

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY		PE NUMBER AND TITLE						
3 - Advanced technology development		0603004A - Weapons and Munitions Advanced Technology						
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
Total Program Element (PE) Cost	106558	92054	59389	74072	76675	79985	79677	81411
232 ADVANCED MUNITIONS DEM	45660	46149	31414	38245	39913	40296	34705	35332
43A ADV WEAPONRY TECH DEMO	27262	22166						
L94 ELECTRIC GUN SYS DEMO	13863	13420	9571	11637	11887	13045	17742	18250
L96 HIGH ENERGY LASER TECHNOLOGY DEMO	4617	9298	17378	23157	23840	25609	26172	26748
L97 SMOKE AND OBSCURANTS ADVANCED TECHNOLOGY	959	1021	1026	1033	1035	1035	1058	1081
L98 HIGH EXPLOSIVE AIRBURST AMMUNITION AND WEAPONS SYS	14197							

**A. Mission Description and Budget Item Justification:** This program element (PE) matures and demonstrates advanced weapons and munitions technologies to increase battlefield lethality and survivability for the Future Force and, where possible, the Current Force. The goal of this program is to provide the warfighter with weapons and munitions that provide equivalent or greater lethality (or other desired effects) at greater ranges, with greater precision, in lighter weight systems and at affordable costs when compared to current weapon systems. Project 232 funds Mounted Combat System (MCS) and Abrams Ammunition System Technologies (MAAST), which provides enhanced capabilities beyond the baseline line-of-sight/beyond-line-of-sight (LOS/BLOS) armament and munition suite and matures the Mid Range Munition (MRM) to add an objective dual-mode hardened seeker for autonomous and designated engagement modes; Common Smart Submunition, which matures and demonstrates component technologies for a next generation precision kill and target-discriminating submunition that can be used in a variety of delivery systems; Fuze and Power for Advanced Munitions, which integrates enabling fuze technologies such as Micro-Electro-Mechanical Systems (MEMS), proximity sensors, Electronic Safe and Arm Devices (ESADs) and hybrid power systems in end item munitions for demonstration purposes; and Non-Lethal Payloads for Personnel Suppression, which designs and demonstrates the munitions to suppress activity or deny access to designated areas using non-lethal means. Project 43A funds congressional special interest items. Project L94 matures enabling technologies for an Electromagnetic (EM) Gun armament system that will lead to demonstrations of the key sub-systems in FY08. Based on successful completion of the component technologies, the Army will initiate an effort in FY09 for the design, fabrication, and test of an integrated EM armament demonstrator on a mobile platform. EM Gun has the potential to revolutionize the future battlefield with its unique performance characteristics, including hypervelocity lethality effects and greatly reduced logistics burden. Project L96 matures and demonstrates technologies that comprise a high energy, solid-state laser weapon. Project L97 matures and demonstrates smoke and obscurant technologies with potential to enhance personnel and platform survivability. Work in projects 232 and L94 is related to, and fully coordinated with, efforts in PE 0602624A (Weapons and Munitions Technology), PE 0602618A (Ballistics Technology). Work in project L96 is related to, and fully coordinated with, efforts in PE 0603005A/441 (Pulse Power for FCS) and PE 0602307/042 (High Energy Laser Technology). Work in this PE associated with project L97 is related to and fully coordinated with, efforts in PE 0602622A/A552 (Smoke/Novel Obscurant Munitions). Work in this PE is performed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny, NJ, the Army Research Laboratory (ARL), Edgewood Chemical and Biological Center, Aberdeen Proving Ground, MD, and Space and Missile Defense Command Technology Center, Huntsville, AL. 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.

**ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)**

**February 2007**

BUDGET ACTIVITY

PE NUMBER AND TITLE

**3 - Advanced technology development**

**0603004A - Weapons and Munitions Advanced Technology**

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY <b>3 - Advanced technology development</b>	PE NUMBER AND TITLE <b>0603004A - Weapons and Munitions Advanced Technology</b>
---	--

<u><b>B. Program Change Summary</b></u>	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	101841	74717	68495	78004
Current BES/President's Budget (FY 2008/2009)	106558	92054	59389	74072
Total Adjustments	4717	17337	-9106	-3932
Congressional Program Reductions		-4385		
Congressional Rescissions				
Congressional Increases		22400		
Reprogrammings	4717	-678		
SBIR/STTR Transfer				
Adjustments to Budget Years			-9106	-3932

FY08 funds decreased to fund higher priority Army efforts.

Twelve FY07 congressional adds totaling \$21516 (after adjustment for Congressional Reductions) were added to this PE.

- (\$2067) Armament Titanium Casting Advancement Program
- (\$3453) Disruptive Technology Acceleration
- (\$1923) Mid-Range Munition (MRM-KE)
- (\$1923) National Nano Manufacturing Center (NNMC)
- (\$959) Manufacturing of Precision Molded Aspheric Optics
- (\$3460) Rapid Insertion of Development Technology
- (\$959) Electromagnetic Gun Technology Maturation and Demo
- (\$1295) Optical Processing Realization for Army Amaments
- (\$1251) Production-class Nanoposder Processing Facility
- (\$959) Reactive Nanocomposite Materials
- (\$2308) Telepresent Rapid Aiming Platform (TRAP)
- (\$959) Terramechanics Research to Reduce Vehicle Rollover

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

<b>BUDGET ACTIVITY</b> <b>3 - Advanced technology development</b>	<b>PE NUMBER AND TITLE</b> <b>0603004A - Weapons and Munitions Advanced Technology</b>						<b>PROJECT</b> <b>232</b>		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
232      ADVANCED MUNITIONS DEM	45660	46149	31414	38245	39913	40296	34705	35332	

**A. Mission Description and Budget Item Justification:** This project matures and demonstrates munitions enhancements and emerging technologies in lightweight structures, smart materials, acoustic/seismic sensors and in-flight update architectures that will enable equivalent or greater lethality (or other desired effects) at greater ranges, with greater precision, in lighter weight systems and at affordable costs when compared to current weapon systems. A major effort is the MCS and Abrams Ammunition System Technologies (MAAST). MAAST supports the maturation and demonstration of hardened dual mode seeker technology for Mid-Range Munition (MRM) (a gun launched precision munition for MCS capable of defeating high-value heavy armor and other targets out to 12km). The MAAST effort also matures technologies such as Low Cost Precision components and subsystems for command-guided projectiles, which will enhance the capabilities of the MCS and the M1A2 through spiral insertion and upgrades. This project also funds the Lightweight Dismounted Mortar Weapon, which is a man-transportable 81mm mortar fabricated from lightweight advanced materials and structures; Common Smart Submunition (CSS), which pursues critical subsystem evaluations leading to system demonstrations of a submunition that offers increased operational efficiency through multiple kills per munition, affords greater flexibility for carrier applications, and enables use of a variety of delivery systems; Non-Lethal Payloads for Personnel Suppression, which enables personnel suppression and area denial at BLOS ranges; Robotic and Network Technologies, which addresses various aspects of making armaments and munitions part of the networked battlespace; and Kinetic Energy Active Protection System (KEAPS), which develops munitions and countermeasures for Active Protection Systems (APS) to enhance survivability for lightly armored, or very lightweight vehicles. Other efforts in this project include: Fuze and Power for Advanced Munitions, which matures technologies that reduce munition sizes while adding tailorable effects to advanced munitions, and also improves advanced on-board munition power systems with increased power densities, increased mission time, improved temperature performance and reduced volume and weight; Countermines/Surface Laid and Buried Mine Neutralization which exploits Laser Induced Plasma Channel (LIPC) to defeat surface laid and buried mines; and Extended Area Protection and Survivability, which demonstrates the use of command-guided medium caliber projectiles for the interception and destruction of incoming rockets, artillery, and mortar rounds. Rheostatic Pulsed Energy Weapon System (RPEWS), which starts in FY08, will investigate weaponizing ultra short pulsed laser (USPL) / laser induced plasma channel (LIPC) onto a hybrid platform vehicle. The cited work is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the Defense Technology Area Plan (DTAP). This work is performed by the US Army Armament Research, Development, and Engineering Center (ARDEC), Picatinny, NJ, in cooperation with the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD, and Tank, Automotive Research, Center (TARDEC), Detroit, MI.

<b><u>Accomplishments/Planned Program:</u></b>	<b><u>FY 2006</u></b>	<b><u>FY 2007</u></b>	<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>
MAAST-MRM: In FY06, two concepts were matured for risk reduction purposes; also in FY06, continued integration of the semi-active laser (SAL) seeker, fabricated, assembled and High-G tested advanced seeker components, conducted hardware in the loop and captive flight tests for the SAL seeker, conducted two test series (4 shots total) of complex SAL guided shots in a designated-mode for guided engagement against a beyond-line-of-sight (BLOS) moving Russian T-72 Main Battle Tank; optimized software to improve tactical capabilities and conducted processor-in-the-loop and hardware-in-the-loop simulations for integrated dual-mode seeker. In FY07, complete fabrication and assembly of integrated dual-mode MRM target acquisition, guidance, and counter active protection systems; demonstrate gun-fired multi-mode MRM at a BLOS target. Efforts described here are coordinated and complimentary to related efforts in PE/project 0602624/H28.	10000	10000		

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE			PROJECT
<b>3 - Advanced technology development</b>	<b>0603004A - Weapons and Munitions Advanced Technology</b>			<b>232</b>
MAAST: In FY06, matured LOS-MP and iterated air-gun tests for fuze electronics, safe and arm hardware; designed, built and tested XM1157 fuze, verified electronics setter box for LOS-MP TRL6 demos; conducted LOS-MP TRL 6 demonstration vs. concrete wall (3 shots reduced g's, 3 shots, High-G); conducted LOS-MP TRL 6 demonstration vs. anti-personnel targets (3 shots reduced g's 3 shots, High-G); fabricated, assembled and conducted gun-fired demonstration of two-way ammunition data link which is applicable to all MCS ammunition types; and completed fabrication, assembly, and demonstration of integrated advanced propulsion capability with temperature compensation and precision ignition (2 propulsion demonstrations with surface coated double base (SCDB) propellant and hybrid propellants; for low cost precision (LCP) effort, down-selected lowest cost sub-component alternatives from two contractor concepts, completed initial designs and conducted component demonstrations that include a forward looking infrared (FLIR) demo, and component demos for yaw sonde, communications, thrusters, and software development for magnetometer sensor, complete design, fabrication, and ballistic demonstration of boosted maneuver capability for MRM KE concept, complete inertial measurement unit (IMU) development effort for in-flight shock mitigation, fabricate bench test, and complete ballistic demonstration of IMU capability in MRM-Chemical Energy(CE) concept. In FY07, fabricate, assemble, and demonstrate multi-function warhead for chemical energy munition for LOS-MP/MRM and demonstrate advanced propellant and robust cartridge case technologies; fabricate, assemble, and demonstrate in-flight tracking and maneuver control performance of projectile with LCP technologies.	16243	16044		
Lightweight Dismounted Mortar Weapon: In FY06, developed, tested, and ballistically demonstrated a lightweight full-scale prototype.	1875			
Pulsed Laser System Technologies: In FY08, will begin system trade study, system engineering and design for integration of the Ultra Short Pulsed Laser (USPL) / Laser Induced Plasma Channel (LIPC) to target acquisition/tracking sub-systems and potential platforms; begin long lead item procurements and test critical USPL components. The initial system configuration will be identified based upon power and energy versus size and weight requirements previously identified under the Countermine/IED Neutralization ATO and completed efforts in PE/project 0602624/H19. In FY09, fabricate and assemble USPL/LIPC and platform interface components; conduct subsystem testing and begin platform integration of the USPL / LIPC weapon components; conduct preliminary system demonstrations. Efforts described here are coordinated and complimentary to related efforts in PE/Project: 0602624/H19.			6225	6883
Ground Based Munitions Technologies: In FY09 initiate design of a ground based munition system capable of being delivered to a precise location once deployed from the primary delivery mechanism (e.g., MLRS, UAV, Fixed and Rotary wing, etc.). Current delivery systems allow for precise delivery to a specified point in space. Once that point is reached the payload is released and allowed to fall to the ground in a random pattern which may or may not be efficient in accomplishing the mission. This effort will be to provide a way to guide the components to the ground once released from the carrier and provide an effective pattern on the ground. As part of the effort, numerous means for providing maneuverability to an object in a free-fall state will be investigated. In addition a concept will be developed which will integrate technologies that will allow a system such as Intelligent Munitions System (IMS) to be emplaced on the ground with a precision that allows the system to be effective as designed. A demonstration of the maneuverability device will be done and a concept plan will be developed. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0602624/H18.				3119
Scaleable Effect Weapon and Munition Systems: In FY08, will establish and evaluate baseline modeling of experimental hardware for evaluation of next generation explosives, reactive materials, and advanced liners. In FY09, will define and evaluate system selectability requirements to allow for controlled lethality against less-than-lethal, controlled lethal area, and extremely lethal target requirements. Will evaluate warhead tailoring methodologies to control munition energy output and will verify modeled scalability effects in reduced munition sizes for man-portable classed systems. Will fabricate and test prototype hardware for evaluation of multipurpose capabilities.			3095	4932
Fuze and Power for Advanced Munitions: In FY06, conducted explosive safety testing of Micro-Electro-Mechanical Systems (MEMS) Safe and Arm (S&A) components and fabricated Electronic Safe and Arm Device (ESAD) components; evaluated performance of	956	4402	4750	

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

BUDGET ACTIVITY	PE NUMBER AND TITLE			PROJECT
<b>3 - Advanced technology development</b>	<b>0603004A - Weapons and Munitions Advanced Technology</b>			<b>232</b>
proximity and safety sensors in limited/simulated environmental. In FY07, continue explosive compatibility and safety tests of MEMS, demonstrate prototype battery designs in laboratory and conduct air gun high-g tests for new thermal and liquid reserve batteries and hybrid power systems; begin alternative/hybrid energy systems evaluations. In FY08, will integrate ESAD subsystem, will conduct demonstration of gun launched multipoint warhead initiation; will conduct performance testing of MEMS S&A device and MEMS impact switch performance in 155 mm projectile, will obtain Fuze Safety Review Board concurrence; For Sensors, will gun launch RADAR proximity fuze, will demonstrate proximity capability in direct fire application, will validate stand-off improvements and size reduction; will achieve lower power for LADAR configuration using advanced laser and detector; for Power, will demonstrate prototype organic chemistry based liquid reserve batteries and thermal management battery improvements with flight tests. Efforts described here are coordinated and complimentary to related efforts in PE/project(s): 0602624/H18, H19, and H28.				
Common Smart Submunition (CSS): In FY06, conducted tower test to characterize Laser RADAR (LADAR) sensor, signal processing, and recognition algorithms for detection, and discrimination of potential targets in dynamic environments. Codified registration algorithms for detecting and tracking up to three target Regions Of Interest (ROIs), evaluated performance in benign and degraded simulated conditions for algorithm consistency; drafted initial key feature extraction code build to registration; began drafting algorithm development plan for discrimination build. In FY07, mature sensor and algorithms for follow-on captive flight test (CFT) to achieve 0.95 probability of discriminating and firing at a target of interest; baseline Autonomous Target Recognition (ATR) performance and identify future iteration work building toward multi-target discrimination capability (Army, Air Force, Navy targets); provide test data for system analysis model and develop and validate a CSS system model for end-to-end simulation evaluation. In FY08, full up functional CSS prototype submunitions will be demonstrated (dropped) at the suspended cable facility at Sandia. LADAR/IR sensor and ATR discrimination algorithms will be verified in a dynamic Captive Carry Test (CCT). All ATR performance sub-sets such as registration, target detection, key feature extraction, and target recognition will be verified during CCT. Evaluations will serve as entrance criteria for System Design Review (SDR #2) and follow on efforts. Efforts described here are coordinated and complimentary to related efforts in PE/project(s): 0602624/H18, H19, and H28.	5737	7970	8703	
Non-Lethal Payloads for Personnel Suppression: In FY06, demonstrated kinetic energy mitigation of payload module, continued target effects analysis, and conducted system flight test demonstration. Efforts described here are coordinated and complimentary to related efforts in PE/project 0602624/H19.	1625			
Lightweight Cannon Integration: In FY09, will apply novel recoil attenuation techniques to large caliber weapons for future spirals of FCS weapon systems. This effort will lay the groundwork for the next generation of highly mobile cannon-based firing platforms with significantly enhanced firepower, i.e., the set of weapons beyond the current NLOS-C or MCS 120mm systems. This will be achieved by exploring RAreaction waVE guN (RAVEN) technologies, momentum cancellation techniques, and rapid fire initiatives.				6111
Advanced Power and Energy Management for Munitions: In FY09, will demonstrate nano-powders for use in MEMS fuzing components, initiate lab-validation of suitable fuel cell configurations for munition systems downselect; will prototype micro-scale igniter for thermal battery and optimize gun-hardened energy harvesting package.				2624
Dual Use Composites (DUC): In FY06, conducted Electronic G-Hardening and Electronic Fuzing for the Silent Operating Aerial Reconnaissance (SOAR) unmanned aerial vehicle (UAV). Began characterization tests of DUC material and built and provided demo for SOCOM Special Projects. In FY07, optimize DUC munition to increase accuracy and lethality through test demonstrations in an operational environment; develop most promising light weight solutions for remote weapon stations on robotic vehicle. Review current and developmental unmanned platforms which would benefit from DUC and provide enhanced technical knowledge of the DUC material through their complexity in design, and will increase the development of items high in fidelity and quality. In FY08, will optimize DUC	474	1081	1696	3535

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT		
<b>3 - Advanced technology development</b>	<b>0603004A - Weapons and Munitions Advanced Technology</b>	<b>232</b>		
munition to increase accuracy and lethality through test demonstrations in an operational environment; Future Force Gun and Munitions will mature most promising lightweight solutions for remote weapon platforms. Select one or two unmanned platforms from the candidates identified during FY07 and produce complex, high fidelity DUC components. In FY09, will optimize and integrate complex high fidelity DUC components into the unmanned platforms selected during FY08; demonstrate the quality, integrity and lethality through tests in an operational environment.				
Tunable Pyrotechnics: In FY08, will evaluate the efficacy of tunable pyrotechnic formulations by integrating and combining pyrophoric reactive materials, Nano Technology and pyrotechnic chemistry. The key process, product, and physical parameters will be evaluated. In FY09, will use the successful candidate formulations and conduct energetic characterization, sensitivity studies, and initial prototype application for counter measures and battle field effects simulators.			1032	2891
Countermine/Surface Laid and Buried Mine Neutralization: In FY07, integrate directed energy power source technologies onto a ruggedized skid to demonstrate and assess the feasibility of further maturing and developing this technology for mine destruction. Efforts described here are coordinated and complimentary to related efforts in PE/project 0602624/H19.		1920		
Extended Area Protection and Survivability (EAPS): In FY06, analyzed and modeled gun-based concepts for a gun-based air defense capability against rockets, artillery, and mortar rounds (RAM) to establish an appropriate caliber, firing rate, and kill mechanism; defined gun-based system requirements and component technology specifications. In FY07, integrate advanced warhead and fuze configurations within the EAPS projectile; and conduct live fire demonstrations to validate lethality against static RAM targets. In FY08, will evaluate an integrated design based on results of "A" and "B" round developments and demonstration firings. Efforts described here are coordinated and complimentary to related efforts in PE/project 0602624/H28.	1482	1516	2813	
Unguided Multiple Explosively Formed Penetrator (MEFP) Warhead (Kinetic Energy Active Protection System (KE-APS)): In FY06, fabricated objective Optical Transceiver Module (OTM). Conducted threat detection verification lab test of the OTM against Kinetic Energy (KE) and High Explosive (HE) threats. Fabricated full-up objective Optical Proximity Fuze (OPF) for unguided KE-APS interceptor. Conducted Spinning BrassBoard Sensor test (SBBST) with live, fly-by KE and HE threats to verify fuze functionality. Conducted MEFP Warhead characterization tests. Designed, fabricated, and tested Objective MEFP Warhead (series#1).	6556			
Future Force Gun and Munition Technology (Lightweight Armaments Enhancement Program): In FY06, matured technologies to improve cannon performance and reduce overall weight including: novel muzzle brake/blast deflector, dual autofrettage process, and a lightweight recoil system recuperator. Supported integration of ARL-developed technology into 120mm XM360 gun to significantly increase accuracy and probability of hit (Ph) with FCS weapons.	712			
Military Operations in Urban Terrain (MOUT)/Urban Lethality Technologies: In FY07, will develop multi-mode, high-blast/anti-armor designs for single warhead configurations and will develop the forward break-in charge designs for tandem configurations. Designs will be used for modeling and fabrication of prototype warheads for experimental validation in FY08. In FY08, will conduct initial modeling and experimental validation of multimode warhead design concepts and fuze requirements for shoulder launched munitions and will mature and evaluate linear shaped charge liner and multipoint initiation designs for a light weight wall breaching system. In FY09, will evaluate advanced fuzing options of multimodal warheads on shoulder launched platforms and will optimize liner and initiation concepts for system integration and conduct wall breach demonstration testing; conduct testing of Kinetic Energy Active Protection System launchers.		2000	3100	8150
Small Business Innovative Research/Small Business Technology Transfer Programs		1216		
<b>Total</b>	<b>45660</b>	<b>46149</b>	<b>31414</b>	<b>38245</b>

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

<b>BUDGET ACTIVITY</b> <b>3 - Advanced technology development</b>	<b>PE NUMBER AND TITLE</b> <b>0603004A - Weapons and Munitions Advanced Technology</b>					<b>PROJECT</b> <b>L94</b>		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
L94 ELECTRIC GUN SYS DEMO	13863	13420	9571	11637	11887	13045	17742	18250

**A. Mission Description and Budget Item Justification:** This project matures and demonstrates Electromagnetic (EM) armament subsystems and the enabling technologies for tactically relevant EM launchers, pulsed power and launch packages (projectiles). EM Guns have the potential to revolutionize the future battlefield by their unique performance characteristics (hypervelocity and reduced-signature launch), potential for elimination of vulnerable propellants, synergistic relationship with hybrid electric vehicles, and potential for significant reduction in sustainment burden. In addition to designing, fabricating, and demonstrating subsystem components, the project resolves system level technology challenges including synchronization/compatibility of twin counter-rotating machines, technology scalability, thermal management, and full energy system performance. After successful demonstration of the critical components and subsystems at tactical scale, an Advanced Technology Demonstration (ATD) effort will be conducted to integrate next generation subsystems into a stand-alone medium caliber armament prototype, comprising robust launcher, pulsed power supply, launch packages, prime power, cooling and auxiliaries, to demonstrate system performance. In FY06, the Kinetic Energy Active Protection System (KEAPS) effort complements work in project 232 that focuses on maturing and demonstrating effectiveness of munitions associated with Active Protection Systems. The cited work is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the Defense Technology Area Plan (DTAP). This project is executed by the Armaments Research, Development, and Engineering Center (ARDEC) at Picatinny, NJ, in cooperation with the Army Research Laboratory (ARL), Adelphi, MD, and The University of Texas at Austin (a University Affiliated Research Center). This work complements and is fully coordinated with efforts in PE/project(s) 0602618A/H75 and PE0601104A/H56.

<u>Accomplishments/Planned Program:</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
EM Gun System Demonstration: In FY06, conducted rail gun manufacturing validation trials, completed subsystem interface requirements, and fabricated half-length, full-caliber version of threshold launcher design for range testing; performed fuze functionality tests and demonstrated the launchability of high-explosive (HE) projectiles in an EM armament environment; fabricated breadboard Pulsed Power Supply (PPS) components, demonstrated critical rotating machine sub-assembly over full operational speed, and conducted verification testing of PPS switch stacks. In FY07, complete fabrication of a partially cantilevered railgun test bed and demonstrate strength of design and scaling effects testing at full scale launch peak loading conditions; test fire an integrated HE, fuzed launch package from a laboratory EM gun; complete acceptance/verification testing of PPS sub-assemblies, manufacture and test the two rotating machines. In FY08, will build a lightweight cantilevered high fidelity railgun with integrated breech and muzzle shunt and demonstrate objective performance at hypervelocity and multi-round launchability; will integrate the compact, twin counter-rotating pulsed alternator power supply, conduct subsystem functional tests and accomplish high fidelity breadboard PPS demonstrations that will establish and validate requisite performance criteria. In FY09, will build upon the test beds to mature next generation EM armament subsystem hardware; will prepare point-of-departure performance specifications to support evolutionary concepts for an integrated, mobile demonstrator platform selected on best balance of technical difficulty and military utility; will generate preliminary designs, conduct flow-down risk analysis, and assess the fidelity of gun launcher, pulsed power, and launch package components/subsystems; will establish system level functionality through physics based models and end-to-end performance simulations.	13863	13074	9571	11637
Small Business Innovative Research/Small Business Technology Transfer Programs		346		
<b>Total</b>	<b>13863</b>	<b>13420</b>	<b>9571</b>	<b>11637</b>

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

<b>BUDGET ACTIVITY</b> <b>3 - Advanced technology development</b>		<b>PE NUMBER AND TITLE</b> <b>0603004A - Weapons and Munitions Advanced Technology</b>					<b>PROJECT</b> <b>L96</b>		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
L96 HIGH ENERGY LASER TECHNOLOGY DEMO	4617	9298	17378	23157	23840	25609	26172	26748	

**A. Mission Description and Budget Item Justification:** This project matures and demonstrates advanced technologies for Future Force High Energy Laser (HEL) weapons technology, and, where feasible, exploits opportunities to enhance Current Force capabilities. The major effort under this project is the development of a mobile one-hundred kilowatt (kW) class Solid State High Energy Laser Technology Demonstrator (HELTD) that is traceable to the form, fit, and function requirements of the Future Force. 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, 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 surface-laid mines and other ordnance from a stand-off distance. HELTD possesses the characteristics required to support future Joint / Army requirements for a lethal capability that is deployable, mobile, self-sustaining, while capable of operating in a full spectrum, networked, information-based battlefield environment. HELs are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems. The HELTD program utilizes a modular building block approach with open systems architecture to ensure growth and interoperability. This modular approach ensures opportunity for technology insertions for maturation of laser, beam control, sensor/radar, integration of power (pulsed), and Battle Management Command, Control, and Computers (BMC3) to support the Current / Future Force. At weapon system power levels of around 100kW, Solid State Laser (SSL) technology has the potential to enhance survivability by addressing the capability gaps identified above. The SSL technology effort in PE 0602307A 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. This program will use and integrate the Pulse Power Supply developed in PE 0603005A scheduled for completion in FY08 and available for integration in FY09. The supporting effort under this project is the development of a Force Encampment Protection System (FEPS) radar designed to detect, track, discriminate, and predict impact / launch points of rockets, artillery, and mortars (RAM) launched from any direction. It meets the demanding 360 degree, short-timeline search requirements imposed by rockets fired directly into defended encampments on depressed trajectories. A novel three-tier antenna configuration enables fast horizon searches as well as track of targets up to 80 degrees elevation, providing near hemispherical radar coverage at a fraction of the cost of a conventional phased array antennas. The FEPS radar will be capable of providing a highly-accurate and reliable sense and warn capability. In order to accomplish this mission, FEPS will have the capability to detect, discriminate, provide impact, and launch point prediction on RAM threats. It also will provide precision track data to directed energy and kinetic energy munitions used to intercept these targets. There are currently no sensors that provide this total capability. The Counter-Rocket, Artillery, and Mortar (C-RAM) program office has identified the FEPS radar technology as key in filling a gap in the search, track, discrimination, and impact point prediction of RAM targets. Work in this project is related to, and fully coordinated with, efforts in PE 0602307A, PE 0602890 D8Z, PE 0603005A, and PE 0603924D8Z (High Energy Laser Joint Technology Office), PE 0605605A (DOD High Energy Laser Systems Test Facility), and PE 0603005A/441 (Combat Vehicle and Automotive 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 Aberdeen Proving Ground, MD, and US Army Space and Missile Defense Command Technical Center, Huntsville, AL.

<b>Accomplishments/Planned Program:</b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
High Energy Laser Technology Demonstrator (HELTD): In FY06, initiated SSL weapon system studies based on the 100kW SSL	2667	6435	17378	23157

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT	
<b>3 - Advanced technology development</b>	<b>0603004A - Weapons and Munitions Advanced Technology</b>		<b>L96</b>	
laboratory devices being developed in PE 0602307A to derive demonstrator technical performance specifications and assess the capabilities of the existing Air Defense target acquisition and Command, Control, Computers, and Intelligence (C3I) capabilities to meet the directed energy weapon specifications. Began preliminary systems engineering analysis and design of a target acquisition and tracking system component with hemispherical coverage that meets precision handover requirements for the HELTD and conducted subscale testing of critical subcomponents and materials to validate the design. In FY07, initiate HELTD subcomponent development with interfaces for items such as the beam control system that incorporates technologies to improve pointing accuracy and minimize jitter to enable improved energy deposition on target at the SSL wavelengths. This includes defining detailed beam control system requirements, conducting design to capabilities trades, and initiating some long lead item procurements. In FY08, will continue fabrication and assembly of the beam control system and design ruggedized versions of the laser components, will initiate Systems Engineering efforts and develop detailed Systems Requirements for the HELTD, will develop detailed interface requirements, and will continue subcomponent development of target acquisition and tracking system. In FY 09, will complete development of the beam control system and begin testing, fabricate the ruggedized laser, and complete the Systems Engineering effort producing a HELTD System Concept (System Functional Review). Will initiate the system integration effort, based on the selected SSL technology and beam control system, through design trades and long lead item procurements and will complete development and initiate prototype testing of target acquisition and tracking system.				
Force Encampment Protection System (FEPS) radar program: In FY06, completed initial design of antenna and switching components; completed design and development of molds for plastic components and Rotman lens; and initiated testing of plastic components for expansion, thermal conductivity and metal plating. Initiated agreement with Massachusetts Institute of Technology / Lincoln Laboratories to test high power components in the Haystack radar facility. Developed test plans for high power testing. In FY07, continue to develop primary Ku-band antenna components, Rotman lens, slotted waveguide radiators, and interconnecting waveguide pieces manufactured from plated plastic. Develop antenna slotted waveguide emitter design and a prototype receiver capable of receiving signals from up to four channels. Develop two elements of the radar array and perform high power, heat dissipation and monopulse tracking tests. At the end of FY07 this program will transition to the US Army Aviation Missile Research, Development, and Engineering Center (AMRDEC) as part of the C-RAM tracking and fire control effort in PE 0603313A.	1950	2600		
Small Business Innovative Research/Small Business Technology Transfer Programs		263		
<b>Total</b>	<b>4617</b>	<b>9298</b>	<b>17378</b>	<b>23157</b>

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

<b>BUDGET ACTIVITY</b> <b>3 - Advanced technology development</b>		<b>PE NUMBER AND TITLE</b> <b>0603004A - Weapons and Munitions Advanced Technology</b>					<b>PROJECT</b> <b>L97</b>		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
L97 SMOKE AND OBSCURANTS ADVANCED TECHNOLOGY	959	1021	1026	1033	1035	1035	1058	1081	

**A. Mission Description and Budget Item Justification:** This project matures and demonstrates smoke and obscurant technologies with potential to enhance personnel/platform survivability by degrading threat force surveillance sensors and defeating the enemy's target acquisition devices, missile guidance, and directed energy weapons. Dissemination systems for new and improved obscurants are developed with the goal of providing efficient and safe screening of deployed forces. A major effort will demonstrate the dissemination of newly developed advanced infra-red (IR) obscurants having four times the previous performance. Modeling and simulation tools developed in PE 0602622A will be matured to predict performance and analyze strategic use of obscurants on the battlefield. Other efforts mature dissemination, delivery, and vehicle obscurant enabling technology with potential to increase survivability through increased standoff and threat protection. After successful demonstration, these technologies transition to the Family of Tactical Obscuration Devices, and other System Development and Demonstration programs. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Area Plan (DTAP). Work in this project is performed by the Army Research, Development, and Engineering Command, Edgewood Chemical Biological Center, Edgewood, MD.

<b><u>Accomplishments/Planned Program:</u></b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Obscurant Enabling technologies: In FY06, developed mature concepts for prototype systems for use in grenades, artillery rounds, and other smoke generating systems; identified techniques for field evaluation of prototype dissemination systems. In FY07, refine design of prototype packaging/dissemination concepts; develop prototype system for advanced IR obscurant. Conduct experiments of new dissemination techniques in a relevant operational environment. In FY08 will mature, fabricate, and test the selected grenade concept as necessary to meet TRL-6 prototype requirements. In FY09, will evaluate dissemination methods and will conduct modeling and analysis of advanced IR obscurants for artillery and mortar applications.	959	992	1026	1033
Small Business Innovative Research/Small Business Technology Transfer Programs		29		
<b>Total</b>	959	1021	1026	1033