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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602307A - 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
	Total Program Element (PE) Cost	25460	19976	14189	17560	20634	21047	21560	22051
042	HIGH ENERGY LASER TECHNOLOGY	15390	12113	14189	17560	20634	21047	21560	22051
04G	MINIATURE DETECTION DEVICES & ANALYSIS METHODS	958	0	0	0	0	0	0	0
NA3	MICROELECTRO MECHANICAL SYSTEMS	7769	4050	0	0	0	0	0	0
NA5	RAPID TARGET ACQUISITION & TRACKING SYSTEM	1343	3813	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program matures technologies for the Army Transformation as related to High Energy Laser (HEL) weapon systems. Potential HEL weapon system missions in the areas of Information Dominance and Force Protection include countering airborne electro-optical sensors and defending against airborne threats, providing a new, low cost per shot, complement to conventional offensive and defensive weapons. This program will address technical issues such as high average power output from compact and more efficient lasers; precision optical pointing and tracking; laser influence degradation due to atmospheric effects; lethality; and effectiveness against low-cost laser countermeasures. A key project within this program is the development of a multi-hundred kilowatt (kW) solid-state laser (SSL) laboratory demonstrator. This project will demonstrate a 15-25 kW diode-pumped solid-state laser (SSL) breadboard in FY04. In FY04, the Army will evaluate this concept against alternative SSL technology approaches being supported by the High Energy Laser (HEL) Joint Technology Office (JTO) High-Power Solid-State Laser program. The most promising technology will then be upgraded to a 100kW SSL laboratory device, scheduled for completion in FY07. The project will continue to mature the selected SSL technology into a multi-hundred kW laboratory device. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work in this program element is related to, and fully coordinated with, efforts in PE 0602890 D8Z and PE 0603924D8Z (High Energy Laser Joint Technology Office), PE 0605605A (DOD High Energy Laser Systems Test Facility), PE 0603305A/TR3 (Army Missile Defense Systems Integration/Mobile Tactical High Energy Laser), and starting in FY06 to PE 0603004/L96 (Weapons and Munitions Advanced Technology). Work is performed by the US Army Space and Missile Defense Command (SMDC), in Huntsville, AL and the Army Test and Engineering Center, White Sands Missile Range, NM. This PE supports the Objective transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds were provided to the program.

B. Program Change Summary	FY 2002	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2003)	26883	11208	11312	17864
Current Budget (FY 2004/2005 PB)	25460	19976	14189	17560
Total Adjustments	-1423	8768	2877	-304
Congressional program reductions				
Congressional rescissions		-292		
Congressional increases		9750		
Reprogrammings	-691	-114		
SBIR/STTR Transfer	-732	-576		
Adjustments to Budget Years			2877	-304

Significant Changes:
FY04 - Funds increased investments in solid state laser efforts.

FY03 Congressional Adds:
Rapid Target Acquisition Tracking System (RTATS), Project NA5 ($3813); MEMS for Defense Applications, Project NA3 ($4050); High Intensity Laser Diode Arrays for SSHCL, Project 042 ($1430)

Projects with no R-2A:
($3813) Rapid Target Acquisition & Tracking System, Project NA5: The objective of this one year Congressional add is to design/mature a brassboard with the critical elements of a rapid, passive infrared (IR) acquisition and tracking system for use in detection of fast, low signature threats such as Anti-Tank Guided Missiles (ATGM). No additional funding is required to complete this project.

($4050) Microelectro Mechanical Systems for Defense Applications, Project NA3: The objective of this one year Congressional add is to continue maturation of a chemical/physical analysis instrument suitable for harsh environments. No additional funding is required to complete this project.

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602307A - ADVANCED WEAPONS TECHNOLOGY**	**042**

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
042	HIGH ENERGY LASER TECHNOLOGY	15390	12113	14189	17560	20634	21047	21560	22051

A. Mission Description and Budget Item Justification: This project matures technologies for Army Transformation relating to solid-state High Energy Laser (HEL) weapon systems. Potential HEL weapon system missions include defense against airborne threats and countering electro-optical sensors. This effort will develop and demonstrate a 15-25 kilowatt (kW) diode-pumped solid-state laser (SSL) breadboard in FY04. In FY04, the Army will evaluate this concept against alternative SSL technology approaches being supported by the High Energy Laser (HEL) Joint Technology Office (JTO) High-Power Solid-State Laser program. The most promising SSL technology will then be upgraded to a 100kW laboratory device, scheduled for completion in FY07. This project would continue to mature the selected SSL technology into a multi-hundred kW laboratory SSL device. The 100kW laser and additional HEL technology components will be refined and upgraded to transition into an integrated SSL weapons system that will be developed in PE 0603004A/L96. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work in this program element is related to, and fully coordinated with, efforts in PE 0602890 D8Z and PE 0603924D8Z (High Energy Laser Joint Technology Office), PE 0605605A (DOD High Energy Laser Systems Test Facility), PE 0603305A/TR3 (Army Missile Defense Systems Integration/Mobile Tactical High Energy Laser), and starting in FY06 to PE 0603004/L96 (Weapons and Munitions Advanced Technology). Work within this PE is performed by the US Army Space and Missile Defense Command (SMDC), in Huntsville, AL and the Army Test and Evaluation Command, White Sands Missile Range, NM. This PE supports the Objective transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds were provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Solid State Laser (SSL) Development: In FY02, demonstrated a 10 kW flashlamp-pumped Solid State Laser (SSL) based on a heat capacity laser design in a laboratory environment. Performed laboratory characterization of SSL performance, designed and tested an integrated active resonator design to improve system beam quality. Began conversion of the flash lamp pumped SSL into a laser-diode pumped device. In FY03, complete integration of the diode-pumped SSL breadboard to include an intra-cavity active resonator demonstration. In FY04, integrate thermal management system into the SSL concept and complete laboratory characterization of the laser device to include thermal cycling time, power management requirements, and beam quality over time and nominal ranges. This breadboard device will demonstrate the major aspects of power scaling, beam combining/quality/efficiency, that support the engineering analysis used in the technology selection process.	9680	8704	8712	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
SSL Subcomponent Development: Laser crystal development - In FY02 began initial testing of SSL crystal response to diode laser pumping, developed and demonstrated production technology to create bulk crystal media (large). In FY03, demonstrate ability to grow high-quality, large diameter (>10cm) laser crystals. In FY04, reliably produce laser crystals, maintaining state-of-the-art crystal dislocation density while increasing crystal diameter by 50 percent. Laser diode development and production - In FY02, developed and demonstrated laser diode/cooler package production techniques (rack and stack) that halve the cost of the diode/cooler packages. In FY03, begin industrial effort for area scaling (monolithic array) of laser diode/cooler package. This technology enables the processing of multiple diode bars per cooler and reduces manpower requirements for assembly. In FY04, begin industrial effort to semi-automate production for additional cost reduction while increasing diode/cooler package life by 50%. Thermal management - In FY02 demonstrated the ability to maintain a uniform temperature across a simulated laser disk. Designed and demonstrated an alternative high cooling capacity system utilizing highly efficient mist-cooling/phase-change techniques. In FY03, maintain a uniform temperature (< 1oC) across a large bulk media crystal. Improve alternative mist-cooling thermal management system to enable a reduction in cool down time by a factor of five. In FY04, integrate scaled versions of thermal management system into SSL breadboards. Design and validate novel rotating disk approach for SSL thermal management. Beam control/atmospheric compensation - In FY02, assessed atmospheric effects and compensation on system lethality and size constraints. Completed preparation of Army Pointer Tracker (APT, former Airborne Laser Lab Beam Director retrofitted for SSL technologies) beam director for integration with 10 kW flashlamp pumped device.	3510	3409	5477	0
SSL System Engineering and Lethality Effects Study – System Engineering - In FY 02, completed thermal storage concept definition; conducted scenario analysis of SSL performance against threat of ATGM; and determined top-level system parameters required for an effective tactically mobile HEL weapon. Lethality - completed 10 kW flashlamp device characterization via beam target interactions; used those interactions to construct physics based model of laser effects.	2200	0	0	0
High Power SSL Development - In FY05, analyze results of competitive 25 kW SSL laboratory demonstrations; down select design, and initiate development of 100kW SSL. Begin procurement of several long-lead items, such as power supplies, crystal media, diode arrays and thermal management technologies. Develop brassboard components for 100kW laser prototype and begin integration.	0	0	0	17560
Totals	15390	12113	14189	17560