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

DATE: February 2002

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

	COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	41,407	66,905	28,271	32,420	33,998	37,305	38,140	Continuing	TBD
3150	Advanced Optics Technology	14,869	22,178	260	898	1,121	3,277	3,350	Continuing	TBD
3151	High Power Solid State Laser Technology	3,582	5,410	8,830	14,566	15,437	16,133	16,439	Continuing	TBD
3152	High Power Microwave Technology	8,022	11,114	12,952	11,614	11,765	11,954	12,117	Continuing	TBD
3647	High Energy Laser Technology	14,934	28,203	6,229	5,342	5,675	5,941	6,234	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0

Note: In FY 2003, space unique tasks in Projects 3150 and 3647 will be transferred to PE 0603500F in conjunction with the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description

This PE 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 2002, Congress added $7 million for Geo Light Imaging National Testbed (GLINT), $1.7 million for sodium wavelength laser, $1.7 million for Manufacturing Analysis for the Advanced Tactical Laser, $6.4 million for the Aerospace Relay Mirror System, $8.5 million for the Field Laser Demonstration Upgrades, and $1.5 million for Laser Spark Countermeasures.

(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.

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

		FY 2001	FY 2002	FY 2003	Total Cost
(U)	Previous President's Budget	42,973	43,758	37,744	
(U)	Appropriated Value	43,371	67,558		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions		-653		
	b. Small Business Innovative Research	-1,018			
	c. Omnibus or Other Above Threshold Reprogram				
	d. Below Threshold Reprogram	-548			
	e. Rescissions	-398			
(U)	Adjustments to Budget Years Since FY 2002 PBR			-9,473	
(U)	Current Budget Submit/FY 2003 PBR	41,407	66,905	28,271	TBD

(U) Significant Program Changes:

In FY 2002, Congress added $7 million for Geo Light Imaging National Testbed (GLINT), $1.7 million for sodium wavelength laser, $1.7 million for Manufacturing Analysis for the Advanced Tactical Laser, $6.4 million for the Aerospace Relay Mirror System, $8.5 million for the Field Laser Demonstration Upgrades, and $1.5 million for Laser Spark Countermeasures.

Decrease in FY 2003 is due to space unique efforts being moved to PE 0603500F.

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

DATE: February 2002

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT: 3150

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
3150 Advanced Optics Technology	14,869	22,178	260	898	1,121	3,277	3,350	Continuing	

Note: In FY 2003, space unique tasks in Project 3150 will be 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 locating, identifying, and analyzing distant and dim objects such as geosynchronous orbit satellites. This work supports high energy laser applications in target verification, accurate and sustainable laser beam placement on target, and near-real-time damage assessment. Several advanced technologies including adaptive optics and specialized optical processing are being developed. The goal is high quality optical image reconstruction, concentrating on removing turbulent atmosphere-induced distortions. In addition to the primary defense applications, many of the technologies have significant astronomy research applications.

(U) FY 2001 ($ in Thousands)

(U) $197 Developed advanced optical technologies for correction of laser beams for projection and optical imaging applications. Demonstrated beam control technologies applicable to space-based systems in a controlled laboratory environment with laboratory scaled breadboards and components. These technologies support applications such as target acquisition, tracking and pointing, target designation, and remote sensing. Advances were made in the ability to project a wide range of laser wavelengths and powers in a single optical system and in minimizing the number of optical components to reduce weight and complexity with the goal of making large space-based optical systems viable.

(U) $184 Investigated advanced concepts to deploy and use large space-based mirrors for applications such as imaging, laser beam projection, and laser beam relay. Continued to pursue component development of advanced optical materials and devices that can be scaled to much larger sizes with the required speed, resolution, and power handling capability for space relay mirror applications.

(U) $7,727 Continued to develop 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) $6,761 Continued upgrades to the Field Laser Demonstrator for increased sensitivity to obtain very accurate data on space objects and to evaluate techniques for remote sensing of the atmosphere. Continued to install a laser radar system on the Advanced Electro-Optical System telescope on Maui, HI. Performed experiments for space applications such as high accuracy orbital measurements, imaging for target identification, and satellite status assessment. Investigated laser imaging of ground targets from unmanned aerial vehicles or satellites for standoff intelligence

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BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT 3150

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

detection.

(U) $14,869 Total

(U) FY 2002 ($ in Thousands)

(U) $489 Develop and laboratory test advanced adaptive optical technologies to support beam stabilization, imaging applications, and target acquisition, tracking, and pointing applications. Explore liquid crystal technology for advanced adaptive optics to demonstrate non-mechanical beam steering in scaled laboratory environment. Technology development work is aimed at reducing weight, power consumption, and complexity of optical systems to enable their use in space platforms.

(U) $6,338 Develop technologies for an aerospace relay mirror. Develop and optimize techniques for dual line of sight pointing from two separate telescopes in space and autonomous alignment of two telescopes. Design an optical payload to perform beam characterization and clean up. Develop point ahead beacon technology.

(U) $6,933 Develop 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. Develop/test operating procedures and software for passive identification of satellites in support of GLINT experiments.

(U) $8,418 Continue 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. Continue 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) $22,178 Total

(U) FY 2003 ($ in Thousands)

(U) $260 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 and they will be transferred at a later date.

(U) $260 Total

(U) B. Project Change Summary

Not Applicable.

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development	0603605F Advanced Weapons Technology	3150

(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.

(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 2002

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT: 3151

COST ($ in Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
3151	High Power Solid State Laser Technology	3,582	5,410	8,830	14,566	15,437	16,133	16,439	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 payoff. 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. Secondly, wavelength specific solid state lasers for military applications such as infrared countermeasures are developed.

(U) FY 2001 ($ in Thousands)

(U) $1,852 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. Demonstrated a fiber laser module, with no free space optical elements, at several tens of watts of power.

(U) $1,037 Developed and demonstrated laser source and beam control technologies needed to counter current and next generation air-to-air and surface-to-air missile threats. Continued development of a reliable four micron wavelength solid state laser, with a goal of achieving five watts average power, for countering current generation threats to aircraft platforms.

(U) $693 Developed and demonstrated novel target coupling technologies needed to counter current and next generation air-to-air and surface-to-air missile threats. Demonstrated novel device structures and incoherent beam combining techniques for improving beam quality, required for fast jet aircraft and large aircraft self-protection.

(U) $3,582 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT 3151

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U) $1,712 Develop 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. Begin work to demonstrate high electrical efficiency (approaching 30%) and beam combining at high power to enable applications requiring high power lasers. Demonstrate coherent beam combining of two 100 watt amplifiers showcasing the building block technology of future directed energy, weapons-class electric lasers. Demonstrate wavelength-versatile integrated laser/nonlinear optics at five watt power levels. Continue development of an all-fiber solution, with no free space optical elements, at power levels approaching 100 watts.

(U) $2,835 Develop and demonstrate laser source needed to counter current air-to-air and surface-to-air missile threats. Demonstrate 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 Develop and demonstrate high-energy laser and beam control, 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 and advanced beam control to control platform vibration, atmospheric jitter, and aero-optic effects. Initiate laser effect testing using a multi-kilowatt laser to determine required energy levels for tactical applications that address next generation threats.

(U) $5,410 Total

(U) FY 2003 ($ in Thousands)

(U) $4,951 Demonstrate 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. Demonstrate high electrical efficiency (goal greater than 30%) and coherent beam combining to enable applications requiring high power lasers. Demonstrate coherent beam combining to achieve one kilowatt and integration technologies for multiple fiber laser modules at moderate powers. Demonstrate wavelength-versatile integrated laser/non-linear optics at 10 watt power levels. Continue development of an all-fiber solution, with no free space optical element, at power levels greater than 100 watts.

(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 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

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development	0603605F Advanced Weapons Technology	3151

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

determine required energy levels for tactical applications that address next generation threats.

(U) $8,830 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.

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DATE: February 2002

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT: 3152

COST ($ in Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
3152	High Power Microwave Technology	8,022	11,114	12,952	11,614	11,765	11,954	12,117	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 2001 ($ in Thousands)

(U) $3,416 Developed and demonstrated HPM technologies to render inoperative electronic components of an adversary's integrated air defense system. Demonstrated and quantified the effectiveness of a repetitively pulsed system against electronic targets of interest. Conducted a full power breadboard demonstration to validate repetitively pulsed capability application development.

(U) $2,997 Developed and demonstrated HPM technologies to render inoperative command and control components of an adversary. Conducted field experiments with brassboard devices to demonstrate command and control warfare effectiveness. Investigated setup of ground-based, field experiments demonstrating effectiveness of air-delivered HPM sub-munition. Applied computer codes to predict coupling to targets and validate their accuracy.

(U) $1,609 Developed, demonstrated, and evaluated active denial technology for several non-lethal mission applications including future peacekeeping assignments. Began human testing demonstrations of vehicle-mounted non-lethal directed energy weapons technology. Continued investigations for man-portable applications. Analyzed critical technologies for airborne active denial applications, including beam control, source efficiency, antenna gain, and aircraft integration.

(U) $8,022 Total

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	PROJECT: 3152

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U)	$4,370	Develop and demonstrate narrowband high power microwave (HPM) technologies to damage or destroy an adversary's electronic systems. Demonstrate pulsed power and narrowband HPM source capability applicable to munitions and airborne concepts. Select repetitively pulsed HPM technology for multi-gigawatt application development. Evaluate narrowband technologies to address aircraft protection against surface to air missiles. Develop and demonstrate wideband HPM technologies to disrupt, degrade, damage, or destroy an adversary's command and control and infrastructure. Develop integrated compact source design(s) based on effects data and technology advances for improved effectiveness in HPM munitions and airborne electronic attack missions.
(U)	$2,178	Conduct effects experimentation on targets to refine source parameters, expand target set, and support susceptibility predictions. Begin building probability of effect database using experimental data from several programs. Transition selected technologies. Continue to refine modeling and simulation codes to more accurately predict wideband HPM coupling in realistic scenarios. Complete probability of effect models for engagement models. Continue to investigate and develop models to quantify the effectiveness of a narrowband repetitively pulsed system against electronic targets of interest applicable to munitions or airborne platforms.
(U)	$2,066	Develop and evaluate active denial technologies for non-lethal weapons applications. Continue analysis of critical technologies for airborne active denial. Investigate test cell development of millimeter wave source for airborne applications.
(U)	$2,500	Develop the means to integrate HPM devices onto unmanned aerial platforms. Perform integration, thermal control, and target studies for such concepts. Investigate the feasibility of using ultra-wideband HPM to geolocate and identify targets of interest, and perform battle damage assessment. Perform lethality assessments of HPM on targets of interest to gauge the military utility and effectiveness of the integrated HPM concept.
(U)	$11,114	Total

(U) FY 2003 ($ in Thousands)

(U)	$4,970	Develop and demonstrate narrowband 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	Continue effects experimentation to expand database and support susceptibility predictions. Apply computer codes to predict coupling to targets and validate their accuracy. Continue to investigate and develop models to quantify the effectiveness of a narrowband repetitively

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development	0603605F Advanced Weapons Technology	3152

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

pulsed system against electronic targets of interest applicable to munitions or airborne platforms.

(U) $2,012 Develop and evaluate active denial technologies for non-lethal weapons applications. Demonstrate next generation vehicle-mounted non-lethal weapons technology. Begin development of millimeter wave source for airborne applications.

(U) $3,700 Develop the means to integrate high power microwave (HPM) devices onto unmanned aerial platforms. Continue integration and target studies for such concepts while beginning investigation of thermal control issues. Define the vehicle integration environment for a HPM device. Investigate the feasibility of using ultra-wideband HPM to geolocate and identify targets of interest, and perform battle damage assessment. Continue to perform lethality assessments of HPM on targets of interest to gauge the military utility and effectiveness of the integrated HPM concept.

(U) $12,952 Total

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:

(U) PE 0602202F, Human Systems 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.

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DATE: February 2002

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PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT: 3647

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
3647 High Energy Laser Technology	14,934	28,203	6,229	5,342	5,675	5,941	6,234	Continuing	

Note: In FY 2003, space unique tasks in Project 3647 will be 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 technology needed for high energy laser weapons that are not space unique. 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 2001 ($ in Thousands)

(U) $664 Performed vulnerability assessments on potential high energy laser targets to provide critical design data for laser systems to defeat these targets. Reviewed/developed the system-level deny/disrupt/damage/destroy criteria for counterspace high energy laser systems, based on new data from satellite vulnerability assessments. Transitioned an improved tool for the analysis of high-resolution optical images to the National Air Intelligence Center.

(U) $5,849 Performed atmospheric compensation/beam control experiments from Starfire Optical Range 3.5-meter telescope for ground-based platforms to support applications including antisatellite weapons, satellite health and diagnostics, and high-resolution satellite imaging. Continued characterization of return signals from laser illuminated satellites to design system for active (laser-illuminated) tracking of unaugmented low earth orbit satellites. Analyzed data from previous satellite imaging and tracking experiments for design of 24-hour laser beam control system. Designed a target-loop atmospheric compensation system for laser projection to satellites on weapons-class beam director (3.5-meter telescope). Modeled and analyzed long-path atmospheric effects for design of advanced adaptive optics for low-elevation compensation of lasers and imaging.

(U) $5,449 Developed and evaluated enhanced beam control/compensation techniques for atmospheric attenuation and distortion on laser beam propagation from airborne platforms for applications such as theater missile defense. Continued computer simulation of additional advanced concepts for active tracking and atmospheric compensation using adaptive optics under propagation conditions representative of typical

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(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

airborne laser engagement scenarios. Conducted advanced active tracking and adaptive optics laboratory experiments using representative turbulence phase screens. Performed passive tracking demonstrations, anisoplanatism studies, and common-path/common-mode studies. Developed and integrated hardware for future static and dynamic active tracking and atmospheric compensation demonstrations using advanced concepts under propagation conditions scaled to represent those expected in airborne laser engagement scenarios.

(U) $2,972 Continued to investigate the LaserSpark missile countermeasure technology. Developed and demonstrated the infrared countermeasures effectiveness of the multiple internal laser effects (MILE) associated with plasma/sparks. Continued laboratory testing of MILE on advanced focal plane array seeker mockups using properly formatted laboratory lasers. Developed flyout simulations of MILE on conical scan and focal plane array seekers. Continued design planning and coordination for a limited field demonstration of aimpoint control and countermeasure effectiveness on in-flight seekers.

(U) $14,934 Total

(U) FY 2002 ($ in Thousands)

(U) $498 Perform vulnerability assessments on potential high energy laser targets to provide critical design data for laser systems to defeat these targets. Provide data from sure-safe analysis to Air Force Space Command, for setting standards for laser illumination of space objects. Improve the data fusion of optical and radar measurements of space objects.

(U) $8,413 Perform 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. Perform compensated laser propagation to satellite targets and use the detailed measurements of energy and beam profile on target to characterize anisoplanatic effects and validate propagation models. Design and begin 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. Integrate scoring laser and sensors for integrated beam control demonstration. Design Rayleigh beacon point-ahead atmospheric compensation system for laser projection to satellites on weapons-class beam director (3.5-meter telescope).

(U) $12,372 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 will enhance high energy laser delivery from an airborne laser weapon system to missile targets. Develop and demonstrate in the laboratory advanced tracking and adaptive optics methods to mitigate the negative optical turbulence effects on an uncompensated high energy laser beam under propagation conditions scaled to represent those expected in airborne laser engagements. Begin wave-optics simulation of two wavefront sensors to enhance the ability to correct for

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

atmospheric disturbances. Update wave-optics computer simulations based on field test results to more effectively evaluate and improve subsequent advanced concepts.

(U) $2,067 Develop and demonstrate the technology for scalable, high energy laser devices with improved efficiency, for insertion in airborne lasers and other potential weapon applications. Evaluate and optimize multiple high pressure ejector nozzles performance using modeling and simulation and laboratory nozzle test stand. Explore iodine injection and iodine generation methods and select the most promising for insertion into advanced chemical oxygen iodine test sequence utilizing a laboratory test stand.

(U) $1,683 Develop and analyze technology that supports manufacturing of the Advanced Tactical Laser (ATL). Collect vibration data on appropriate aircraft to better understand the dynamic disturbances that would be encountered on an ATL. Evaluate other effects, such as thermal blooming and aero-optical aberrations, that have the potential to severely limit an ATL's performance. Evaluate designs and manufacturing capability for compact inertial reference units, including upgrades to the Stabilized Inertial Measurement System stable platform, to reject base motion disturbances due to aircraft vibration and acoustics.

(U) $1,486 Continue 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. Conduct critical experiments on components and subsystems to establish error budgets and performance specifications. Continue testing of MILE on advanced focal plane array seeker mockups. Assess IRCM effectiveness on flyout simulations of MILE on conical scan and focal plane array seekers. Conduct laboratory hardware experiments to validate flyout modeling and anchor computer simulations.

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

(U) $28,203 Total

(U) FY 2003 ($ in Thousands)

(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 and they will be transferred at a later date.

(U) $371 Perform vulnerability assessments on potential high energy laser targets to provide critical design data for laser systems to defeat these targets.

(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 will enhance high energy laser delivery from an airborne laser

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

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. Evaluate the performance of various wavefront sensors to maximize the ability to correct for atmospheric disturbances. Assess candidate advanced track algorithms to increase stability of the high power beam on target. Initiate demonstration and evaluation of the compensated beacon illumination technique. Anchor wave optics propagation code to the demonstrated beam control performance.

(U) $1,102 Develop and demonstrate the technology for scalable, high energy laser devices with improved efficiency for insertion in airborne lasers and other potential weapon applications. Continue to evaluate and optimize multiple high pressure ejector nozzles performance using modeling and simulation and laboratory nozzle test stand evaluations. Begin integration of most promising iodine injection and iodine generation methods into an advanced chemical oxygen iodine test sequence utilizing a laboratory test stand.

(U) $6,229 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.