a testbed for assessment of tactical laser beam control/fire control sensors. Evaluate tracking, discrimination, and targeting algorithms for tactical high energy lasers and surveillance/situational awareness missions.

(U) $23,803 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $0 No Activity.

(U) $0 Total

(U) B. Project Change Summary

Not Applicable.

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

(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.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: February 2003
BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology
PROJECT: 3150	

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

(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) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT: 3151

COST ($ in Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
3151	High Power Solid State Laser Technology	5,002	8,638	14,241	15,125	15,643	15,923	16,164	16,388	Continuing	

(U) A. Mission Description

This project continues to yield 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) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $1,712 Developed low-cost, scalable, high power solid state laser architectures by integrating fiber lasers with diode-laser pump sources for directed energy applications such as unmanned aerial vehicle designators/imagers and next generation weapons applications such as space-based and airborne lasers. Began work to demonstrate high electrical efficiency (approaching 30%) and beam combining at high power to enable future applications requiring high power lasers. Demonstrated coherent beam combining of multiple 10 watt fiber amplifiers showcasing the building block technology of future directed energy, weapons-class electric lasers. Demonstrated wavelength-versatile integrated laser/nonlinear optics at five watt power levels. Continued development of an all-fiber solution, with no free space optical elements, at power levels approaching 100 watts.

(U) $2,427 Developed and demonstrated a laser source needed to counter current air-to-air and surface-to-air missile threats. Demonstrated a multi-wavelength source (two and four microns) with sufficient brightness, based on novel device structures and incoherent beam combining techniques developed in FY 2001, for countering current generation threats to aircraft platforms.

(U) $863 Developed and demonstrated high energy laser and beam control technologies for airborne tactical applications, including air-to-air and surface-to-air scenarios. Technologies investigated included lasers for long-range detection of targets in clutter and advanced beam control to control platform vibration, atmospheric jitter, and aero-optic effects. Initiated laser effect analysis and testing to determine required energy levels

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT 3151

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

and issues for tactical applications that address next generation threats.

(U) $5,002 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $4,759 Demonstrate scalability of high power solid state laser architectures for tactical directed energy applications such as unmanned aerial vehicle designators/imagers and next generation weapons applications such as advanced gunship and airborne laser illuminators. Begin to develop future directed energy, weapons-class electric laser technology at power levels greater than 10 kilowatts, with scalability to 100 kilowatts.

(U) $3,351 Develop and demonstrate laser source technologies needed to counter current air-to-air and surface-to-air missile threats. Demonstrate a reliable and compact multispectral (bands I, II, and IV), solid state laser for countering current generation threats to aircraft platforms.

(U) $528 Develop and demonstrate high energy laser technologies for airborne tactical applications, including air-to-air and surface-to-air scenarios. Technologies being addressed include lasers for long-range detection of targets in clutter, high power compact laser scalability, and advanced beam control to compensate platform vibration, atmospheric jitter, and aero-optic effects. Continue laser effects testing and begin development of a multi-kilowatt solid state laser testbed to determine required energy levels, propagation effects, and beam control requirements for tactical applications that address next generation threats.

(U) $8,638 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $7,371 Demonstrate scalability of high power solid state laser architectures for tactical directed energy applications such as unmanned aerial vehicle designators/imagers and next generation weapons/components applications such as advanced gunship and airborne laser illuminators. Demonstrate future directed energy, weapons-class electric laser technology at power levels greater than 10 kilowatts, with scalability to 100 kilowatts. Begin design for 25 kilowatt demonstrator laser. Investigate systems-level issues such as weight and volume.

(U) $3,257 Develop and demonstrate laser source technologies needed to counter current air-to-air and surface-to-air missile threats. Deliver a low-cost, reliable, and compact multispectral (bands I, II, and IV), solid state laser subsystem to the Large Aircraft Infrared Countermeasures System Program Office for future integration into aircraft platforms.

(U) $3,613 Develop and demonstrate high energy laser technologies for airborne tactical applications, including air-to-air and surface-to-air scenarios. Technologies being addressed include 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.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT 3151

(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

Begin installation of a multi-kilowatt solid state laser testbed to confirm previous test results at system power levels and wavelengths.

(U) $14,241 Total

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:

(U) PE 0602102F, Materials.

(U) PE 0603270F, Electronic Combat Technology.

(U) PE 0602605F, Directed Energy Technology.

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

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT: 3152

COST ($ in Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
3152	High Power Microwave Technology	7,478	12,670	8,414	11,534	11,590	13,677	11,915	12,083	Continuing	

(U) A. Mission Description

This project develops high power microwave (HPM) generation and transmission technologies that support a wide range of Air Force missions such as the potential denial, 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. Millimeter wave force protection technologies are also 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 weapons 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) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $3,585 Developed and demonstrated narrowband HPM technologies that damage or destroy an adversary’s electronic systems. Demonstrated pulsed power and narrowband HPM source capabilities applicable to munitions and airborne concepts. Selected repetitively pulsed HPM technology for gigawatt application development. Evaluated narrowband technologies to address aircraft protection against surface-to-air missiles. Developed and demonstrated wideband HPM technologies to disrupt, degrade, damage, or destroy an adversary’s command and control and infrastructure. Developed integrated compact source design based on effects data and technology advances for improved effectiveness in HPM munitions and airborne electronic attack missions.

(U) $2,030 Conducted effects experiments on targets to refine source parameters, expand target set, and support susceptibility predictions. Began building a probability of effect database using experimental data from several programs. Transitioned selected technologies. Refined modeling and simulation codes to more accurately predict wideband HPM coupling in realistic scenarios. Completed probability of effect predictions for engagement models. Investigated and developed models to quantify the effectiveness of a narrowband repetitively pulsed system against electronic targets of interest applicable to munitions or airborne platforms.

(U) $1,863 Developed and evaluated active denial technologies for non-lethal weapons applications. Continued development of in-house expertise applicable to future platforms (i.e., airborne) via support of characterization/effects with upgraded active denial field system. Began engineering design of next generation millimeter wave sources for airborne active denial technology. Continued analyzing critical technologies for airborne active denial. Began investigation of test cell development of millimeter wave source for airborne applications.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT 3152

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U)	$7,478	Total

(U) FY 2003 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$4,688	Develop and demonstrate narrowband high power microwave (HPM) technologies to disrupt, degrade, damage, or destroy an adversary's electronic systems. Demonstrate pulsed power and narrowband HPM source capability applicable to munitions and airborne concepts. Demonstrate a repetitively pulsed gigawatt-class HPM experiment. Conduct wideband field experiments with integrated compact devices to demonstrate effectiveness of wideband HPM for munitions and airborne electronic attack. Conduct initial ground-based, field experiments demonstrating effectiveness of air-delivered HPM munitions.
(U)	$2,270	Conduct effects experiments to expand database and support susceptibility predictions. Apply computer codes to predict HPM coupling to targets and validate code prediction accuracy. Continue to investigate and develop models to quantify the effectiveness of HPM waveforms against electronic targets of interest applicable to munitions or airborne platforms. Continue to refine the ability to calculate probability of kill for representative targets.
(U)	$2,012	Develop and evaluate active denial technologies for non-lethal, anti-personnel, weapons applications including ground and airborne applications. Conduct specific characterization/effects/demonstrations with the active denial Advanced Concept Technology Demonstration ground system demonstration or the upgraded active denial field brassboard. Complete engineering design of next-generation millimeter wave sources for airborne active denial technology. Analyze critical technologies for airborne active denial including the use of unique computational simulation. Design hardware for a ground-based system demonstrator of millimeter wave source for airborne applications.
(U)	$3,700	Develop the means to integrate HPM devices on aerial platforms and investigate specific target sets of interest. Begin target identification efforts: individual targets, groups, and clusters. Begin conducting experiments with a HPM source within a new, appropriately sized transverse electromagnetic cell anechoic chamber. Install and use a trans/twist reflector antenna on the existing anechoic chamber for smaller experiments. Perform integration tests on existing aircraft so as to define the vehicle integration environment for a HPM device. For several aircraft, obtain hardware and software interface specifications for integration of source on aircraft. Start performing integration, thermal control, and target studies for such concepts.
(U)	$12,670	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT 3152

(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$3,423	Develop and demonstrate narrowband and wideband high power microwave (HPM) technologies to disrupt, degrade, damage, or destroy an adversary's electronic systems. Continue to demonstrate pulsed power and narrowband HPM source capability applicable to munitions and airborne concepts. Demonstrate an integrated repetitively pulsed gigawatt-class HPM breadboard. Continue to conduct wideband field experiments with integrated compact devices to demonstrate effectiveness of wideband HPM for munitions and airborne electronic attack. Continue to conduct ground-based, field experiments demonstrating effectiveness of air-delivered HPM munitions. Conduct an integrated wideband target identification experiment.
(U)	$1,400	Conduct effects experiments to expand database and support susceptibility predictions. Continue to apply computer codes to predict HPM coupling to targets and validate code prediction accuracy. Continue refinement of models to quantify the effectiveness of HPM waveforms against electronic targets of interest applicable to munitions or airborne applications. Continue to refine the ability to calculate probability of kill for representative targets.
(U)	$2,727	Develop and evaluate active denial technologies for non-lethal, anti-personnel, weapons applications to include ground and airborne system variants. 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 interacting 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. Begin the development of ground-based airborne level system demonstration hardware.
(U)	$864	Develop the technology to integrate HPM devices on aerial platforms and investigate specific target sets of interest. Continue airborne electronic attack specific target identification efforts for individual targets and group and/or cluster of targets. Continue conducting experiments in the new 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 a 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)	$8,414	Total

(U) B. Project Change Summary

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT 3152	

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

(U) Related Activities:

(U) PE 0602202F, Human Systems Technology.

(U) PE 0602605F, Directed Energy Technology.

(U) PE 0603851M, Nonlethal Weapons - Dem/Val.

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

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT: 3647

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
3647 High Energy Laser Technology	26,702	8,270	4,369	3,570	2,013	2,132	2,160	2,187	Continuing	

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

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) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $447 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. Provided data from predictive avoidance analysis to Air Force Space Command to allow them to set standards for laser illumination of space objects. Improved the data fusion of optical and radar measurements of space objects.

(U) $6,829 Performed atmospheric compensation/beam control experiments from the Starfire Optical Range 3.5-meter telescope for applications including antisatellite weapons, relay mirror systems, satellite health and diagnostics, and high-resolution satellite imaging. Performed compensated laser propagation to satellite targets and used the detailed measurements of energy and beam profile on target to characterize anisoplanatic effects and validate propagation models. Designed and began integration of laser beam control system using active tracking and target return loop adaptive optics with higher bandwidth signal processing and enhanced data capture capabilities. Integrated scoring laser and sensors for integrated beam control demonstration. Designed Rayleigh beacon point-ahead atmospheric compensation system for laser projection to satellites on weapons-class beam director (3.5-meter telescope).

(U) $13,007 Developed and evaluated beam control/compensation techniques for atmospheric attenuation and distortion on laser beam propagation from airborne platforms for applications such as theater missile defense. These efforts supported the Airborne Laser (ABL) Advanced Technology Demonstration to enhance high energy laser delivery from the ABL weapon system to missile targets. Developed and demonstrated in the laboratory advanced tracking and adaptive optics methods to mitigate the negative optical turbulence effects on an uncompensated high energy

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT 3647

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

laser beam under propagation conditions scaled to represent those expected in Airborne Laser engagements. Began wave-optics simulation of two wavefront sensors to enhance the ability to correct for atmospheric disturbances. Updated wave-optics computer simulations based on field test results to more effectively evaluate and improve subsequent advanced concepts.

(U) $1,564 Developed and demonstrated the technology for scalable, high energy laser devices with improved efficiency, for insertion in future airborne lasers and other potential weapon applications. Analyzed and enhanced multiple high pressure ejector nozzles performance using modeling and simulation. Began development of a laboratory nozzle test stand to evaluate new designs. Explored iodine injection and iodine generation methods and selected the most promising for insertion into advanced chemical oxygen iodine test sequence utilizing a laboratory test stand.

(U) $1,685 Developed and analyzed technology that supports manufacturing of the Advanced Tactical Laser. Evaluated designs and manufacturing capability for compact inertial reference units, including upgrades to the Stabilized Inertial Measurement System (SIMS) stable platform, to reject base motion disturbances due to aircraft vibration and acoustics. Incorporated manufacturing analysis results into a design for a next-generation SIMS with improved performance.

(U) $1,486 Continued to investigate the LaserSpark missile Infrared Countermeasure (IRCM) technology and develop/demonstrate the infrared countermeasure effectiveness of the multiple internal laser effects (MILE) associated with plasma/sparks. Conducted critical experiments on components and subsystems to establish error budgets and performance specifications. Continued testing of MILE on advanced focal plane array seeker mockups. Assessed IRCM effectiveness on flyout simulations of MILE on conical scan and focal plane array seekers. Conducted laboratory hardware experiments to validate flyout modeling and anchor computer simulations.

(U) $1,684 Fabricated brassboard sodium-wavelength laser to be used as a mesospheric beacon for adaptive optics systems on large-aperture telescopes. Designed and began radiometry experiments to characterize sodium beacon performance. Began design of a hybrid beacon adaptive optics system combining sodium and Rayleigh laser beacons for atmospheric compensation of large telescopes at visible and near-infrared wavelengths.

(U) $26,702 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $1,192 This project previously included space unique efforts which have been transferred to PE 0603500F, Multi-disciplinary Space Advanced Development Technology. These funds represent the civilian salaries for the work effort transferred.

(U) $371 Perform 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. Update target system response databases for improved predictive avoidance analyses.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT 3647

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

(U)	$3,564	Develop and evaluate beam control/compensation techniques for atmospheric attenuation and distortion on laser beam propagation from airborne platforms for applications such as theater missile defense. These efforts support the Airborne Laser (ABL) Advanced Technology Demonstration to enhance high energy laser delivery from the ABL weapon system to missile targets. Complete experimental testing of advanced active tracking and atmospheric compensation concepts and begin transition of algorithmic approaches to the ABL acquisition program. Begin field testing of advanced beam control architectures against a scaled target. Assess advanced technology improvements to support ABL block upgrades. Continue concept refinement through modeling and simulation of improved wave front sensors and the two-beacon concept. Begin technology transition to the ABL System Program Office.
(U)	$966	Develop and demonstrate the technology for scalable, high energy laser devices with improved efficiency for insertion in future airborne lasers and other potential weapon applications. Continue to evaluate, demonstrate, and enhance multiple high pressure ejector nozzles performance using modeling and simulation and laboratory nozzle test stand evaluations. Begin integration of the most promising iodine injection and iodine generation methods into an advanced chemical oxygen iodine test sequence utilizing a laboratory test stand. Validate performance of components.
(U)	$2,177	Fabricate brassboard sodium-wavelength laser to be used as mesospheric beacon for adaptive optics systems on large-aperture telescopes. Complete low power laser sky tests. Start high power laser tests.
(U)	$8,270	Total

(U) FY 2004 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$2,293	Develop and demonstrate the technology for scalable, high energy laser devices with improved efficiency for insertion in future airborne lasers and other potential weapon applications. 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. Integrate components to predict system level performance and discover system level issues. Investigate chemical recirculation on tactical airborne platforms.
(U)	$2,076	Develop and evaluate beam control/compensation techniques for atmospheric attenuation and distortion on laser beam propagation from airborne platforms for applications such as theater missile defense. These efforts support the ABL Advanced Technology Demonstration to enhance high energy laser delivery from the ABL weapon system to missile targets. Demonstrate advanced tracking methods and adaptive optics compensation techniques that double the Strehl ratio (peak intensity on target) in stressing atmospheric turbulence. Demonstrate the performance of various wavefront sensors to maximize the ability to correct for atmospheric disturbances through field demonstrations.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT 3647	

(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

Complete demonstration and evaluation of the compensated beacon illumination technique. Anchor wave optics propagation code to the demonstrated beam control performance. Complete technology transition to the Airborne Laser System Program Office.

(U) $4,369 Total

(U) B. Project Change Summary

Not Applicable.

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

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

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.