ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2005

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

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		14425	24495	21139	21989	22496	22964	23420	23884
042	HIGH ENERGY LASER TECHNOLOGY	13450	15148	21139	21989	22496	22964	23420	23884
NA5	ADVANCED WEAPONS COMPONENTS (CA)	975	9347	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This applied research Program Element (PE) investigates advanced technologies for Future Force High Energy Laser (HEL) weapons technology, and, where feasible, exploits opportunities to enhance Current Force capabilities. This PE also investigates new technology concepts in space applications. The major effort under this PE is the development of a multi-hundred kilowatt (kW) Solid State Laser (SSL) laboratory demonstration that can be integrated into a HEL weapon to provide increased ground platform-based lethality. HEL systems have the potential to address the following identified Army capability gaps: 1) Defeat In-Flight Projectiles such as rockets, artillery, mortars, anti-tank guided missiles, rocket propelled grenades, and man-portable surface-to-air missiles; 2) Ultra-Precision Strike with little to no collateral damage; 3) Disruption of Electro-Optical (EO) and Infra-Red (IR) sensors; and 4) Neutralizing mines and other ordnance (especially improvised explosive devices (IEDs)) from a stand-off distance. HELs are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems. At weapon system power levels of greater than 100kW, SSL technology has the potential to enhance Future Combat Systems (FCS) survivability by addressing the capability gaps identified above. This SSL technology effort addresses technical issues such as high average power output from compact and more efficient lasers; precision optical pointing and tracking; laser effects degradation due to atmospheric effects; lethality against a variety of targets; and effectiveness against low-cost laser countermeasures. The multi-hundred kilowatt 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. Project NA5 funds Congressional interest items. Work in this PE 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). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). 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.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2005)	16641	19589	19962
Current Budget (FY 2006/2007 PB)	24495	21139	21989
Total Adjustments	7854	1550	2027
Net of Program/Database Changes			
Congressional Program Reductions	-1191		
Congressional Rescissions			
Congressional Increases	9750		
Reprogrammings			
SBIR/STTR Transfer	-705		
Adjustments to Budget Years		1550	2027

Change Summary Explanation:
FY06 - Increased funding ($1550K) to enhance Applied Research in Space Technology.
FY07 - Increased funding ($2027K) to enhance Applied Research in Space Technology.

Two FY05 Congressional Adds totaling $9750 were added to this PE.

FY05 Congressional Adds with no R-2A:
($3117) Army Missile and Space Technology Initiative, Project NA5: The purpose of this one year Congressional add is to develop a Government standard Hypersonic Computational Fluid Dynamics Model for evaluating PEO ASMD future Cruise Missile and Theater Missile defense concepts. No additional funding is required to complete this project.

($6233) Rapid Targeting Acquisition and Tracking System (RTATS), Project NA5: The purpose of this one year Congressional add is to enable a demonstration of the RTATS on targets such as rockets, artillery, mortar, and Anti-Tank Guided Missiles to accuracies needed to support a Solid State Laser Weapon. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2005

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

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
042	HIGH ENERGY LASER TECHNOLOGY	13450	15148	21139	21989	22496	22964	23420	23884

A. Mission Description and Budget Item Justification: This applied research project investigates advanced technologies for Future Force High Energy Laser (HEL) weapons technology, and, where feasible, exploits opportunities to enhance Current Force capabilities. This project also investigates new technology concepts in space applications. The major effort under this project is the development of a multi-hundred kilowatt (kW) Solid State Laser (SSL) laboratory demonstration that can be integrated into a HEL weapon to provide increased ground platform-based lethality. HEL systems have the potential to address the following identified Army capability gaps: 1) Defeat In-Flight Projectiles such as rockets, artillery, mortars, anti-tank guided missiles, rocket propelled grenades, and man-portable surface-to-air missiles; 2) Ultra-Precision Strike with little to no collateral damage; 3) Disruption of Electro-Optical (EO) and Infra-Red (IR) sensors; and 4) Neutralizing mines and other ordnance (especially improvised explosive devices (IEDs)) from a stand-off distance. HELs are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems. At weapon system power levels of greater than 100kW, SSL technology has the potential to enhance Future Combat Systems (FCS) survivability by addressing the capability gaps identified above. This SSL technology effort addresses technical issues such as high average power output from compact and more efficient lasers; precision optical pointing and tracking; laser effects degradation due to atmospheric effects; lethality against a variety of targets; and effectiveness against low-cost laser countermeasures. The multi-hundred kilowatt 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. Work in this project 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). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). 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.

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
Solid State Laser (SSL) Development, Phase 1 – 25kW: In FY04, assembled and demonstrated 32kW of laser power out of a 4-module, diode-pumped Solid State Heat Capacity Laser (SSHCL) breadboard using 10-cm square laser slabs. Modified intra-cavity active resonator and conducted laboratory characterization of the diode-pumped laser device to include thermal cycling time, power management requirements, and beam quality. Demonstrated the major aspects of power scaling and beam combining/quality/efficiency. In FY05, integrate the intra-cavity resonator and sliding laser disk thermal management concept into the SSHCL breadboard design to improve run-time performance. Analyze results of competitive 25 kW Joint High Power SOlid State Laser (JHPSSL) Program laboratory demonstrations and independent Government testing; down select best SSL design, and initiate development of a 100kW SSL laboratory device.	9680	12248	0	0
SSL Subcomponent Development: - Laser crystal development - In FY04, reliably produced laser crystals, maintaining state-of-the-art crystal dislocation density while increasing crystal size from 8 to 10 cm square. In FY05, procure and test optical and thermal properties of high quality ceramic slabs as an alternative crystal material. In FY06, will procure and test large, high quality, ceramic crystal slabs that are 8 to 10 cm square. - Thermal management - In FY04, demonstrated a scaled version of a thermal management system designed for the SSHCL breadboard. Designed, demonstrated and validated the feasibility of a novel sliding laser disk thermal management concept to reduce SSHCL run-time limitations. In FY06, will integrate ceramic test slabs into laser breadboard and evaluate impact on thermal properties of the laser system. - - Laser diode development – In FY04, initiated an industrial effort to enable area scaling (monolithic array) of laser diode/cooler package, which enables the processing of multiple diode bars per cooler and reduces manpower requirements for assembly, thereby significantly reducing manufacturing costs. In FY06, will procure and fabricate laser diode arrays for the 100kW laboratory laser breadboard. - Beam quality technologies - In FY05, develop and test advanced resonator concepts to improve beam quality.	3770	1100	1200	0

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Solid State Laser Effects: - Laser Lethality and Propagation Assessments - In FY05, expand lethality assessment to include representative threat system components. Use the flash-lamp pumped demonstrator at HELSTF to assess propagation effectiveness of the SSL wavelength through at least 500 m of atmosphere. In FY06, will continue laser propagation and lethality studies at tactical ranges both at HELSTF and other test facilities using SSLs. In FY07, will conduct lethality assessments on an expanded target set representative of identified capability gaps. - Laser Modeling and Simulation – In FY05, enhance on-going High Energy laser Joint Technology Office efforts in establishing a DoD-wide validated M&S capability for effectively modeling SSL technology. In FY06, will initiate the development and validation of performance and propagation models for Solid State Lasers in a tactical environment. In FY07, will begin integration of validated models into approved Army war-gaming models.	0	1800	1500	1500
SSL Development, Phase 2 – 100kW: In FY06, will procure long lead items and begin integration of components into subsystems that form the basis of a 100kW laboratory laser device that meets the JHPSSL Program Phase 2 performance goals. In FY07, will fabricate remaining components; integrate subsystems into a laser breadboard and conduct preliminary performance tests with an intermediate goal of achieving a 60kW laser output with good beam quality.	0	0	15339	17289
Advanced Laser Concepts: In FY06, will initiate concept exploration into novel laser concepts that stress high efficiency and low weight. In FY07, will initiate concept exploration into monolithic high brightness diode/diode laser capabilities for tactical applications.	0	0	1550	1600
Space Application Concepts: In FY06, will initiate unique intelligence, surveillance, reconnaissance, missile warning, battle management, and communications technologies leveraging the Joint Warfighting Space / Tactical Satellite (JWS/TacSat) Demonstration efforts to validate Army space force enhancement needs. In FY07, will continue space payload/technology investigations to support cooperative Hyperspectral Imaging (HSI), Synthetic Aperture Radar (SAR), and Blue Force Tracking (BFT) payload development for experimentation in the JWS/TacSat initiative.	0	0	1550	1600
Totals	13450	15148	21139	21989