ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602705A - ELECTRONICS AND ELECTRONIC DEVICES**

	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	92221	81773	43391	45365	46983	46404	45870	46856
EM4	Electric Component Technologies (CA)	9392	11531						
EM6	HEATING AND COOLING TECHNOLOGIES (CA)	3834	2720						
EM7	POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)	39487	30757						
H11	BATTERY/IND POWER TECH	11567	11705	13662	13218	12847	11939	10669	10903
H17	FLEXIBLE DISPLAY CENTER	5973	4798	6066	6603	7163	7175	7289	7405
H94	ELEC & ELECTRONIC DEV	21968	20262	23663	25544	26973	27290	27912	28548

A. Mission Description and Budget Item Justification: This program element (PE) funds enabling capabilities for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities by researching and investigating technologies in areas such as electronic components, power components, frequency control and timing devices, and display technologies. The objective of the program is provide technologies to perform precision deep fires against critical mobile and fixed targets; to provide exceptional all-weather, day or night, theater air defense against advanced enemy missiles and aircraft; and enhanced communications and target acquisition for current and future Army systems. Project H11 funds research on advanced portable power technologies (batteries, fuel cells, hybrids, engines, chargers, and power management) that enable: safe, reliable, and cost effective power sources; reduced system power requirements and logistics burden; increased mission duration. Project H94 funds research in the physical sciences essential to all land combat systems that contain any of the following component technologies: electronics, photonics, flexible displays, micro electromechanical systems, imaging laser radar (LADAR), magnetic materials, ferroelectrics, microwave and millimeter-wave components, and electromechanical systems (engine generator sets). Project H17 supports research at the Flexible Display Center to enhance battlefield situational awareness, increased vehicle mobility, survivability, and lethality, while reducing acquisition and support costs. Supported capabilities include autonomous missile systems, advanced land combat vehicles, smart anti-tank munitions, electric weapons, secure jam-resistant communications, automatic target recognition (ATR), foliage-penetrating radar, and combat identification. It supports all of the science and technology thrust areas that employ electronic and portable power-source technology. Projects EM4, EM6, and EM7 fund congressional special interest efforts.

Work in this PE is related to and fully coordinated with efforts in PE 0602120A (Sensors & Electronic Survivability), PE 0602782A (Command, Control, Communications Technology), PE 0602709A (Night Vision Technology), PE 0602783A (Computer and Software Technology), PE 0603008A (Command, Control, Communications Advanced Technology), and PE 0603772A (Advanced Tactical Computer Science and Sensor 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 Army Research Laboratory and the Army Communications and Electronics Research Development, and Engineering Center, Fort Monmouth NJ.

B. Program Change Summary	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	91925	42175	41729	41917
Current BES/President's Budget (FY 2008/2009)	92221	81773	43391	45365
Total Adjustments	296	39598	1662	3448
Congressional Program Reductions		-5702		
Congressional Rescissions				
Congressional Increases		45900		
Reprogrammings	296	-600		
SBIR/STTR Transfer				
Adjustments to Budget Years			1662	3448

Twenty-nine FY07 congressional adds totaling $43994 (after adjustment for Congressional Undistributed Reductions) were added to this PE.

($1726) E-Beam Reticle and Lithography Inspection
($959) Nanofluidic Electronic Sensor Tech for Def Applica
($2396) PEM Fuel Cell Quiet Tactical Generators
($958) Direct Methanol Fuel Cell Lifetime Imp Program
($1533) Mfg Tech Dev of Adv Components for High Power SSL
($1869) Compact Tactical Laser Program
($1150) Def Sys Modernization and Sustainment Initiative
($958) Micromachined Switches in Spt of Transformational
($958) Q-Band Millimeter Wave Power for TacSat Comms
($1438) Renewable Energy for Military Applications
($2637) Transcritical CO2 Environmental Control Unit
($1247) Soldier Fuel Cell System
($1534) Flexible Polymer Multilaminate Packaging
($1534) Weapons of Mass Destruction Marking Set
($2157) Adv High-Energy Rechargeable Lithium Air Battery
($958) Conformal Lithium for Polymer Belt Battery
($1054) Lithium Metal Air Battery
($1917) Novel Zinc Air Power Sources for Mil Apps
($958) Field-Ruggedized Mid-Range Dir Methanol Fuel Cells
($2875) Jet/Diesel-Fueled Military Fuel Cell System
($958) Miniature Tactical Energy Systems Development

($1917) Portable Solid Oxide Fuel Cell SOFC/JP8 Demo
($1869) Sold Port Fuel Cell Power-Using Solid Fuel Hyd Gen
($958) Thi Cylinder Iron Disulfide Primary Battery
($1438) Revolutionary 1.5V Alkaline
($958) Advanced Portable Power Institute
($1917) Non-Flam, High En Dens, Low Temp Warrior Battery
($1917) Portable Energy Devices
($1246) Pulse Tech Army Battery Mngt for Lithium Batteries

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602705A - ELECTRONICS AND ELECTRONIC DEVICES**	**H11**

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
H11 BATTERY/IND POWER TECH	11567	11705	13662	13218	12847	11939	10669	10903

A. Mission Description and Budget Item Justification: This project conducts applied research to identify, advance, and enhance emerging power generation, energy storage, and power management technologies for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. This project researches advancements in electrochemistry, energy conversion, and signature suppression technologies, including those for primary batteries, rechargeable battery hybrids, fuel cells, power management, and components for electromechanical power generation. There is a critical need for ultra-lightweight man portable power, chargers, and power management for the dismounted Soldiers. The Soldier Hybrid Power and Smart Chargers effort investigates high energy and high power density hybrid power source components including rapid recharging methods using smart chargers, fuel cell systems, and smart rechargeable batteries. It also investigates novel power management methods through low power design tools and software operating system dynamic power management. The Silent Mobile power effort funds research in power sources that are smaller and more fuel-efficient and in advanced cooling systems enabling tactical sustainability and survivability. Both efforts will provide future Soldiers and other future force platform applications low weight and volume, safe, reliable, cost-effective power sources, reduced system power requirements, increased mission duration and reduced cost and logistics burdens.

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 in this project is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth, NJ.

Accomplishments/Planned Program:	FY 2006	FY 2007	FY 2008	FY 2009
Soldier Hybrid Power and Smart Chargers: Develop and evaluate hybrid power sources, rapid battery chargers, and power management technologies in order to decrease soldier load, increase power capabilities, and decrease battery costs. In FY06, developed and evaluated propane fueled small Stirling engine generator components for silent manportable (<10 kilograms) power 160 watts; designed and demonstrated a hybrid fuel cell power source with reformed methanol fuel. In FY07, investigate system-level smart chargers integrated with a quiet power source, including Stirling engines and fuel cells, for stand-alone charging; design and demonstrate ruggedized Soldier hybrid power source for 72 hour mission; investigate micro-reformer components for logistic fueled manportable power source. In FY08, will evaluate methanol fueled Soldier hybrid fuel cell power source for 72 hour mission at 700 watt-hours per kilogram; will investigate rugged JP-8 burners for solid oxide power sources. In FY09, will demonstrate JP-8 fueled Soldier hybrid solid oxide fuel cell; will demonstrate manportable 160 watt JP-8 linear free piston Stirling engine power source weighing less than 10 kilograms; will evaluate 250 watt reformed JP-8 fuel cell for battery charging.	7567	7294	6880	6751
Silent Mobile Power: Investigate component and system level power technologies that will provide higher energy, reduced weight, quiet, more fuel and cost efficient power generation sources, including silent mobile power sources, cogeneration cooling systems, and tactical power management systems. In FY06, investigated fuel cell reformer components for 1-2 kW system for scout vehicle silent watch; investigated and matured logistic fueled Stirling engine generator components for silent mobile (for vehicle/trailer platforms) power >1kW; evaluated integrated 2 kW fuel processing system operating on low-sulfur fuel. In FY07, evaluate components for 2 kW fuel processing system operating on high sulfur fuel (>300 parts per million sulfur); evaluate a preliminary prototype of a 1-2 kW Stirling	4000	4125	4782	3467

engine generator system on JP-8. In FY08, will demonstrate controlled operational testing in a laboratory environment of 1-2 kW Stirling engine generator on JP-8 fuel; will demonstrate controlled operational testing in a laboratory environment of 2 kW fuel cell generator on JP-8 fuel; will demonstrate a preliminary prototype cogeneration cooling system using waste heat from a quiet power source. In FY09, will mature system integration and controls in order to demonstrate 2 kW solid oxide fuel cell generator and 1-2 kW Stirling engine generator in relevant field environment; will demonstrate integrated power/cooling cogeneration system.				
Lithium Air Battery: Develop and investigate advanced materials, material processes, and electrochemical components that will produce a high energy density (>1,000 Watt-hours/kilogram) lithium air power source for soldiers. In FY08, will investigate lithium organic and inorganic materials and processes to produce highly conductive electrolytes to achieve greater than 0.5 mill-Amps/square centimeter current densities; will demonstrate prototype lithium air cells/batteries having energy densities greater than 800 Watt-hours/kilogram; will demonstrate material stability of lithium air cell components to achieve high shelf life (greater than one year). In FY09, will develop material and cell fabrication processes to produce high energy density, stable, safe lithium air battery; will demonstrate prototype lithium air cells/batteries having energy densities greater than 1,000 Watt-hours/kilogram.			2000	3000
Small Business Innovative Research/Small Business Technology Transfer Programs		286		
Total	11567	11705	13662	13218

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February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602705A - ELECTRONICS AND ELECTRONIC DEVICES**	**H17**

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
H17 FLEXIBLE DISPLAY CENTER	5973	4798	6066	6603	7163	7175	7289	7405

A. Mission Description and Budget Item Justification: This project funds the Army's Flexible Display Center (FDC). The objective of this project is to mature flexible display technologies toward Army applications thereby providing leap-ahead technology to our Soldiers. Flexible displays are inherently rugged (no glass), light weight, conformal, potentially low cost, low power, and hence offer enhanced and new capabilities across a broad spectrum of Army applications. Areas of investigation include: lightweight, low power, and rugged flexible displays. 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 in this project is performed by the Army Research Laboratory (ARL). Note: This project was previously funded in PE 0602705A project H94 and is a restructuring of ongoing research into a distinct project for visibility and management oversight.

Accomplishments/Planned Program:	FY 2006	FY 2007	FY 2008	FY 2009
The objective of this research is to mature flexible display technology for future vehicle and future Soldier applications. The research is being conducted at the Flexible Display Center (FDC) at Arizona State University. Management will be conducted by ARL in collaboration with Natick Soldier Center, the FDC, industry, and other university partners. In FY06, designed, fabricated, and devised display drivers for reflective and emissive specimen displays (up to 4" diagonal). The 4" diagonal displays will be delivered for the FY07 Future Force Warrior (FFW) capstone demonstrations. In FY07, design and fabricate 4" diagonal active matrix reflective and emissive displays with enhanced resolution and functionality and begin to qualify the pilot line for displays up to 15" diagonal. In FY08, the FDC will deliver reflective displays up to 10" diagonal from the pilot line for the next generation Soldier Systems. The FDC will begin full color designs. In FY09, the FDC will deliver up to 10" diagonal reflective and emissive displays from the pilot line with increasing performance for next generation FFW.	5973	4666	4066	4603
Flexible display partnerships funded through the U.S. Diplays Consortium (USDC) for tools, process, and materials development that directly support the FDC. In FY08, will establish programs through the USDC that support the FDC with existing tool modifications, processes, related material, and device development. The programs will directly support the FDC and the Army's mission to develop flexible displays and manufacturing technology for flexible displays. In FY09, will mature the USDC programs that directly support the FDC and the Army's mission to develop flexible displays and manufacturing technology for those displays.			2000	2000
Small Business Innovative Research/Small Business Technology Transfer Programs		132		
Total	5973	4798	6066	6603

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February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602705A - ELECTRONICS AND ELECTRONIC DEVICES**	**H94**

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
H94 ELEC & ELECTRONIC DEV	21968	20262	23663	25544	26973	27290	27912	28548

A. Mission Description and Budget Item Justification: The objective of this project is to conduct applied research in electronics and electronic devices including opto-electronics to support advanced power and energy generation and storage; Command, Control, Communications, and Computers (C4); and Intelligence, Surveillance, and Reconnaissance (ISR) technologies for the Future Force. This research supports thrusts aimed at enhanced battlefield situational awareness; increased vehicle mobility, survivability, and lethality; reduced acquisition cost; and reduced operations and support costs. Areas of investigation include: low noise clocks and oscillators; lasers and focal plane arrays for eye-safe laser radar (LADAR) and standoff target acquisition sensors like forward-looking infrared (FLIR); micro-electromechanical systems (MEMS) for multi-function radio frequency (RF) applications as well as smart munitions; advanced RF modules to support radars and communications systems; high-temperature high-power inverter circuits for electric drives; prognostics and diagnostics to reduce logistics demands; micro-power generators and advanced batteries, fuel reformers, and fuel cells for hybrid power sources for individual Soldier and platform applications. The fabrication of novel structures on new electronic materials, such as langasite for oscillators or molecular beam epitaxy (MBE) of semiconductor superlattices and the hybridization of opto-electronic (OE) devices with electronics will be key enablers for more affordable opto-electronic devices with new capabilities. These fabrication techniques require a more complete understanding of fundamental properties, growth techniques, and processing of new materials. These new materials and structures also require the development of new design and layout techniques, more sensitive and flexible test and analysis capabilities, and new means of packaging to protect the devices and promote control of heat and atmosphere while enabling transport of signals and power. These challenges can only be overcome with judicious application of a basic understanding of the physics and chemistry of the electronic and opto-electronic processes. These projects serve to enhance the survivability, lethality, and mobility of future Army platforms by enhancing their survivability electronics suite; increasing ranges while decreasing time lines for target acquisition sensors; and evolving more efficient, controllable power sources, and displays. 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 in this project is performed by the Army Research Laboratory (ARL).

Accomplishments/Planned Program:	FY 2006	FY 2007	FY 2008	FY 2009
Design and mature high performance antennas and antenna arrays for RF front-end architectures supporting multifunction radar and communication systems. This work also includes evaluation and validation of these prototype designs. Among the issues addressed in this antenna development are scanning techniques, broadbanding, beamforming, polarization, platform integration, and affordability. In FY06, assessed Electronically Scanned Antenna (ESA) requirements for Army communications. Designed and matured multiple apertures in Joint Service Communications bands that can be integrated into composite armor. Designed high sensitivity single millimeter wave (mmW) microbolometer detector for radiometry applications. In FY07, design Satellite Communication on the Move (SOTM) and Terrestrial communication antennas and evaluate early prototypes. Evaluate high sensitivity mmW microbolometer detector array. In FY08, will validate that these antenna prototypes can be integrated into Army platforms through simulations and laboratory validation. In FY09, will mature these designs based on the measured laboratory data and transition the work to Communications and Electronics Research, Development, and Engineering Center (CERDEC).	2449	2376	2698	2507
Investigate micro and nano technology for small low cost, highly reliable, RF MEMS switches, resonators, and filters for multifunction RF applications; design highly stable low-noise oscillators with low-acceleration sensitivity by integrating photonic resonators and	2807	2320	3456	3702

conventional microwave components to improve the capability of radar systems to detect slow moving targets; mature components and software for C4 technology; and perform research in advanced tactical software tools for mobile, ad hoc network access control, intrusion detection, and authentication techniques for the Future Force. In FY06, fabricated a full piezoelectric lead zirconium titanate (PZT) MEMS switch based ESA for missile seekers. Investigated initial phase of 1/f noise (pink noise) physics in resonators and optimize miniature dual-mode resonators with low-g sensitivity leading to high-g smart munitions. In FY07, initiate investigations of 1/f phase noise perturbations and dual-mode resonators for stabile oscillators; initiate fabrication of wafer-level packaging with a MEMS phase shifter process for multifunction RF applications; start characterization of stabilized oscillator dual-mode crystals with low hysteresis temperature effects. In FY08, will devise a process for wafer-level packaging with a MEMS phase shifter for multifunction RF applications and complete investigation of 1/f phase noise perturbations and dual-mode resonators for stable oscillators. In FY09, will investigate approaches for a wafer level antenna. Prepare and integrate passive RF electronics with ARL's RF MEMS switch fabrication process.				
Research, design, and investigate new component materials, structures, devices, and electromagnetic issues of millimeter wave (mmW) components and active devices, such as vacuum electronic (VE) devices and millimeter wave integrated circuits (MMICs), to achieve higher output power, power-added-efficiency, linearity, and dynamic range for increased operation and detection range in future systems, unmanned aerial vehicles (UAVs), Electronic Warfare (EW), radar, and Soldier systems. In FY06, fabricated, and evaluated high power (60 W) Q-band millimeter wave power module (MMPM) amplifier; investigated reliability of gallium nitride (GaN) devices under high temperature, fabricated second generation devices, and implemented packaging concepts with thermal modeling. In FY07, initiate characterization, analysis, and evaluation of high power (80 W) Ka-band MMPM; and inititate design and characterizion of GaN transmit/receive (T/R) and power amplifier modules. In FY08, will complete efforts on Ka-band MMPM and GaN modules. Will design low noise GaN amplifier integrated in mini-package and will analyze thermal properties for high power packaged amplifiers. In FY09, will design and fabricate integrated low noise and high power T/R package for antenna array.	3205	2415	3533	3205
Investigate eye-safe, scanner-less, 3-D imaging laser radar (LADAR) for both long-range reconnaissance and short-range unmanned ground and air vehicle applications. Investigate optical limiter designs with promising nonlinear materials in order to provide passive protection of Future Force electro-optic (EO) vision systems from damage from laser threat devices. In FY06, evaluated and selected a nonlinear limiting material class with large bandwidth and high optical density for extensive characterization in tandem limiter configuration and fabricated and evaluated an imaging LADAR using an image tube as a receiver. In FY07, use the image tube LADAR to evaluate obscured target detection through 3-D LADAR imagery in simulated UAV and ground-to-ground scenarios; transition LADAR architecture to CERDEC for integration into UAV EO payloads; show large-dynamic-range, broadband optical limiting in a tandem limiter configuration chosen to match that of the Tank and Automotive Research, Development, and Engineering Center (TARDEC) system demonstrator with single Charge Coupled Device (CCD) sensor; transition selected broadband nonlinear limiting material to TARDEC for integration into the system demonstrator. In FY08, will utilize TARDEC testing results on the system demonstrator to further maximize performance of materials for CCD protection and will fabricate an integrated solid-state version of the LADAR architecture for transition to CERDEC and Armaments Research, Development, and Engineering Center (ARDEC). In FY 09, will retro-fit the solid-state version of the ladar receiver into the image tube to obtain improved performance required by Aviation and Missile Research, Development, and Engineering Center (AMRDEC).	3174	2738	1871	1118
Investigate multi-color, passive infrared (IR), imaging focal plane arrays (FPAs) for long range target detection and identification. Investigate molecular beam epitaxy (MBE) growth techniques for the growth of mercury cadmium telluride (HgCdTe) on Silicon (Si) substrates for both the mid-wave infrared (MWIR) and long-wave infrared (LWIR) spectral region to significantly decrease the cost and to allow the development of large area arrays. Design and fabricate arrays for higher operating temperature. In FY06, fabricated large area	1729	2260	2175	2170

FPA with up to 1000x1000 pixels for LWIR; fabricated new detectors for higher operating temperature; and analyzed passive IR target and background signatures for advanced IR dual-band passive sensors. In FY07, research MWIR and LWIR FPAs with high operating temperatures of 180 Kelvin for MWIR and 120 Kelvin for LWIR. In FY08, will investigate multicolor (Short Wave IR (SWIR)/MWIR/LWIR) FPAs for enhanced range and detection. In FY09, will research polarization sensitive data collection and analysis for improved target classification and identification and explore FPAs with on-chip processing.				
Investigate a broad base of extremely quick, accurate, and novel photonic architectures to enable detection of hazardous substances to enhance Soldier survivability. Investigate the hybridization of OE devices with electronics for IR scene projectors and compact 3-D imaging. In FY06, evaluated MEMS photoacoustic sensor performance for feasibility as a trace-level chemical sensor. In FY07, explore possible chip-level technologies (Quantum/Interband Cascade Lasers, MEMS microphones, and MEMS actuators) for incorporation into MEMS photoacoustic chemical sensing system. In FY08, will characterize current biomimetic recognition elements using several laboratory analytic methodologies; will evaluate olfactory sensor based on integrated MEMS photoacoustic system; will characterize efficacy of molecular recognition elements devised using rapid directed evolution methodologies and will investigate multi-band IR 2-D arrays for scene generation. In FY09, will assess recognition elements as alternative biologically-inspired methods to produce advanced photonic and electronic structures and investigate hybrid techniques incorporating novel recognition elements and spectroscopic inspection and investigate highly compact OE transceivers for 3-D imaging.	904	505	2678	4063
Investigate, design, and fabricate MEMS based components to improve power generation and micro-cooling technology for both the dismounted Soldier and Future Force systems. In FY06, fabricated a MEMS based fuel pump and fuel injector devices; designed and fabricated reclaimed energy system for small engines; and fabricated micro-cooling systems capable of 250 W/cm2. In FY07, design and fabricate reclaimed energy systems for small engines; investigate methods to integrate MEMS based fuel/air delivery devices into small engines; and design and fabricate cooling systems that provide 500 W/cm2. In FY08, will investigate advanced MEMS cooling systems, will demonstrate MEMS components on a small system and will fabricate MEMS valves for high flow applications. In FY09, will fabricate a heteroscopic turbine cooler; and will investigate improved MEMS rotary pumps, MEMS valves, and high flow low power atomizers.	4675	4577	3355	4248
Investigate and evaluate prognostics and diagnostics (P&D) algorithms; design, fabricate, and evaluate MEMS and other sensors; and design, develop code, and evaluate database for the integration into decision systems to extend sensor rationalization and minimize downtime via condition-based maintenance. In FY06, fabricated multi-level high-g MEMS switch wafers for capturing sudden accelerations; evaluated sensors for advanced core-sensor suite, processor and transceiver in multi-node network; and fabricated tag brassboard to experimentally validate selected core electronics. In FY07, initiate reduction of MEMS switch reset voltage and design initial package; initiate evaluation of fault identification criteria and determine physics of failure modes. In FY08, will fabricate experimental core module applied to specific commodities. Module will entail a coded algorithms transceiver, core sensors, processor, and remote sensor interface. Will conduct preliminary experimentation on networked RF link and incorporate fault algorithms. In FY09, will implement cross-correlated algorithms in an open architecture P&D system and will conduct fault prognostic tests enhancing algorithms and user interface in an open architecture environment.	2675	2653	2888	2954
Investigate technology for advanced batteries, fuel reformers, and fuel cells to be used in hybrid power sources for future electromagnetic armor and smart munitions. Investigate and mature silicon carbide (SiC) power module technologies to enable compact high temperature (up to 150°C heat sink temperature) and high power density converters for motor drive and pulse power applications for the Future Force. In FY06, provided electrode/electrolyte materials technology for enhancing charge/discharge rate of advanced Li-ion batteries and investigated absorbents for removing sulfides in military fuel for fuel cells. In FY07, provide improved electrolyte for low temperature Li-ion batteries and sulfur-tolerant catalysts for logistic fuel processing for fuel cells. In FY08, will explore new technology for reserve	350	347	1009	1577

batteries and more stable sulfur tolerant catalysts. Will investigate and mature high-temperature (90° - 120°C) SiC power modules implemented in voltage-controlled SiC power devices for low power hybrid electric vehicle (HEV) power conversion. In FY09, will explore higher energy reserve battery materials and higher power Li-ion battery materials. Will investigate and mature high-temperature (90° - 120°C) SiC power modules for medium power conversion.				
Small Business Innovative Research/Small Business Technology Transfer Programs		71		
Total	21968	20262	23663	25544