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

February 2003

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602705A - ELECTRONICS AND ELECTRONIC DEVICES

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		48000	59682	33694	42005	47066	44630	44163	44957
EM4	ELECTRONIC DISPLAY RESEARCH	8609	0	0	0	0	0	0	0
H11	BATTERY/IND POWER TECH	17226	30858	7320	12929	17488	13651	12781	12892
H94	ELEC & ELECTRONIC DEV	22165	28824	26374	29076	29578	30979	31382	32065

A. Mission Description and Budget Item Justification: This program element provides enabling capabilities for the Objective Force by researching and investigating 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 to provide electronic components, power components, frequency control and timing devices, display technologies, and low-cost, lightweight, high-energy density power sources for communications, target acquisition, and miniaturized displays, for applications such as the Future Combat Systems (FCS) and soldier systems. This program consists of research in the physical sciences essential to all land combat systems that contain any of the following component technologies: electronics, photonics, magnetic materials, ferroelectrics, microwave and millimeter-wave components, batteries, electromechanical systems (engine generator sets) and fuel cells. Supported systems 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. Work in this PE is related to and fully coordinated with efforts in PE 0602120 (Sensors & Electronic Survivability), PE 0602782 (Command, Control, Communications Technology), PE 0602709 (Night Vision Technology), PE 0602783 (Computer and Software Technology), PE 0603008 (Command, Control, Communications Advanced Technology), and PE 0603772 (Advanced Tactical Computer Science and Sensor Technology). The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Laboratory and the Army Communications and Electronics Research Development and Engineering Center Fort Monmouth NJ. This PE supports the Objective Force transition path of the Transformation Campaign Plan.
No Defense Emergency Response Funds have been provided to this program.

B. Program Change Summary	FY 2002	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2003)	49965	27448	30167	31664
Current Budget (FY 2004/2005 PB)	48000	59682	33694	42005
Total Adjustments	-1965	32234	3527	10341
Congressional program reductions				
Congressional rescissions		-2760		
Congressional increases		36550		
Reprogrammings	-951	-342		
SBIR/STTR Transfer	-1014	-1214		
Adjustments to Budget Years			3527	10341

Change Summary Explanation:
Significant Changes:
FY04-05: Funds realigned to increased investments in power and energy, and prognostics and diagnostics efforts.

FY03 Congressional Adds:
Logistics Fuel Reformer Development Program, Project H11 ($1750); Center for Advanced Fuel Cell Technology, Project H11 ($2000); Soldier Fuel Cell System, Project H11 ($1050); Cylindrical Zinc Air Battery for Land Warrior Applications, Project H11 ($1000); Improved High Rate Alkaline Cell, Project H11 ($1000); Rechargeable Cylindrical Cell System – Lithium Ion/Nickel Metal Hydride, Project H11 ($1000); Dry Polymer Extrusion for Battery Cathode and Electrode Research, Project H11 ($3700); Extrusion on Multilaminate Battery Packaging, Project H11 ($4500); Solid State Polymer Battery for Land Warrior System, Project H11 ($1000); Intelligent Power Control for Sheltered Systems, Project H11 ($3800); Liquid Silicone Lithium Rechargeable Battery, Project H11 ($1500); Low Cost Reusable Alkaline Manganese-Zinc, Project H11 ($600); Flat Panel Displays, Project H94 ($7000); Display and Development and Evaluation Laboratory, Project H94 ($1750); Miniature and Micro Fuel Cells, Project H11 ($3500); Portable Hybrid electric power systems, Project H11 ($1400).

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

February 2003

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

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H11	BATTERY/IND POWER TECH	17226	30858	7320	12929	17488	13651	12781	12892

A. Mission Description and Budget Item Justification: This project conducts applied research to identify, advance and enhance emerging power generation and power management technologies for the Objective Force. There is a critical need for ultra-lightweight manportable power, chargers, and power management for the dismounted soldier in support of Land Warrior and Objective Force Warrior (OFW). Mobile electric power sources that are smaller and more fuel efficient are key enablers for tactical sustainability and survivability. This project researches advancements in energy conversion, electrochemistry, and signature suppression technologies, including those for primary batteries, rechargeable battery hybrids, fuel cells, power management, and components for electromechanical power generation. It will provide (1) high energy and high power density hybrid power source components that combine the best features of individual power technologies, (2) rapid recharging systems, and (3) power management through low power design tools and software operating system dynamic power management. It will provide the OFW and other OF 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 High Energy, Cost-Effective Primary and Rechargeable Batteries program will modify cost-effective commercial battery technologies to provide advanced high energy batteries and hybrid power sources that can be used for both training and combat. The Integrated Power Generation and Management Technologies program will provide high energy, low cost and fuel-efficient non-battery portable and mobile power sources and investigate low power technologies to reduce the power consumption of future electronic devices. The Portable and Mobile Power Sources for the Objective Force program will mature various emerging power source technologies to provide high energy, low weight portable power sources for Land Warrior, the Objective Force Warrior, and mobile electric power sources for Objective Force platform applications. This project supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds were provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
-High Energy, Cost Effective Primary and Rechargeable Batteries: Completed a four year effort in High Energy, Cost Effective Primary and Rechargeable Batteries. Tested, in the field, a forward area battery charging system comprised of a high energy metal-air battery and smart charging cables; provided a prototype battery with energy density greater than 300 watt hours/kilogram, and evaluated a proof-of-concept electrochemical capacitor for hybrid digital pulse C4I applications with 10 times power density and two to four times energy density, integrated into a hybrid power source for field testing in digital pulse C4I and high-power vehicle applications that lasts more than three times the battery alone in the same envelope.	1169	0	0	0
- Integrated Power Generation and Management Technologies: Completed a three year effort in Integrated Power Generation and Management Technologies. Tested, in the field, a scalable power electronics package in a five kilowatt engine generator set; tested, in the laboratory, power on-the-move capabilities. Tested, in the field, a battery/battery hybrid; tested, in the field, a kinetic energy harvesting system; integrated components for a stand-alone 500 watt thermophotovoltaic (TPV) power source. Enhanced the initial low power design tool for additional power consumption reductions in soldier systems; implemented and tested power management techniques for soldier systems on a distributed test bed.	2997	0	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Portable and Mobile Power for the Objective Force: This effort researches Hybrid Power Source and Power Management technologies for Land Warrior (LW) and the Objective Force Warrior (OFW). The effort investigates technology components including Low Temperature Ionic Membrane Development, Mobile Power Fuel Cell Development, Micro Power Source Development for Sensors, Logistic Fuel Meso/Micro Engine Development, and Power Management Development for OFW, 10 kW Generator Component Development, Logistic Fuel Reformers for 1-2 kW Fuel Cells, and Battery Charger Development. In FY03, researches and laboratory demonstrates system level smart charger technology for mobile platform with 2.5 hr recharge for LW LI7 battery, system metal-air/lithium battery hybrid power source (4 lbs) with 200 Wh/kg, and 300 Wh/kg re-fuel. In FY04, investigates10 kW proof-of-concept system components leading to quiet, smaller, and fuel-efficient generator, investigates safe polymer lithium-ion rechargeable LW LP10 battery (2 lbs) with 170 Wh/kg. In FY05, demonstrates system level smart charger technology with 2 hr recharge integrated for LW LP10 battery, 1-2 kW reformed logistic fuel cell components for scout vehicle silent watch, lighter weight battery hybrid power source (3.5 lbs) with 250 Wh/kg, 350 Wh/kg re-fuel for soldier systems, and power management software with 50% power reduction in operating system of LW, investigates logistic fueled meso/micro power components leading to hybrid power source for OFW.	0	4331	7320	12929
- Congressional Adds for Logistics Fuel Reformer Development Program: The objective of this one year congressional add is to integrate microchannel reformer technology components into an integrated system for both a man-portable methanol fuel reformer and a multi-kilowatt sulfur-laden fuel reformer. No additional funding is required to complete this project.	0	1668	0	0
- Congressional Adds for Center for Advanced Fuel Cell Technology: The objective of this one year congressional add is to research micro fuel cell technologies to include (1) new electrolytes and cataysts, (2) improved membranes, and (3) heat and water management. No additional funding is required to complete this project.	0	1908	0	0
- Congressional Adds for Soldier Fuel Cell System: The objective of this one year congressional add is to test and evaluate a prototype fuel cell system under various combat scenarios. No additional funding is required to complete this project.	0	1002	0	0
- Congressional Adds for Cylindrical Zinc Air Battery for Land Warrior Applications: The objective of this one year congressional add is to investigate and integrate the Cylindrical Zinc Air Battery for Land Warrior. No additional funding is required to complete this project.	0	955	0	0
- Congressional Adds for Improved High Rate Alkaline Cell (or CFx): The objective of this one year congressional add is to incorporate cells into batteries and test under various simulated equipment load scenarios. No additional funding is required to complete this project.	0	955	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Congressional Adds for Rechargeable Cylindrical Cell System - Lithium Ion/Nickel Metal Hydride: The objective of this one year congressional add is to test and evaluate Rechargeable Cylindrical Cell System under extreme temperatures. No additional funding is required to complete this project.	0	955	0	0
- Congressional Adds for Dry Polymer Extrusion for Battery Cathode and Electrode Research: The objective of this one year congressional add is to research high conductivity electrodes and electrolytes that will be incorporated in cells for testing and evaluation. No additional funding is required to complete this project.	0	3531	0	0
- Congressional Adds for Extrusion on Multilaminate Battery Packaging: The objective of this one year congressional add is to incorporate multilaminate recipies into lithium-ion cells for test and evaluation. No additional funding is required to complete this project.	0	4293	0	0
- Congressional Adds for Solid State Polymer Battery for Land Warrior System: The objective of this one year congressional add is to investigate lithium-ion cells with newly developed high-conductivity polymer electrolyte. No additional funding is required to complete this project.	0	955	0	0
- Congressional Adds for Liquid Silicone Lithium Rechargeable Battery: The objective of this one year congressional add is to investigate additives to decrease the flammability of electrolytes. No additional funding is required to complete this project.	0	1431	0	0
- Congressional Adds for Low Cost Reusable Alkaline Manganese-Zinc: The objective of this one year congressional add is to test and evaluate batteries in the 5590 configuration under SINCGARS load scenario. No additional funding is required to complete this project.	0	573	0	0
- Congressional Adds for Miniature and Micro Fuel Cells: The objective of this one year congressional add is to investigate materials and stacks for miniature and micro fuel cell applications. No additional funding is required to complete this project.	0	3340	0	0
- Congressional Adds for Portable hybrid electric power systems: The objective of this one year congressional add is to investigate methanol concentration measurement and control issues, system balance-of-plant optimization and control, DMFC/Li-ion hybridization issues, and model development including both detailed and system-level models. No additional funding is required to complete this project.	0	1335	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Congressional Adds for Intell Pwr Control for Sheltered Sys: The objective of this one year congressional add is to investigate small, modular, distributed shelter power management system, lightweight intelligent power distribution systems, automatic power adapter switches, IPMS integrated smart chargers for smart batteries, high energy energy density battery bank/Uninterrupted Power Supply, highly efficient miniature DC to DC converters, remote monitoring and control HW/SW of integrated power management system, and studies into potential power management of unmanned ground systems (UGSs), unmanned ground vehicles (UGVs) and on-the-move systems. No additional funding is required to complete this project.	0	3626	0	0
Power Sources for the Dismounted Soldier: The objective of this one year congressional add was to investigate the following: a cylindrical zinc-air cell for Land Warrior, fuel cell for soldier systems, an improved high rate alkaline cell, a logistics fuel reformer, and a rechargeable cylindrical cell system. No additional funding is required to complete this project.	7532	0	0	0
-Power Sources for Non-Objective Force Applications: The objective of this one year congressional add was to investigate the following: low cost reusable alkaline manganese-zinc batteries, polymer extrusion/multilaminate processes, and a cylindrical battery replacement for a tube-launched optically-tracked wire-guided missile, improved target acquisition system. No additional funding is required to complete this project.	4562	0	0	0
Congressional Add: The objective of this one year congressional add was to investigate heat actuated coolers for portable military applications. No additional funding is required to complete this project.	966	0	0	0
Totals	17226	30858	7320	12929

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February 2003

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

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H94	ELEC & ELECTRONIC DEV	22165	28824	26374	29076	29578	30979	31382	32065

A. Mission Description and Budget Item Justification: This project supports applied research in the application of the sciences of physics, electrochemistry, biotechnology and electronics to advance power generation, Command, Control, Communications, Computers (C4) and Intelligence, Surveillance and Reconnaissance (ISR) technologies for the Future Combat Systems (FCS) and the Objective Force. These technologies support thrusts aimed at enhanced battlefield situational awareness, increased vehicle mobility, reduced acquisition cost, and reduced operations and support costs; they are critical to the realization of the vision of a medium weight force with the capability to detect, target, and engage the enemy of the future. The technical areas addressed under this project are: frequency control; electro-optic sensors to include eye safe laser radar and midwave infrared (MWIR, 3- to 5-micron) and longwave (LWIR, 8- to 12-micron) bands; microelectromechanical systems (MEMS) for multi-function radio frequency (RF) applications as well as smart munitions (e.g., inertial measurements); advanced 16-18, 35, and 95 GHz (Ku, Ka and W-band) modules for RF applications; high temperature high power inverter circuits for all-electric vehicles; microturbines; prognostics and diagnotics to reduce logistics demands; and advanced lithium-ion batteries, metal/air batteries, fuel reformer, fuel cells for hybrid power sources for individual soldier applications and FCS. Technical barriers include: more stable oscillators for frequency control in communications and location finding, more complete understanding of fundamental properties, growth techniques, and processing of new materials and their exploitation in electronic devices for high performance infrared detectors, high voltage and high power control electronics; MEMS device design and fabrication techniques; RF microcircuit design; high power and high voltage power materials and device design, more energetic electrodes, more conductive and stable electrolytes for batteries and fuel cells, compact fuel reformers to provide hydrogen for fuel cells. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, Project reliance and supports the Objective Force transition path of the Transformation Campaign Plan. This program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Research Laboratory (ARL). No Defense Emergency Response Funds were provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- Mature components and software for C4 technology. Mature affordable design concepts for an integrated radio frequency sensor which performs radio, radar, and control functions to allow communications, combat-ID, target acquisition and track, active protection, and munition command guidance through a single antenna for use on small ground and air vehicles. Perform research in advanced tactical software tools for mobile, ad hoc network access control, intrusion detection, and authentication techniques for the objective force. In FY02, completed fabrication of Ka-Band multifunction testbed modules for evaluation of research concepts and conducted laboratory experiments on agent based vulnerability assessment tools for low bandwidth networks. In FY03, complete integration of solid state modules into 2D Escan antenna. Predict attack types by identifying mobile ad hoc network vulnerabilities and postulate concepts for solutions. In FY04, complete design and testing of planar, polarimetric radiating elements for wide bandwidth mmW arrays; and identify automated agent based deployment techniques and verify there robustness through experiments. In FY05, complete True Time Delay beam steering in 2 dimensions for widebandwidth, high-resolution RF sensors and provide techniques and software codes for autonomous use in the field to prevent intrusions and to repel attacks.	2662	1762	1600	1600
- Investigate micro and nano technology for small low cost highly reliable RF MEMS switches, resonators and filters for multifunction . In FY02, experimentally verified finite element modeling for design of RF MEMS switch, filter and resonators using smart material, lead zirconate titanate, for multifunction RF applications. In FY03, fabricate Aluminum Nitride (AlN) resonators for high frequency filter applications. In FY04, initiate reliability testing of 1st generation AlN MEMS resonators and design 2nd generation resonators for high frequency filter applications. In FY05, examine the performance of E-Beam lithography in patterning nanoscale RF structures for FCS and OFW communications.	1036	750	1115	1300
- Investigate and provide the world's first high-temperature matrix converter for motor drive applications (future electric vehicles) using silicon carbide technology. In FY02, completed and evaluated 4 kW silicon carbide bi-directional switch as a proof-of-principle, high temperature circuit for matrix converter. In FY03 fabricate silicon carbide power devices and implemented world's first high-temperature bi-directional switch (10 kW) for development of high-temperature matrix converter for motor drive applications In FY04 fabricate and validate a 10 kW silicon carbide (SiC)-based high-temperature matrix converter for motor control and a 300 kW Si-based matrix converter for power distribution. In FY05 Implement a high-temperature controller circuit for 10 kW matrix converter.	1613	1800	1650	350

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Design highly stable, low-acceleration sensitivity, low-noise oscillators, by integrating the high quality factor of photonic resonators and conventional microwave components for improved Future Combat System radar systems engaging in slow moving target detection. In FY02, completed the design of very low phase noise oscillators and first prototype units have been fabricated for the low radar doppler system. In FY03 assess noise characteristics for fiber optic opto-electronic oscillator (OEO) and model performance. In FY04, evaluate performance of microsphere based OEO with performance suitable for moving target indicator (MTI) sensors. In FY05, test phase locked microsphere based stabilized local oscillator (STALO) with RF Frontends.	2879	2900	2500	1900
- Investigate new component materials, structures and EM issues to enhance the performance of mmW components and active devices, such as vacuum electronic devices (VEDs) and millimeterwave integrated circuits (MMICs), and to enhance integration. In FY02, designed a new temperature stable ferroelectric dielectric material for compact antenna phase shifters and new piezoelectric resonators with ten times lower acceleration sensitivity have been used in the design of oscillator and filter applications for mobile Future Combat Systems. In FY03, complete fabrication of Ka- and Q band millimeter power modules (MMPMs) for EW and radar applications. In FY04, integrate VE tube with semiconductor amplifier and power supply in MMPMs and characterize. In FY05, evaluate new components to support design of next generation mmW active apertures.	1958	1700	2250	2426
- Research and design improved, millimeter-wave solid-state devices based on new device materials and structures to achieve higher output power, power-added-efficiency, linearity, and dynamic range for increased operation and detection range in systems such as FCS, UAV and soldier system. In FY02, completed compact multichannel transmit/receive (T/R) module designs prototype units for integration to antenna and beam forming network for system evaluation. In FY03, evaluate prototypes in two-dimensional (2D) Escan and create enhanced design with new higher dynamic range MMICs from FCS-Comms program. In FY04, assess performance of microwave/millimeter wave wide bandgap (WBG) devices and circuits. In FY05, complete T/R module incorporating wide bandgap (WBG) based MMICs to support tactical unmanned aerial vehicles (TUAV) SAR/MTI radar.	1843	1400	775	1500

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Investigate technology for advanced batteries, fuel reformers and fuel cells to be used in hybrid power sources for the objective force warrior, future combat systems (e.g., electromagnetic armor and smart munitions. In FY02, formulated an experimental rechargeable Lithium (Li)-ion battery chemistry with flame-retardant electrolyte and nanophase electrode material. In FY03, investigate a Li/air battery chemistry for very high specific energy battery charger. In FY04, formulate and evaluate new catalysts for efficient hydrocarbon reformation for fuel cells. In FY05, provide technology for an advanced high-energy rechargeable battery with low flammability/ good charge retention at high temperatures and for a Li/air battery and for fuel cell systems utilizing carbonaceous fuels. (This work is in support of project AH11.)	2073	1400	1550	1500
- Investigate eye-safe scannerless 3-D imaging laser radar for both long-range FCS and short-range unmanned ground and air vehicle applications. In FY02, completed laboratory concept demonstration of scannerless 3-D imaging laser radar. In FY03, demonstrate a scannerless laser radar breadboard system in the field. In FY04, integrate eye-safe components, laser and detector operating at 1.5 um, into radar breadboard system. In FY05, demonstrate an improved eye-safe version, field test, and collect data to show functionality for target acquisition and robotic navigation.	3376	2300	450	450
- Investigate multi-color infrared (IR) imaging cameras, small pixel focal plane arrays (FPAs) capable of both passive IR and active laser detection and acousto-optical tunable filter (AOTF) based hyperspectral imagers for target detection and identification for FCS, countermine, active protection, and other Army applications. In FY02, used dual-color long-wave camera to show detection of recently buried mines. In FY03, show feasibility of an integrated sensor using large-area dual-color MWIR/LWIR detector arrays and 3-D imaging laser radar for target acquisition and identification for FCS vehicles. In FY04, demonstrate improved long-wave IR AOTF for hyperspectral imaging. In FY05, demonstrate provision of mid-wave IR azimuth and elevation tracking information to radar kinetic energy projectile tracker for FCS vehicle survivability active protection system.	2995	3636	2100	2100

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Research semiconductor superlattice and quantum dot materials for high operating temperature, high-performance IR detectors and mid-wave infrared (MWIR) quantum cascade lasers to reduce the cost of FCS and other Army sensors. In FY02, demonstrated room-temperature pulsed operation for systems such as systems such as missile countermeasure laser radar or chemical/biological agent detection. In FY03, show continuous-wave operation at temperatures reachable by inexpensive thermoelectric coolers. In FY04, demonstrate operation of quantum dot detectors at temperatures significantly higher than required for present state-of-the-art high-performance IR detectors, showing potential for lower-cost sensors. In FY05, demonstrate low defect density antimony-based superlattice material for future high operating temperature IR detectors.	1730	2353	2484	2450
- Investigate optical limiter designs with promising nonlinear materials in realistic, emulated Army imaging devices for enhanced survivability. In FY03, characterize highly nonlinear reverse saturable absorbing (RSA) dyes in low frequency number testbeds. In FY04 fabricate and characterize the nonlinear properties of phase change materials (such as fast switches), sacrificial materials. In FY05 have characterized mercury mirrors, engineered RSA materials, two-photon absorbing materials and characterize highly nonlinear optical materials (such as large pi-conjugated organic molecules).	0	350	1000	1000
- Investigate a broad base of extremely quick, accurate, and small photonic devices to detect biological point and remote agents to enhance soldier survivability. In FY04, demonstrate MEMS based and interferometric chemical detection. In FY05, demonstrate remote particle scattering biosensor.	0	0	1500	1500
- Investigate, design and fabricate a micro electro mechanical system (MEMS) based micro-gas turbine generator for producing electricity and cooling for the dismounted soldier for the Objective Force Warrior and beyond. In FY04, the micro gas turbine will be operated using hydrogen as fuel. In FY05, provide the first hydrocarbon fueled turbojet generator.	0	0	1000	3000
- Investigate and evaluate prognostics and diagnostics (P&D) algorithms; design, fabricate and evaluate micro-electro-mechanical systems (MEMS) and other sensors; and design, code, and evaluate database for the integration into logistics decision support systems to extend operational life and minimize downtime via condition-based maintenance. In FY04, design and demonstrate combined MEMS and nanotechnology sensor concept models. In FY05, conduct validating experiments on MEMS/nanotechnology sensors.	0	0	2400	3000
- In FY04 mature flexible display backplane, electronics and materials. In FY05, mature flexible display technology to develop prototypes.	0	0	4000	5000

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Flat Panel Displays: The objective of this one-year Congressional add is to improve the quality of equipment and materials available from U.S. suppliers for flat panel display technologies; to identify and insert improvements into manufacturing, pre-production and pilot facilities; and to establish standards and manufacturing benchmarks for the flat panel display industry. No additional funding is required to complete this project.	0	6779	0	0
- Display and Development and Evaluation Laboratory: The objective of this one-year Congressional add is to conduct research in the fabrication and characterization of luminescent materials, components, and prototype display devices for flexible displays; and to create a database of information on display technologies and vendors. No addtional funding is required to complete this project.	0	1694	0	0
Totals	22165	28824	26374	29076