Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	134.946	60.859	62.962	-	62.962	63.203	64.039	63.947	63.885	Continuing	Continuing
EM4: *Electric Component Technologies (CA)*	38.766	-	-	-	-	-	-	-	-	Continuing	Continuing
EM6: *HEATING AND COOLING TECHNOLOGIES (CA)*	5.571	-	-	-	-	-	-	-	-	Continuing	Continuing
EM7: *POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)*	35.514	-	-	-	-	-	-	-	-	Continuing	Continuing
EM8: *High Power and Energy Component Technology*	8.599	13.631	15.402	-	15.402	15.238	15.086	14.434	14.678	Continuing	Continuing
H11: *Tactical and Component Power Technology*	12.508	11.988	11.395	-	11.395	11.016	11.571	11.411	10.485	Continuing	Continuing
H17: *FLEXIBLE DISPLAY CENTER*	6.737	6.974	7.508	-	7.508	7.633	7.944	8.224	8.349	Continuing	Continuing
H94: *ELEC & ELECTRONIC DEV*	27.251	28.266	28.657	-	28.657	29.316	29.438	29.878	30.373	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) is applied research on technologies in areas such as electronic components, power components, frequency control and timing devices, high power microwave devices, and display technologies. The applied research on these technologies will enable the ability to perform precision deep fires against critical mobile and fixed targets; investigate exceptional all-weather, day or night, theater air defense against advanced enemy missiles and aircraft; as well as investigate enhanced communications and target acquisition through support of capabilities such as autonomous missile systems, advanced land combat vehicles, smart anti-tank munitions, electric weapons, secure jam-resistant communications, automatic target recognition, foliage-penetrating radar, and combat identification. This PE sustains applied research on high-power, microwave, electronic components and technologies (project EM8), advanced portable power technologies (batteries, fuel cells, hybrids, engines, chargers, and power management) (project H11), applied research on flexible displays in conjunction with the Flexible Display Center (project H17), and applied research on electronic component technologies such as photonics, micro electromechanical systems (MEMS), imaging laser radar, magnetic materials, ferroelectrics, microwave and millimeter-wave components, and electromechanical systems (project H94).

Work in this PE complements and is fully coordinated with efforts in PE 0602120A (Sensors and Electronic Survivability), PE 0602782A (Command, Control, Communications Technology), PE 0602709A (Night Vision Technology), PE 0602783A (Computer and Software Technology), PE 0603001A (Warfighter Advanced Technology), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army	DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*

Projects EM4, EM6 and EM7 fund congressional special interest items.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work is performed by the Army Research Laboratory, Adelphi, MD, and the Army Communications-Electronics Research, Development, and Engineering Center, Fort Monmouth NJ and Aberdeen Proving Ground, MD.

B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	134.532	60.859	62.285	-	62.285
Current President's Budget	134.946	60.859	62.962	-	62.962
Total Adjustments	0.414	-	0.677	-	0.677
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	1.431	-			
• SBIR/STTR Transfer	-1.017	-			
• Adjustments to Budget Years	-	-	0.677	-	0.677

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT EM4: *Electric Component Technologies (CA)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
EM4: *Electric Component Technologies (CA)*	38.766	-	-	-	-	-	-	-	-	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Electronic Component applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Micromachined Switches in Support of Transformational Communications Architecture ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Investigated technologies to optimize the performance of packaging for radio frequency (RF) Micro Electro Mechanical Systems (MEMS) switches and wafer-scale fabrication of Micro-Assemblies silicon on insulator RF MEMS switches.	2.387	-	-
Title: Advanced Power Source for Future Soldiers. ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Explored novel alkaline membrane electrolyte technologies for the next generation soldier fuel cell system.	1.193	-	-
Title: High-Frequency, High-Power Electronic and Optoelectronic Devices on Aluminum Nitride (AIN). ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Performed research on high frequency, high power electronic and optoelectronic devices.	3.184	-	-
Title: Self-Powered, Lightweight, Flexible Display Unit on a Plastic Substrate ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:***	3.024	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT EM4: *Electric Component Technologies (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Developed reflective display technology based on novel imprint lithography that will advance manufacturing base. Integrated solar cells with flexible displays.			
Title: Large Format Li-Ion Battery ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed technology for manufacturing large format lithium ion battery integrated with battery management system.	4.934	-	-
Title: Maryland Proof of Concept Alliance for Defense Technologies ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Fostered the commercialization of electronics components technologies through research, development, experiments, and worked with the various technology transfer offices and venture development offices.	1.592	-	-
Title: Advanced Power Generation Unit for Military Applications ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Investigated an advanced power generation system technology.	0.647	-	-
Title: Mid-Infrared Super Continuum Laser ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Investigated laser technology for potential electronic countermeasure applications.	0.796	-	-
Title: Soldier Situation Awareness Wristband ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Investigated body-worn Situational Awareness technology.	1.114	-	-
Title: Printed and Conformal Electronics for Military Applications	1.592	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT EM4: *Electric Component Technologies (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Investigated printed and conformed electronics technologies.			
Title: Eye Safe Laser Range Finder ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Investigated technology for eye-safe laser range-finders.	2.388	-	-
Title: Unmanned System Algorithm Development ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Explored algorithms for integration of unmanned systems with manned systems.	3.184	-	-
Title: Special Operations Forces (SOF) Technology Insertion ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Investigated technologies developed in small numbers for the Special Operations Forces (SOF) that might be applicable to broader Army use.	5.967	-	-
Title: Flexible Solar Cell for Man Portable Power Generator ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Investigated technology for low cost, flexible solar cell generating systems.	0.796	-	-
Title: Direct Carbon Fuel Cell ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:***	2.785	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Investigated technology for a portable power generating system.			
Title: Advanced Composite Nickel-Manganese-Cobalt Lithium Ion Battery ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Investigated composite nickel-manganese-cobalt lithium ion battery to optimize electrode performance.	2.387	-	-
Title: Army Asset Visibility Enhancement ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This effort investigated automatic identification technologies to provide Army users with more accurate and up-to-date information on the logistics pipeline.	0.796	-	-
Accomplishments/Planned Programs Subtotals	38.766	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT EM6: *HEATING AND COOLING TECHNOLOGIES (CA)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
EM6: *HEATING AND COOLING TECHNOLOGIES (CA)*	5.571	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Heating and Cooling applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Cogeneration for Enhanced Cooling and Heating of Advanced Tactical Vehicles ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item conducted advanced research to concurrently demonstrate a diesel engine driven (DED) engine integrated with a waste heat recovery co-generation system, an optimized powertrain cooling module, and a novel low-global warming potential (GWP) alternative refrigerant, showing system performance at military high ambient conditions.	3.183	-	-
Title: Advanced Tactical 2KW External Combustion Power Sources for Cogeneration Applications ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item matured and delivered a 2 kilowatt (KW) jet fuel propellant (JP-8) fueled demonstrator utilizing an external combustion free-piston Stirling engine.	2.388	-	-
Accomplishments/Planned Programs Subtotals	5.571	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT EM7: *POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
EM7: *POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)*	35.514	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding Power and Energy Component applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Novel Zinc Air Power Sources for Military Applications ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item delivered fourth generation primary zinc-air batteries in several form factors, including body-worn, with state-of-charge indicator capability.	1.989	-	-
Title: Oregon Nanoscience and Microtechnologies Institute (ONAMI) Miniature Tactical Energy Systems Development ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item completed construction of a 5 kilowatt co-generation absorption system and a 5 kilowatt heat-actuated expander-compressor heat pump system.	2.486	-	-
Title: Bio-Battery ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item developed a hybrid biological battery with long run time for low drain applications.	0.795	-	-
Title: Ceramic Membrane - 10(X) More Energy for Battery Systems ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:***	2.387	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT EM7: *POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
This Congressional Interest Item optimized selected critical component technologies from Phase 1 and Phase 2 for final input into a manufacturing Phase 3 program; demonstrated optimized Lithium-Air high energy density batteries and Lithium-Air charger batteries to the U.S. Government for independent testing.			
Title: Enzyme Biofuel Cell (SEBC) ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item experimented with a biofuel cell power source that will operate an unmanned ground system.	1.194	-	-
Title: Soldier Portable Power Pack (SP3) for the 21st Century Warrior ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item developed a man-packable 300W 28V DC battery charger/auxiliary power unit that runs on pure methanol.	2.388	-	-
Title: Advanced Soldier Portable Power Systems Technologies ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item developed a half size primary and rechargeable battery with smart power manager that can process energy from multiple energy sources.	2.467	-	-
Title: Solid Oxide Fuel Cell Powered Tactical Smart Charger ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item experimented with a 500 Watt solid oxide fuel cell operating on military logistic fuel JP-8 with integrated battery charging capability and ruggedized the integrated charger package to protect against shock and vibration.	0.955	-	-
Title: High-Volume Manufacturing Development for Thin-film Lithium Stack Battery Technologies ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:***	0.796	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT EM7: *POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
This Congressional Interest Item developed low cost and high energy electrode material for lithium ion batteries, developed Silicon deposition on carbon nanotube, and developed higher voltage cathode battery.			
Title: Advanced Wearable Power System Manufacturing ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item developed advanced processes and supporting capabilities to ensure the domestic, affordable producability of this advanced wearable power system. Developed a 20 watt, 1,000 watt hour per kilogram (wh/kg) conformal, planar power system that is wearable with modular lightweight load-carrying equipment vest and body armor.	1.592	-	-
Title: Improved Energy Density Battery ***Description:*** This is a Congressional Interest Item ***FY 2010 Accomplishments:*** This Congressional Interest Item developed improved materials (manganese and iron doping nanophosphate) for lighter weight and faster charging BB-2590/U battery.	1.990	-	-
Title: Military Fuel Cell Genset Technology Demonstration ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item experimented with reliable and ruggedized solid oxide fuel cell (SOFC) technology and systems for military generator set applications.	1.990	-	-
Title: Advanced Flexible Solar Photovoltaic Technologies ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item developed an advanced flexible solar photovoltaic system based on novel photovoltaic chemistries, substrates, production processes, and coating techniques to achieve a flexible photovoltaic system for tactical power generation applications.	2.388	-	-
Title: Intelligent Energy Control Systems (IECS) ***Description:*** This is a Congressional Interest Item.	2.388	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	**PROJECT** EM7: *POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: This Congressional Interest Item developed an intelligent energy control system that networks stand-alone generator sets with alternative energy systems into a hybrid intelligent power management system to create an energy efficient and cost-effective mobile grid.			
Title: Advanced Hybrid Chemistry for Portable Power ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item created a power source for Army use that possesses both the extraordinary specific energy of carbon mono-fluoride (CFx), while also having the broad based rate and temperature capabilities necessary to replace Lithium-sulfur dioxide (Li/SO2) for field use, reducing battery weight by 1/2 and increasing energy by 2x.	2.547	-	-
Title: Market Viable, Dual-Use, Advanced Energy Storage Solutions Development ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** This Congressional Interest Item devised a cell system that is lower in cost and higher in performance than conventional graphite/ lithium cobalt oxide or graphite/lithium nickel manganese cobalt oxide.	3.979	-	-
Title: Ruggedized Military Laptop Fuel Cell Power Supply-Project Phase 3 ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Developed a Direct Methanol Fuel cell (DMFC) powered laptop power supply.	3.183	-	-
Accomplishments/Planned Programs Subtotals	35.514	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	**PROJECT** EM7: *POWER AND ENERGY COMPONENT TECHNOLOGIES (CA)*

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT EM8: *High Power and Energy Component Technology*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
EM8: *High Power and Energy Component Technology*	8.599	13.631	15.402	-	15.402	15.238	15.086	14.434	14.678	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts research and evaluate high-power electronic components and technologies. These technologies have application in compact, light-weight power and energy storage, power and energy conversion, conditioning, radio frequency (RF)/microwave and solid-state laser directed energy weapons (DEW), and traditional and non-traditional RF and laser electronic attack. The ongoing directed energy effects and power component work is coordinated with and, as appropriate, leveraged by DEW and power/energy programs in the Air Force, Navy, High Energy Laser Joint Technology Office, Defense Threat Reduction Agency, national labs, university consortia, and relevant industry and foreign partners.

The work in this project is coordinated with the Tank and Automotive Research, Development, and Engineering Center (TARDEC); the Armaments Research, Development, and Engineering Center (ARDEC); the Aviation and Missile Research, Development, and Engineering Center (AMRDEC); and the Communications and Electronics Research, Development, and Engineering Center (CERDEC). These efforts were previously funded in PE 0602120A (Sensors and Electronic Survivability).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work on this project is performed by the Army Research Laboratory (ARL), Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: High Power Components	2.069	2.323	1.177
Description: Research and evaluate materials and component structures that enable the investigation of the higher energy density and efficiency required by next generation Army systems such as electromagnetic armor, hybrid-vehicle propulsion electronics, directed energy sources, pulse power, small unattended ground sensors, and Soldier systems.			
FY 2010 Accomplishments: Designed power sources and antennas for higher frequency and power output; implemented silicon carbide (SiC) high-power density modules for pulse switching levels > 10 Mega Watt (MW).			
FY 2011 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Implement system with new sources and antennas for counter electronics applications; develop SiC based high-power density modules for switching levels > 25 MW; as well as investigate and evaluate pulse power technologies for electromagnetic armor and microwave applications. ***FY 2012 Plans:*** Will investigate advanced wide band gap materials for use in high voltage pulse applications (>10kV).			
Title: High Energy Laser ***Description:*** Research novel solid-state laser concepts, architectures, and design components enabling high energy laser technology for Army specific DEW applications. Exploit breakthroughs in laser technology and photonics basic research to meet the stringent weight/volume requirements for platforms. Applied research will be conducted in close collaboration with domestic ceramic (and other) material vendors, university researchers, as well as major laser diode manufacturers. ***FY 2010 Accomplishments:*** Implemented cryogenically-cooled, gain medium in highly scalable, eye-safe, Erbium (Er)-doped lasers based on advanced laser ceramics. ***FY 2011 Plans:*** Investigate power and efficiency scaling potential of resonantly-pumped Ytterbium (Yb)-free Er-doped fiber laser architectures for high power eye-safe DEW applications. ***FY 2012 Plans:*** Will investigate scalability and efficiency potential of resonantly-pumped, eye-safe, lasers in a 2-2.1 micrometer atmospherically transparent spectral domain based on Holmium (Ho)-doped crystals and ceramics.	2.400	2.591	2.499
Title: Directed Energy (DE) ***Description:*** Investigate, research, and evaluate technologies related to DEW technology, electronic warfare (EW) survivability/ lethality, and supporting high power components to enhance the survivability/lethality of Army platforms. ***FY 2010 Accomplishments:*** Designed, developed and implemented components to reduce the size and weight of counter Improvised Explosive Device (IED) and mines systems, as well as continued to conduct lab and field assessments to understand susceptibility level of targets; investigated RF DE interoperability issues by conducting susceptibility analysis of Army radios. ***FY 2011 Plans:***	1.558	1.724	2.165

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Support ARDEC in demonstrating military utility of payload concept. Support Air Defense Artillery Center and AMRDEC in investigating the feasibility and effectiveness of RF DEWs against electronically guided rockets, artillery and mortars (RAM) for their Enhanced Area Air Defense program. Transition target effects data and basic design package for RF DE Air Defense System to Center via AMRDEC. Investigate susceptibility profile for unmanned aerial vehicle system. ***FY 2012 Plans:*** Will continue the development of counter electronic systems and electronic warfare (EW) technology for CERDEC; will continue susceptibility investigations of a variety of targets; as well as transition effects data to applicable Research Development and Engineering Centers (RDECs).			
Title: Platform Power Components ***Description:*** Investigate, research, and evaluate compact, high efficiency, high-temperature, high power component technologies (switches, magnetics, capacitors, etc.) for hybrid platform propulsion, power generation, and power distribution. ***FY 2010 Accomplishments:*** Evaluated power components for high-temperature (100 degrees Centigrade (C) coolant), 250 kilowatt (kW) traction drive inverter and 150 kW battery-to-bus converter. ***FY 2011 Plans:*** Investigate power components for higher temperature operations (110 C coolant) and smaller circuits for platform upgrade programs. ***FY 2012 Plans:*** Will evaluate small high efficient wide band gap power modules and circuits utilizing high power component technologies as well as high performance passive components operating at a coolant temperature of 100 C.	1.500	3.862	4.708
Title: Platform Power Integration and Control ***Description:*** Investigate, research, and evaluate power stage and control circuit technologies for implementation of high-power density, high efficiency power converters for hybrid platform propulsion power generation and power distribution for new platforms and platform modernization efforts. ***FY 2010 Accomplishments:*** Validated gate control circuitry for high-temperature (100 C coolant) operation. ***FY 2011 Plans:***	0.446	1.482	3.628

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Conduct experiments with high-temperature, high power density 100 kW battery-to-bus converter. ***FY 2012 Plans:*** Will research control techniques and the use of advance passive devices to provide <60kW high-temperature (110 C) converters; and will investigate advanced power conversion techniques for directed energy applications.			
Title: Power Switching for Protective Systems ***Description:*** Investigate, research, and evaluate technologies relating to compact, high-power, high-efficiency pulse power for electronic survivability applications such as electromagnetic (EM) Armor, advance EM Armor, and Electronic Protection Systems. Such technologies include storage capacitors, direct current (DC-DC) converters, and high rate-of-current-rise pulse switches. ***FY 2010 Accomplishments:*** Evaluated fast rise storage capacitors at 1.5 joules/cubic centimeter (J/cc) and SiC pulse switch die at 3 kiloampere (kA) with fast rate-of-current-rise. ***FY 2011 Plans:*** Investigate component technology that can be implemented into a compact high-efficiency DC-DC pulse converter and SiC pulse switch die at 4.5 kA with fast rate-of-current-rise for powering a distributed EM Armor system. ***FY 2012 Plans:*** Will investigate SiC pulse switch die at 6 kA with fast rate-of-current-rise; and will experimentally validate a compact power converter for self-contained battery module concept that allows advanced high power systems to be used on current force and next generation vehicles.	0.626	1.649	1.225
Accomplishments/Planned Programs Subtotals	8.599	13.631	15.402

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT H11: *Tactical and Component Power Technology*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H11: *Tactical and Component Power Technology*	12.508	11.988	11.395	-	11.395	11.016	11.571	11.411	10.485	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project identifies, advances, and enhances emerging power generation, energy storage, and power management technologies. This project funds research 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. This project also researches power sources that are smaller and more fuel-efficient, advanced cooling systems that enable tactical sustainability and survivability, and investigates novel power management methods through low power design tools and operating system dynamic power management software.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research, Development and Engineering Command, Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Monmouth, NJ and Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Soldier Hybrid Power and Smart Chargers	8.937	7.736	7.257
Description: This effort develops and validates hybrid power sources, rapid battery chargers, and power management technologies in order to decrease Soldier load, increase power capabilities, and decrease battery sizes and costs. ***FY 2010 Accomplishments:*** Developed advanced fabrication processes that enabled the reproduction of lithium air (Li/Air) battery cells in larger scale batches suitable for production, and conducted experiments in a laboratory environment on a lithium air battery in packaged form having greater than 400 watt hours per kilogram (Wh/kg); developed a 25W hybrid power source at greater than 400 Wh/kg; conducted experiments on a micro-electro mechanical system-based burner and integrated it with a thermal electric engine for a portable power source functioning in a laboratory environment. ***FY 2011 Plans:*** Develop processes and materials required for an integrated safe Li/Air battery; evaluate a disposable Soldier battery (Li/Air) at 800 Wh/kg in a relevant environment; experiment with a 150-300W portable squad power source/charger weighing 25 lbs, and a 50-100W hybrid power source weighing 3.5 lbs at 1000 Wh/kg. ***FY 2012 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT H11: *Tactical and Component Power Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will develop a lower cost membrane for protected lithium anode portion of lithium air battery; will optimize solid electrolyte membrane to prevent lithium metal corrosion; will investigate and develop lower cost processes capable of high volume manufacturing of Li/Air battery; will experiment with packaged battery having >800 Wh/kg energy density; will validate safety characteristics of disposable Soldier battery (Li/Air); will experiment with disposable Soldier battery (Li/Air) in an operational environment; will assess balance of plant (controls, fans, heat transfer coatings, etc.) that will help improve efficiency for portable squad power source/charger and reduce weight of hybrid power source; will experiment with hybrid power source in a relevant environment.			
Title: Silent Mobile Power ***Description:*** This effort investigates component and system level power technologies that provide higher energy, reduced weight, quieter, and more fuel and cost efficient power generation sources to support the full spectrum of C4ISR power consumers. Products are silent mobile power technologies for waste-heat recovery systems, transitional power sources in the 500W-2kW range, and towable 100 kW generator sets. ***FY 2010 Accomplishments:*** Experimented in a laboratory environment with a waste-heat recovery system and a 500W transitional power source. ***FY 2011 Plans:*** Experiment with a high mobility multipurpose wheeled vehicle towable 100 kilowatt power unit in a relevant environment; experiment with a waste-heat recovery system in a relevant environment. ***FY 2012 Plans:*** Will conduct studies to identify emerging nanomaterials for applications to power electronics and fuel processing subsystems for 250W to 2 kW applications; will advance and incorporate a new generation of materials (like catalysts for processing JP-8 for use in gasoline engines, ceramic nanocoatings applied to key electromechanical components to enhance durability/life/power-output of current generator sets, and nanotubes applied to develop thermoelectric materials with high electrical but low thermal conductivity) to augment performance of emerging and military power systems in the less than 2 kW range.	3.571	4.252	4.138
Accomplishments/Planned Programs Subtotals	12.508	11.988	11.395

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	**PROJECT** H11: *Tactical and Component Power Technology*

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT H17: *FLEXIBLE DISPLAY CENTER*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H17: *FLEXIBLE DISPLAY CENTER*	6.737	6.974	7.508	-	7.508	7.633	7.944	8.224	8.349	Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this project is to conduct and support applied research at the Army's Flexible Display Center (FDC) at the Arizona State University. The FDC conducts applied research on flexible display technologies that would make them inherently rugged (no glass), light weight, conformal, potentially low cost, and low power. The resultant display technology would enable enhanced and new capabilities across a broad spectrum of Army applications. Work in the FDC is performed collaboratively with the Army Research Development and Engineering Centers (RDECs) that include; the Natick Soldier RDEC(NSRDEC), Tank Automotive RDEC (TARDEC), Communications-Electronics RDEC (CERDEC), Armament RDEC (ARDEC), and Aviation and Missile RDEC (AMRDEC).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is executed by the Army Research Laboratory (ARL), Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Flexible Display Center (FDC) ***Description:*** The Flexible Display Center (FDC) is developing high resolution flexible reflective (electrophoretic) and emissive (organic light emitting diodes) displays. ***FY 2010 Accomplishments:*** The FDC continued full color designs and implemented color versions of flexible displays up to 6 inch diagonal (reflective) and 4 inch diagonal (emissive). ***FY 2011 Plans:*** FDC optimizes color reflective displays for size and resolution, and is transitioning reflective displays up to 6-8 inch diagonal to PEO Soldier. ***FY 2012 Plans:*** The FDC will continue to integrate color reflective displays and transition displays to integration efforts to include further development of emissive displays with size and resolution optimized to fulfill needs and requirements.	4.970	5.031	5.345
Title: FlexTech Alliance (FTA) (formerly known as U.S. Displays Consortium)	1.767	1.943	2.163

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT H17: *FLEXIBLE DISPLAY CENTER*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: Flexible display partnerships funded through the FTA for tools, process, and materials development that directly support the FDC. ***FY 2010 Accomplishments:*** Investigated the integrated programs and identified new technology gaps for flexible displays. In addition, programs were developed to support emerging display technologies, such as higher performing thin film transistors for emissive displays, processes to enable flexible color filters and related integration; flexible display partnerships were reviewed and modified to ensure state-of-the-art tools, materials development and materials processes that directly support the goals of the FDC. ***FY 2011 Plans:*** FTA conducts flexible electronics development to enable emissive displays. The FTA continues supporting the development for emerging needs in state-of-the-art tools, materials development and materials processes that directly support the goals of the FDC. ***FY 2012 Plans:*** The FTA will continue to support the goals of the FDC and have direct impact on the development of reflective and emissive displays that will transition into a number of ongoing efforts; in addition, toolsets developing efforts necessary for further display and flexible electronics development will be supported.			
Accomplishments/Planned Programs Subtotals	6.737	6.974	7.508

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT H94: *ELEC & ELECTRONIC DEV*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H94: *ELEC & ELECTRONIC DEV*	27.251	28.266	28.657	-	28.657	29.316	29.438	29.878	30.373	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

The objective of this project is to conduct applied research on 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. Areas of investigation include: low noise clocks and oscillators; lasers and focal plane arrays for eye-safe laser radar and standoff target acquisition sensors like forward-looking infrared; 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; and novel structures on new electronic materials for oscillator and opto-electronic applications. This research enables enhanced battlefield situational awareness; increased vehicle mobility, survivability, and lethality; reduced acquisition cost; and reduced operations and support costs.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Army Research Laboratory (ARL), Adelphi, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Antennas	1.743	1.774	3.473
Description: Design and develop 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 designs. Among the issues addressed in this antenna development are scanning techniques, broadbanding, beamforming, polarization, platform integration, and affordability.			
FY 2010 Accomplishments: Developed and assessed novel platform based antenna designs.			
FY 2011 Plans: Validate in-situ antenna performance.			
FY 2012 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT H94: *ELEC & ELECTRONIC DEV*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will develop and fabricate new antenna material structures.			
Title: RF MEMS ***Description:*** 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 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. ***FY 2010 Accomplishments:*** Investigated beam steering using an integrated piezoelectric MEMS (PiezoMEMS) enabled wafer level antenna, investigated an integrated PiezoMEMS switchable filter combining both low voltage switches with high-Q filters. ***FY 2011 Plans:*** Investigate system-in-package solutions for combining active components with PiezoMEMS wafer level antenna, PiezoMEMS switchable filters, and broadband PiezoMEMS switch matrices. Investigate building blocks for mechanical microcontroller based on PiezoMEMS switch technology (i.e. registers, latches, and arithmetic logic units). ***FY 2012 Plans:*** Will determine cycle reliability in packaged PiezoMEMS switches targeting lifetime in excess of 1 Billion Cycles; will develop switch technologies with extremely low on state resistances (<0.5 Ohm); will develop switchable filter technology spanning low MHz to low GHz; and will investigate PiezoMEMS devices for operation near or above 100 GHz.	1.606	2.394	4.231
Title: Millimeter Wave Components ***Description:*** 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 monolithic microwave integrated circuits (MMICs), to achieve higher output power, power-added-efficiency, linearity, and dynamic range for increased operation and detection range. ***FY 2010 Accomplishments:*** Designed advanced mixed-signal RF integrated circuits (RFIC), and implemented models to investigate new materials and processes for high speed and high power electronic devices. ***FY 2011 Plans:***	7.251	6.499	3.701

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT H94: *ELEC & ELECTRONIC DEV*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Develop reduced chip-set, thermally optimized RF modules, and perform material and device measurements to correlate and validate device models for new materials and processes for high speed and high power electronic devices. ***FY 2012 Plans:*** Will design highly integrated silicon based technology for multi-channel, multi-function RFICs; will develop emerging III-V devices for heterogeneous integration of mm-wave to TeraHertz (THz) subsystems.			
Title: Imaging Laser Radar (LADAR) ***Description:*** Investigate eye-safe, scanned and scannerless three dimensional (3-D) LADAR for both long-range reconnaissance and short-range unmanned ground and air vehicle applications. Conduct studies on technologies for long-range non-cooperative biometric identification. Investigate optical limiter designs with promising nonlinear materials for passive protection of electro-optic (EO) vision systems from damage from laser threat devices. ***FY 2010 Accomplishments:*** Implemented broad-aperture fast opto-electronic shutters for optical sights, sensors, and Soldier vision; improved performance of liquid cell optical limiting materials and transitioned to Tank and Automotive Research, Development, and Engineering Center, as well as developed electro-optic characterization methods for thick poled electro-optic polymers; evaluated 3-D autonomous navigation LADAR integrated onto a small robotic platform (Packbot); and developed an optical augmentation laser-based sensor. ***FY 2011 Plans:*** Extend opto-electronic sensor protection effort to address jamming threats; ruggedize and harden autonomous navigation LADAR; and implement solid-state scannerless LADAR for unmanned ground applications. ***FY 2012 Plans:*** Will perform skin-based phenomenology measurements for development of long-range uncooperative biometrics identification; will integrate LADAR onto additional small-robotic platforms and perform relevant-environment experiments; and will experimentally validate multi-element electro-optic shutter array.	3.223	3.109	2.591
Title: Infrared (IR) Imaging ***Description:*** Investigate large area 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), Strained Layer Superlattices (SLS) and Corrugated Quantum Well Infrared Photodetector (C-QWIP) detector arrays for both the mid-wave infrared (MWIR) and long-wave infrared (LWIR) spectral region to significantly decrease the focal plane array cost. Design and fabricate arrays for higher operating temperature. ***FY 2010 Accomplishments:***	2.182	2.184	2.639

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT H94: *ELEC & ELECTRONIC DEV*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Determined tradeoffs between filter complexity to best exploit high intensity emissions associated with hostile fire via a visible optic sensor; and characterized higher operating temperature HgCdTe devices, evaluated dual color C-QWIPs and measured lifetime in SLS detectors. ***FY 2011 Plans:*** Implement an Electro-Optic (EO) based sensor solution to detect threat launches prior to threat arrival. Determine feasibility of integrating commercially available EO imagers into a threat warning and location sensor system. Integrate narrow band filters into EO imager optical path to enhance threat signal count. Evaluate large area dual color Focal Plane Arrays (FPAs) suitable for such applications as persistent surveillance and distributed aperture systems. ***FY 2012 Plans:*** Will experimentally validate an improvement in SLS minority carrier lifetimes and show progress toward achieving 2K x 2K quantum well infrared focal plane arrays.			
Title: Photonics ***Description:*** 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 Opto-electronic (OE) devices with electronics for optical fuze and IR scene projectors. ***FY 2010 Accomplishments:*** Evaluated hybrid recognition element/spectroscopy optical assay for hazardous chemical and/or energetics detection from previous down-selected evaluations; as well as investigated detectors for passive IR fuzing. ***FY 2011 Plans:*** Examine luminescence manipulation of hazardous materials using femto-second laser pulse-shaping excitation techniques; investigate Silicon photonic modulator devices for high bandwidth on-chip interconnects. ***FY 2012 Plans:*** Will investigate active and passive optical fuzes; will down-select laser pulse-shaping excitation scheme for further investigations of energetic materials detection; will down-select and develop photoacoustics method with most potential trace energetic detection using currently maturing infrared laser diodes sources; as well as will investigate construction of advanced peptide recognition elements using iterative process involving computational modeling coupled with experimental characterizations.	3.307	2.685	1.576
Title: MEMS ***Description:*** Investigate, design, and fabricate MEMS based components to improve power generation and micro-cooling technology for both the dismounted Soldier and future force systems.	2.072	1.570	3.190

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT H94: *ELEC & ELECTRONIC DEV*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: Developed miniature power converters using MEMS passive components. ***FY 2011 Plans:*** Validate low power atomizer integrated with heavy fuel combustors for portable power generators. ***FY 2012 Plans:*** Will mature a milliwatt scale battery to actuator power converter component for micro robotic system.			
Title: Prognostics and Diagnostics ***Description:*** 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. ***FY 2010 Accomplishments:*** Evaluated multi-mode algorithms for diagnostic extension of electronics. ***FY 2011 Plans:*** Design scheme for implementation on electronic subsystems. ***FY 2012 Plans:*** Will implement and conduct experiments of P&D on electronic system.	2.773	3.013	2.979
Title: Power and Energy ***Description:*** Investigate technology for advanced batteries, fuel reformers, and fuel cells to be used in hybrid power sources for future electromagnetic armor and smart munitions, Hybrid Electric Vehicle, and Soldier power applications. Investigate silicon carbide (SiC) power module technologies to enable compact high efficiency, high temperature (up to 150 C heat sink temperature) and high power density converters for motor drive and pulse power applications. ***FY 2010 Accomplishments:*** Investigated and developed high-temperature (80-100 C) SiC power modules for high-efficiency medium power conversion; investigated the stability of lithium cobalt phosphate (LiCoPO4) chemistries as a high voltage cathode material for Li ion batteries; incorporated new gas gettering agents into thermal batteries for munitions; investigated and implemented heat sources for thermal batteries, and explored higher energy materials for primary batteries; evaluated anion conducting membranes for fuel	3.094	5.038	4.277

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602705A: *ELECTRONICS AND ELECTRONIC DEVICES*	PROJECT H94: *ELEC & ELECTRONIC DEV*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
cell applications; and developed improved Gallium Nitride (GaN) substrates and diodes for high efficiency and high temperature electronics. ***FY 2011 Plans:*** Develop high temperature (100-110 C) SiC power modules for high-efficiency high density power conversion; develop higher rate cathodes for Li-ion chemistries; investigate and develop materials, components, and devices for thin film and conformal thermal batteries and advanced liquid reserve batteries. ***FY 2012 Plans:*** Will investigate high-temperature (110-120 C) high-frequency SiC power modules with integrated sense and gate drive for use in compact high-efficiency power conversion modules; will investigate stable high voltage anode, cathode and electrolyte components for Li ion batteries; will incorporate Si anode materials in Li ion cells; will develop improved alkaline fuel cell membranes; as well as will evaluate lifetime and rise time of thin film batteries.			
Accomplishments/Planned Programs Subtotals	27.251	28.266	28.657

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.