ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602624A - Weapons and Munitions 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	123684	118331	40469	30663	30446	30510	31273	31549
H18	ARTY & CBT SPT TECH	12809	12932	14624	12190	14486	17129	17673	17724
H19	CLOSE COMBAT WEAPONRY	5909	7849	5457	7311	4511	1981	2025	2069
H1A	WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE	86505	83815						
H28	MUNITIONS TECHNOLOGY	18461	13735	20388	11162	11449	11400	11575	11756

A. Mission Description and Budget Item Justification: This program element (PE) designs and develops improved weapons and munitions technologies to enable combat overmatch for the Future Force and, where feasible, for Current Force enhancements. Efforts in this PE result in increased system lethality and survivability with the potential for lower weight, reduced size, and improved affordability. Project H28 supports the Guided Blast and Guided Focused-Frag Explosively Formed Penetrator Warheads, for the 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. Projects H18, H19, and H28 support the Common Smart Submunition effort, which designs and develops component technologies for next generation precision kill and target-discriminating submunition that can be used in a variety of delivery systems. Additionally, Projects H18, H19, and H28 support the Fuze and Power for Advanced Munitions efforts, which in tandem enables tailorable warhead effects for increased functionality and also designs and evaluates new on-board munition power systems with increased energy/power densities in order to extend the range and increase the lethality of future munitions. A major effort in project H18 is the Insensitive Munition (IM) Technologies Initiative, which is focused on reducing unplanned/accidental detonation of munitions. This work is related to and fully coordinated with IM work at the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD, (Program Element (PE)/Project 0602618/H80) and the Aviation and Missile Research, Development, and Engineering Center, Huntsville, AL, (PE 0602303/214). Project H1A funds congressional special interest items. Project H28 focuses on the design and evaluation of advanced warheads (shaped charge and Explosively Formed Penetrators (EFPs)); novel energetics/explosives; and high impetus, low flame temperature propellants to reduce wear on gun tubes. Most products of this PE transition to PE0603004A (Weapons and Munitions Advanced Technology) for maturation and demonstration. 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 primarily performed by the Army Armament Research, Development, and Engineering Center at Picatinny Arsenal, NJ, as well as the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD, and the Aviation and Missile Research, Development, and Engineering Center, Huntsville, AL.

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B. Program Change Summary	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	125267	35344	33361	33918
Current BES/President's Budget (FY 2008/2009)	123684	118331	40469	30663
Total Adjustments	-1583	82987	7108	-3255
Congressional Program Reductions		-895		
Congressional Rescissions				
Congressional Increases		84750		
Reprogrammings	-1583	-868		
SBIR/STTR Transfer				
Adjustments to Budget Years			7108	-3255

FY08 funds increased to support development of active protection system (APS) interceptor warheads.

Thirty-eight FY07 congressional adds totaling $81229 (after adjustment for Congressional Undistributed Reductions) were added to this PE.

($2876) Green Armaments Technology (GAT)
($1870) Armaments Information Assurance
($2493) Homeland/Perimeter Defense Technologies
($2492) TEMPER
($958) Seamless Data Display
($958) Active Coatings Technology
($1054) Adv Tech Lightweight Arm Sys-Rarefaction Wave Gun
($4217) Adv Materials & Processes for Armament Structures
($2493) Armament Sys Engineering & Integr Init (ASE12)
($2157) Electroconversion of Energetic Materials
($4410) Army Center of Excellence in Acoustics
($3738) Developmental Mission Integration
($4073) Engineered Surfaces for Wpns Sys Life Extension
($1581) Fatigue Odometer-Veh Comp & Gun Barrels Proj
($2204) Micro/Nano Systems Technology Research
($1773) Nanoparticle Dev for Energetic Mat/Prot Systems
($1869) Non-Nuclear Earth Penetrator Operational Prototype
($1869) Precision Manufacturing Initiative
($3738) Remotely Operated Weapons/Sensor Technology

($1342) Toxin Guard Research
($958) Transition Laser Engineered Net Shaping Technology
($1869) Armament Manufacturing Model/Science
($958) Civilian Military Incident Management (CMIM) Tool
($2492) Electrolytic Super-Capacitors, Polymer f/FCS App
($2827) Energetic Formulation and Fabrication
($3834) High Speed Data Communications System (HSDCS)
($1390) Improved Airborne Command and Control System (IACC
($3450) Integrated Command Operations Program (ICOP)
($958) Ltweight Munitions & Surveillance Sys for Unmanned
($2396) Parts-on-Demand for CONUS Operations
($2588) Plasma Acoustic Dazzier Denial Systems Initiative
($2061) Sculpted Transparent Armor
($1390) SOSSEC Demo only for Penn Army National Guard
($1054) Steering Guided Mun & Projectiles w/Microactuators
($1054) UGV Weaponization
($958) Weapon System Integration Force Protection Vehicle
($1869) Advanced Rarefaction Weapon Engineered System
($958) Hospital Emergency Planning & Integration

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602624A - Weapons and Munitions Technology**	**H18**

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
H18 ARTY & CBT SPT TECH	12809	12932	14624	12190	14486	17129	17673	17724

A. Mission Description and Budget Item Justification: This project conducts applied research on technologies to enable advanced munitions, submunitions, smart munitions, networked fires, fire control, combat support systems, cannon fires, and mortar fires in support of the Future Force and, where feasible, to enhance Current Force capabilities. Technology challenges include reducing artillery target location errors, providing real-time targeting data to fire direction centers, and enhancing functionality of sensor inter-networking to support information dominance strategies. Improved smart munitions are pursued to enhance Non Line-of-Sight (NLOS) capabilities and area denial capabilities. These munitions can be delivered by a wide range of munition/missile systems with significant increases in lethality effectiveness and number of kills per individual munition/missile to reduce logistic burden. Major efforts include: Common Smart Submunition (CSS), which designs and evaluates component technologies for a next generation precision kill and target-discriminating submunition that can be used in a variety of delivery systems; and an Insensitive Munition (IM) Technology initiative, which focuses on identifying, maturing, and applying technologies that will reduce unplanned, accidental, and/or sympathetic detonation of munitions in order to meet IM requirements. For gun propulsion systems, the focus of the IM effort is on designing barrier and venting technologies for existing and future gun propulsion systems and developing high energy, IM gun propellants at the sub-scale level for emerging gun programs. For warheads, this effort investigates venting mechanisms and IM liner technologies for existing and future explosive projectiles. In addition, the effort develops predictive models and simulations for IM technologies. Other efforts in this project include: Fuze and Power for Advanced Munitions, which researches and evaluates technologies that reduce munition size and add tailorable effects for advanced munitions; and Future Force Gun and Munition Technology, which matures leap-ahead concepts for future armaments, munitions, and energetics and exploits novel nano-structured metal/ceramic materials. In FY07, this project also researches high power microwave technology for use as non-lethal weapons. 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 U.S. Army Armament Research, Development, and Engineering Center (ARDEC), at Picatinny, NJ, and the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD.

Accomplishments/Planned Program:	FY 2006	FY 2007	FY 2008	FY 2009
Common Smart Submunition (CSS): In FY06, fabricated hardened breadboard electronic components; conducted sensor tower test/data collection; developed CSS models for analyzing/evaluating systems packaging, integration, and deployment scenarios; determined packaging architecture for CSS electronics; concluded options trades for go-forward design small enough for Unmanned Aerial Vehicle, missile, and projectile applications. In FY07, conduct full up integration of components/subsystems into prototype tactical submunition. Execute Technology Readiness Level (TRL) tests to evaluate and establish baseline performance in these critical areas: 1) sensors and algorithms (Autonomous Target Recognition - ATR, Simulated Computer Lab runs, Captive Flight Test - CFT); 2) Orientation and Stabilization (O&S) spin/stability performance (helicopter drop/spin tests); and 3) High-G survivability (shock tests, Soft Recovery System [SRS] tests). Evaluate Modeling and Simulation (M&S) analyses for carrier/submunition packaging, dispense, engagement, and effectiveness. In FY08, post-test operational performance metrics will be quantified and baselined as entrance criteria for 2nd System Design Review in Dec 2008; specifically the sensor transmit/receive performance, algorithm/ATR discrimination capability, O&S samara blade performance (slow and high speed deployments), and High-G survivability of components/sub-systems (sensor module, electronics, Safe and Arm [S&A] module, battery, O&S module. Efforts described here are coordinated and complimentary to related efforts in PE/Project(s): 0602624/H19 and H28, and PE/Project 0603004/232.	5493	2844	3208	

IM Technologies Initiatives: In FY06, demonstrated laboratory scale warhead venting designs; developed reactive flow models for downselected candidate explosives; fabricated and evaluated second iteration of propellants. In FY07, design full scale warhead venting; conduct experimental characterization and bullet impact/fragment impact (BI/FI) modeling of Non-Line-of-Sight Launch System (NLOS-LS); downselect most promising propellant formulations and conduct subscale demonstration of best propellant for ballistic and IM performance. In FY08, will show high lethality in a full scale prototype warhead venting and reactive liner design; will conduct sympathetic detonation (SD) modeling and experimental characterization of low order behavior. In FY09, will complete SD/BI modeling including low order response.	2092	3001	1050	250
Fuze and Power for Advanced Munitions: In FY06, conducted laboratory evaluations, and refined design for MEMS S&A components, Electronic Safe and Arm Devices (ESADs) and safety sensor designs. In FY07, integrate MEMS S&As and ESADs with sensors and continue laboratory, flight test of prox technologies, evaluation of integrated system to validate models. In FY08, will evaluate performance and safety of ESAD and MEMS sub-assemblies. Efforts described here are coordinated and complimentary to related efforts in PE/Project(s): 0602624/H19 and H28, and PE/Project 0603004/232.	3394	3292	3000	
FF Gun and Munition Technology (Lightweight Armaments Enhancement Program): In FY06, initiated test planning for successful FY05 approaches. Nanotechnologies for FF Armaments and Munitions: In FY07, investigate/characterize nanomaterial based powders for use with low energy initiation (LEI) concepts. In FY08, will conduct advanced concept investigations for Direct Write technologies (including lab demonstrations). (Direct Write Technologies involves placing a thin line of explosive (i.e., writing) onto a surface or chip for the purposes of reducing the size and weight of an explosive train/detonator.) In FY09, will investigate integration of developed Direct Write technologies into actual armaments systems and subsystems. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.	137	424		
High Powered Microwave - Non-Lethal (HPM-NL): In FY07, investigate a non-explosive HPM payload capable of being fired from a Line-of-Sight (LOS), Non-Line-of-Sight (NLOS), and Beyond-Line-of-Sight (BLOS) platform and will cause temporary or permanent electronic disruption with reduced collateral effects; conduct trade studies to establish design parameters; evaluate various HPM source technologies; establish target defeat metrics. Model various launch methods and subsequent performance characteristics. In FY08, will model component behavior and fabricate individual components of the system, and conduct component experiments for antenna, primer power, pulsed power, and microwave source and will model effects on infrastructure targets; will integrate results from infrastructure targets with battlefield effectiveness models. G-Hardened design will be evaluated to address structural integrity in a gun launch environment. Iterative exterior, interior, and terminal ballistics will be modeled for various delivery methods. In FY09, will commence integration of individual components and will model the integration of the combined system. Mechanical High-G design and electrical analyses will be performed in tandem to address electrical shielding effectiveness; will commence laboratory effects testing of an integrated laboratory prototype against relevant electronic materiel; results of testing will feed battlefield models to achieve improved battlefield modeling fidelity.		3206	5808	6935
G-Hardened Sensor Tech for Munitions: In FY06, began development of multi-mode integrated g-hardened sensor packages; characterized baseline sensor designs for survivability versus performance and performed gun launch experiments to demonstrate survivability of individual component technologies.	963			
Near Autonomous Unmanned Systems: In FY06, conducted system engineering and tradeoff analysis to identify the best technical approach to provide a remote armament capability for Armed Robotic Vehicle; began concept design and analysis of the ammunition handling system, the weapon, weapon mount, and control system. Conducted market survey to determine available fire control technologies that could be leveraged.	730			

Novel Propulsion Technology for Future Force: In FY08, will conduct modeling and simulation based study to drive formulation and configuration parameters for very high energy survivable gun propulsion systems. In FY09, will fabricate small samples and conduct subscale evaluations of the most promising propellants.			1558	2027
Direct Fire Lethality: In FY09, will initiate trade studies for next generation Kinetic Energy (KE) penetrator to maintain overmatch lethality of large caliber gun system(s) of FCS and Stryker Brigade Combat Team; will research the potential for alternate materials for KE penetrators; will initiate system engineering designs for course correction technology for application in 120mm long rod penetrators.				2978
Small Business Innovative Research/Small Business Technology Transfer Programs		165		
Total	12809	12932	14624	12190

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February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602624A - Weapons and Munitions Technology**	**H19**

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
H19	CLOSE COMBAT WEAPONRY	5909	7849	5457	7311	4511	1981	2025	2069

A. Mission Description and Budget Item Justification: This project focuses on conducting applied research and designing technologies for maneuver and fire support cannon armament systems in support of Future Combat System (FCS), the Future Force and, where feasible, to enhance Current Force capabilities. The project conducts research in technologies that will result in significantly greater lethality at longer ranges with more accurate delivery, significantly reduced logistics footprint, and reduced life cycle costs for ground combat platforms. Both hardware and analytical tools (software) are refined and used to assess performance, identify problem areas and formulate solutions. This project develops advanced multi-mode fuzing component, and directed energy weapons and munitions to defeat surface laid and buried mines and threat electronic systems. Countermine neutralization exploits Laser Induced Plasma Channel (LIPC) to defeat surface laid and buried mines and other threats; Non-Lethal Payloads for Personnel Suppression, which enables personnel suppression and area denial at BLOS ranges; Warfighter Technology for Future Operations, which refines advanced on-board munition power systems with increased energy/power densities, increased mission time, improved temperature performance, and reduced volume and weight for a variety of applications, and integrates and tests single and multiple Explosively Formed Projectiles (EFPs and MEFPs). The Near Autonomous Unmanned Systems effort designs and evaluates a remote weapon station optimized for high-reliability on an unmanned vehicle; Pulsed Laser System Technologies, which starts in FY08, conducts system engineering, designs, and evaluation of power and energy demands required for weaponizing LIPC onto a hybrid platform. Work in project H19 is related to, and fully coordinated with, efforts in projects H18 and H28 (also in program element (PE) 0602624A) PE 0602618A (Ballistics Technology), and projects 232 and L94 in PE 0600304A (Weapons and Munitions Advanced Technology). 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 U.S. Army Armament Research, Development, and Engineering Center (ARDEC), at Picatinny, NJ, and the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD.

Accomplishments/Planned Program:	FY 2006	FY 2007	FY 2008	FY 2009
Non-Lethal Payloads for Personnel Suppression : In FY06, conducted laboratory and field testing to determine concentration levels of suppression payload to achieve desired effects against personnel; conducted dissemination test and initial health and environmental assessment. In FY07, verify effectiveness of the NL payload and its dissemination technique at the target area via a system flight test demonstration in relevant environments. (The round is not destroyed, but will follow a trajectory different from the disseminated NL payload submunitions. Thus, the round is not completely Non-Lethal, but the payload is.) Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.	1377	1725		
Mine neutralization: In FY06, conducted modeling & simulation to increase channel length of laser filamentation for Laser Guided Energy (LGE)/Laser Induced Plasma Channel (LIPC); evaluated different directed energy (DE) waveform types for effective defeat of surface laid and buried mines; conducted laser filamentation testing to determine laser parameters required for integration with high voltage energy or other Directed Energy (DE) waveforms. In FY07, integrate brass board laser with DE system(s) to demonstrate LGE technology; conduct laboratory testing to verify laser integration parameters and perform low level target effects testing for countermine. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.	2580	3611		
Fuze and Power for Advanced Munitions: In FY06, conducted laboratory evaluations and initial testing of preliminary designs on new	1952	695		

thermal and liquid reserve batteries and hybrid systems as power sources for current and future munitions. Common Smart Submunition: In FY07, will integrate component technologies (Multiple Explosively Formed and Single Explosively Formed Projectiles) for dynamic warhead tests using novel energetics in the combined effects warhead design. Airborne Test Bed (ATB) modifications and fabrication will be completed enabling sensor/sublet suspension from helicopter and cabling of electronics wiring harness for Captive Flight Tests (CFTs) and Captive Carry Tests (CCTs). Rapid downloading of test data for playback/goodness check hardware and processes will be analyzed, decided, and incorporated into test program. Efforts described here are coordinated and complimentary to related efforts in PE/Project(s): 0602624/H18 and H28, and 0603004/232.				
Near Autonomous Unmanned Systems (NAUS): This effort addresses the safe weapon operations and self security risk areas of NAUS. In FY07, complete detailed design of concept; fabricate and assemble breadboard components including the ammo handling system; conduct laboratory experiments to prove out interfaces between the weapon, mount, fire control, and ammo handling subsystems; continue design and checkout of the control system; and, define and validate the interfaces with an Armed Robotic Vehicle (ARV) through experimentation. In FY08, will fabricate and assemble prototype hardware; conduct laboratory evaluations to assess functionality of subsystems; and, simulate functionality in wireless operation mode. In FY09, will complete check out of system and integrate with robotic platform. Efforts described here are coordinated and complimentary to related efforts in PE/Project(s): 0602624/H18 and H28; 0602601/H91; 0602618/H03; 0602120; and, 0603005/515.		1752	1977	1999
Pulsed Laser System Technologies: In FY08, will evaluate power and energy demands required for weaponizing Laser Induced Plasma Channel (LIPC) onto a hybrid electric platform vehicle. Will also perform trade studies to determine vehicle/platform capabilities and limitations using a LIPC based weapon system. In FY09, will perform physics based modeling and simulation (M&S) to determine LIPC based platform limitations. Will also run M&S force on force scenarios to determine LIPC based weapon system effectiveness in the battlefield. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.			3480	2077
Ground Based Munitions Technologies: In FY09, urban technologies for ground based munitions will be evaluated for use with the Intelligent Munitions System (IMS). As part of this effort, a set of sensor suites will be optimized for the urban environment and emerging sensor modalities will be investigated. In addition, target engagement approaches from a ground based munition which can engage both personnel and light vehicles while minimizing collateral damage will be evaluated. Will evaluate the sensor concepts and recommend best approach for further development. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.				3235
Small Business Innovative Research/Small Business Technology Transfer Programs		66		
Total	5909	7849	5457	7311

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602624A - Weapons and Munitions Technology**	**H28**

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
H28	MUNITIONS TECHNOLOGY	18461	13735	20388	11162	11449	11400	11575	11756

A. Mission Description and Budget Item Justification: This project advances the state of the art for enabling munitions technologies supporting the Future Force and, where feasible, to enhance Current Force capabilities. The project focuses on achieving increased lethality using smaller and lighter weapon systems with smaller and lighter armaments by funding efforts that design and evaluate warheads, multipurpose blast/fragmentation/shaped charge, and Explosively Formed Penetrators (EFPs), high energy explosives, large-caliber gun propellants with barrel wear-reducing additives, energetics, and advanced materials/processes for warheads. Novel warhead architectures, new propellant techniques, and advanced material technologies are applied to produce smaller, lighter, more effective, multi-role warheads with advanced warhead liners to more efficiently defeat existing and projected targets. High-energy, high-density explosives are designed to increase lethality and optimize performance. New improved energetic materials provide numerous transition opportunities for weapon system upgrades. High-impetus propellant formulations, when coupled with technologies such as electrothermal chemical ignition, offer increased muzzle kinetic energy, precision ignition, and repeatability. This project funds Novel Energetic Materials for the Future Force, which matures advanced energetic materials with the ability to control energy release for precision munition and counter-munition applications; Hardened Combined Effects Penetrator Warhead Technology, which provides overmatch lethality using a single warhead capable of defeating armor, bunkers, personnel, and Unmanned Air Vehicles (UAVs). The Future Force Guns and Munition Technology effort designs and evaluates technologies for lighter weight 120mm gun components, lightweight nano-materials for UAVs, and the Common Smart Submunition effort which is coordinated with and complementary to the work performed in H19 and is focused on warhead performance. In addition, the Guided Blast Warhead and Guided Focused-Frag Explosively Formed Penetrator (EFP) efforts develop warhead technology critical to the Kinetic Energy Active Protection System (APS); 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; and G-Hardened Sensor Technology for Munitions, which develops ground sensors hardened to resist the forces of gun-launch and ground impact. Work in project H28 is related to, and fully coordinated with, efforts in projects H18 and H19 (also in program element (PE) 0602624A), PE 0602618A (Ballistics Technology), and projects 232 and L94 in PE 0600304A (Weapons and Munitions Advanced Technology). Efforts under this project are 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 U.S. Army Armament Research, Development, and Engineering Center (ARDEC), at Picatinny, NJ, and the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD. The APS countermunition efforts are in support of the Tank Automotive Research, Development, and Engineering Center (TARDEC) under PE 0603005A (Combat Vehicle and Advanced Automotive Technology).

Accomplishments/Planned Program:	FY 2006	FY 2007	FY 2008	FY 2009
Mounted Combat System and Abrams Ammunition System Technologies (MAAST): In FY06, matured advanced propulsion charge for Line-of Sight Multi-Purpose (LOS-MP) munition and matured a robust combustible cartridge case design; statically tested Mid-Range Munition (MRM) multi-mode warhead designs and completed initial design and integration of counter active protection sytem (APS) for MRM. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.	3313			
Novel Energetic Materials for the Future Force: In FY06, selected multipurpose warhead as the system application for demonstration of novel energetic materials, and tested the metal pushing capability and simulated the blast performance of several candidate fills against an LX-14 baseline. Selected two explosives that exceeded that metal pushing and blast capabilities of LX-14 while remaining within LX-14	5740	6581		

cost. In FY07, bound the pressure and temperature characteristics of the novel energetic materials for warheads through additional testing and modeling of selected multi-purpose warhead designs; conduct analysis to determine performance/survivability characteristics compared to current systems with conventional energetics; conduct experiments with best-performing energetic materials in multipurpose warheads.				
Hardened Combined Effects Penetrator Warhead Technology: In FY06, incorporated enhanced blast explosives and advanced lethal fragmentation designs into hardened shaped charge warheads. Designed and developed Fast-Jet unitary shaped charge warheads to defeat combined Explosive Reactive Armor (ERA)/base armor targets with a single munition. In FY07, evaluate test results and refine and optimize warhead designs accordingly. Repeat in-process testing to confirm performance of optimized warheads. Perform advanced hardening design, advanced fragmentation/multipurpose energetic, and unitary hardened shaped charge ERA defeat demonstrations. In FY08, will demonstrate optimized blast fragmentation, optimized warhead penetration, and munition integrated objective hardened enhanced blast/frag warheads against a broad target set including armor, personnel, material, and fortified structures. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.	5537	4114	4250	
Future Force Gun and Munition Technology (Lightweight Armaments Enhancement Program-LAEP): In FY06, incorporated specific technologies, such as Composite Overwrap tube, Dual Autofrettage, Composite Recuperator, Advanced Muzzle Brake into two (2) full size gun components with significant weight reductions for system specific applications on 120mm direct fire weapons. Developed concepts for integration of technologies on Current Force systems. Fuze and Power for Advanced Munitions: In FY06, evaluated performance and investigated producibility of a hybrid munition power. Common Smart Submunition: In FY06, improved aerostability and hit accuracy of EFP warhead. In FY07, complete testing of LAEP gun components to TRL 6. Nanotechnologies for Future Force Armaments and Munitions: In FY08, will conduct an investigation of the use of Lightweight Materials Applications to unmanned aerial vehicles (UAV's); will conduct advanced concept investigations for direct write technologies (including lab demonstrations). (Direct Write Technologies involves placing a thin line of explosive (i.e., writing) onto a surface or chip for the purposes of reducing the size and weight of an explosive train/detonator.) In FY09, will integrate the best candidate technologies from the FY08 investigation into actual UAV Systems; will investigate integration of developed direct write technologies into actual armaments systems and subsystems. Efforts described here are coordinated and complimentary to related efforts in PE/Project(s): 0602624/H18 and H19, and PE/Project 0603004/232.	1871	361	1261	3023
Guided Blast Warhead: In FY06, the critical system interfaces were established, parametric studies were conducted using modeling and simulation (M&S) and validation testing. In FY08, the baseline warhead will be characterized through M&S and verification testing and demonstrated in near tactical environments. This work is coordinated with Unguided EFP Warhead work in PE0603004/Project 232.	2000		5000	
Extended Area Protection and Survivability (EAPS): In FY07, analyze and model advanced warhead and fuze designs; fabricate and test against static targets. In FY08, evaluate the effectiveness of a lethality round (the standard projectile envelope configured for an advanced warhead technology kill mechanism), and a course correction round (the standard projectile envelope containing course correction technology for increased accuracy). The final decision on the integration of the EAPS projectile will be based on the results of these two technology demonstrations. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.		1284	2958	
Guided Focused-Frag Multiple Explosively Formed Penetrator (MEFP) Warhead: In FY08, will mature warhead with Modeling and Simulation (M&S) and validation testing, and will characterize warhead against all classes of threats. In FY09, will characterize baseline warhead with M&S and verification testing, and demonstrate in near tactical environments. This work is coordinated with Unguided EFP Warhead work in PE0603004/Project 232			5000	3533
G-Hardened Sensors Technology for Munitions: In FY07, continue experimentation (begun in FY06 in 602624/H18) and baseline designs		1141	1919	1606

to ensure survivability of the more fragile sensor modalities such as acoustic and electro-optical. Initiate hardening sensor elements to withstand impact during deployment. Categorize integrated sensor packages and begin design and integration of a multi-modal sensor suite into an 81mm and 40mm form factor. In FY08, will conduct lab experiments and demonstrate survivability of individual and integrated component technologies in > 20kG environments based on metrics developed earlier. Will develop architecture for networking sensors from different G-hardened nodes for target localization. Will begin fabrication of hardware and demonstrate ruggedness of sensors through testing conducted with air gun experimentation. Will perform initial demonstration of miniaturized highly-integrated components imbedded in munitions to include 81mm mortars. In FY09, will refine integrated design approach and G-hardened packaging. Will demonstrate survivability of individual and integrated component technologies in > 30kG and demonstrate (through live fire of munitions) the remote deployment of fully integrated prototypes packaged into mortars and 40mm grenades. Will implement architecture for distributed, low complexity, and power efficient decentralized network fusion of multiple G-hardened nodes for target localization.				
Scaleable Warhead Technology: In FY09, will conduct modeling and simulation studies of warhead concepts for evaluation of scaleable baseline performance against multiple target set configurations. Efforts described here are coordinated and complimentary to related efforts in PE/Project 0603004/232.				3000
Small Business Innovative Research/Small Business Technology Transfer Programs		254		
Total	18461	13735	20388	11162