Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602303A: *MISSILE TECHNOLOGY*	PROJECT 223: *AERO-PROPULSION TECHNOLOGY*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
223: *AERO-PROPULSION TECHNOLOGY*	4.785	7.560	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Aero-Propulsion Technology.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	3.190	7.560	0.000	0.000	0.000
Mariah II Hypersonic Wind Tunnel Development Program: In FY09 this Congressional Interest Item supported development of a hypersonic wind tunnel capable of a full 60 seconds of operation at fully duplicated flight conditions. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2	1.595	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602303A: *MISSILE TECHNOLOGY*	PROJECT 223: *AERO-PROPULSION TECHNOLOGY*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
LENS XX Hypervelocity Ground Testing Development: In FY09, this Congressional Interest Item supported design, fabrication, and validation on an expansion tunnel for very high Mach number ground testing. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	4.785	7.560	0.000	0.000	0.000

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602303A: *MISSILE TECHNOLOGY*	PROJECT G04: *AIR DEFENSE TECHNOLOGIES (CA)*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
G04: *AIR DEFENSE TECHNOLOGIES (CA)*	2.552	10.425	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Air Defense Technologies.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.552	5.969	0.000	0.000	0.000
D-NET: Electrically Charged Mesh (ECM) Defense Net Troop Protection System: In FY09 this Congressional Interest Item supported development of a helicopter active protection system concept consisting of a lauchable net to intercept incoming threats and defeat via mechanical and/or electrical discharge *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2	0.000	2.069	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602303A: *MISSILE TECHNOLOGY*	PROJECT G04: *AIR DEFENSE TECHNOLOGIES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Portable Sensor for Toxic Gas Detection. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Swarms Defense System. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	2.387	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Accomplishments/Planned Programs Subtotals	2.552	10.425	0.000	0.000	0.000

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602303A: *MISSILE TECHNOLOGY*	PROJECT G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*	2.945	2.487	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Missile Technologies Initiatives applied research.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	0.782	0.000	0.000	0.000	0.000
Materials Applications Research Center: This Congressional Interest Item supported application of low cost and improved thermoplastic composites and metal casting to missiles. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2	0.583	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602303A: *MISSILE TECHNOLOGY*	PROJECT G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Center of Excellence in Integrated Sensor Systems (CEISS): This Congressional Interest Item supported the advancement of the state of knowledge in areas of sensor and data fusion, contextual detection and classification, future sensor systems and architectures for missile defense, and other homeland security applications. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Novel Lightweight Armor Material for Insensitive Munitions Protection of Tactical Missiles. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	0.000	2.487	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602303A: *MISSILE TECHNOLOGY*	PROJECT G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #4 Extreme Light Sources. University of Florida. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.580	0.000	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	2.945	2.487	0.000	0.000	0.000

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-2, PB 2011 Army RDT&E Budget Item Justification											DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602307A: *ADVANCED WEAPONS TECHNOLOGY*							
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**Base FY 2011 Estimate**	**OCO FY 2011 Estimate**	**Total FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	22.638	21.964	18.190	0.000	18.190	20.034	22.377	24.730	26.059	0	174.182
042: *HIGH ENERGY LASER TECHNOLOGY*	19.050	19.576	18.190	0.000	18.190	20.034	22.377	24.730	26.059	Continuing	Continuing
NA5: *Advanced Weapons Components (CA)*	3.588	2.388	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) investigates enabling technologies for High Energy Laser (HEL) weapons. The major efforts under this PE develop component technologies such as efficient, high energy, solid state laser designs and adaptive optics, and lethality / effectiveness measurements that enable better models and simulations for future HEL weapon designs. Project NA5 funds congressional special interest items. Work in this project is related to, and fully coordinated with, efforts in PE 0602890F (HEL Research) and PE 0603924F (HEL Advanced Technology Program), PE 0605605A (DOD High Energy Laser Systems Test Facility (HELSTF)), PE 0602120A (Sensors and Electronic Survivability), PE 0603004A (Weapons and Munitions Advanced Technology) Project L96, and to PE 0603005A (Combat Vehicle and Automotive Advanced Technology) Project 441. 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 U.S. Army Space and Missile Defense Command (SMDC), in Huntsville, AL, the U.S. Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC) in Huntsville, AL, and the High Energy Laser Systems Test Facility, at White Sands Missile Range, NM.

Exhibit R-2, PB 2011 Army RDT&E Budget Item Justification	DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602307A: *ADVANCED WEAPONS TECHNOLOGY*

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	23.187	19.678	20.690	0.000	20.690
Current President's Budget	22.638	21.964	18.190	0.000	18.190
Total Adjustments	-0.549	2.286	-2.500	0.000	-2.500
• Congressional General Reductions		-0.114			
• Congressional Directed Reductions					
• Congressional Rescissions		0.000			
• Congressional Adds		2.400			
• Congressional Directed Transfers					
• Reprogrammings	0.101	0.000			
• SBIR/STTR Transfer	-0.650	0.000			
• Adjustments to Budget Years	0.000	0.000	-2.500	0.000	-2.500

Change Summary Explanation

FY10 Congressionally directed increases. FY11 funding realigned to higher priority efforts.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602307A: *ADVANCED WEAPONS TECHNOLOGY*	PROJECT 042: *HIGH ENERGY LASER TECHNOLOGY*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
042: *HIGH ENERGY LASER TECHNOLOGY*	19.050	19.576	18.190	0.000	18.190	20.034	22.377	24.730	26.059	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates and develops advanced technologies for High Energy Laser (HEL) weapon systems to enable more efficient lasers with greater power output. This includes technologies to support development of alternate laser sources; precision optical pointing and tracking components; adaptive optics to overcome laser degradation due to atmospheric effects; and thermal management systems to remove excess heat. In addition, this effort conducts laser lethality testing and analysis against a variety of targets and investigates the impact of low-cost laser countermeasures. Solid State Laser (SSL) efforts continue to leverage other funds provided by the HEL Joint Technology Office (JTO), the Air Force, and the Navy to develop multiple technical approaches that reduce program risk and maintain competition. Work in this project is related to, and fully coordinated with, efforts in PE 0602890F (HEL Research) and PE 0603924F (HEL Advanced Technology Program), PE 0605605A (DOD High Energy Laser Systems Test Facility (HELSTF)), PE 0602120A (Sensors and Electronic Survivability), PE 0603004A (Weapons and Munitions Advanced Technology) Project L96, and to PE 0603005A (Combat Vehicle and Automotive Advanced Technology) Project 441. 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 U.S. Army Space and Missile Defense Command (SMDC), in Huntsville, AL, the U.S. Aviation and Missile Research, Development, and Engineering Center (AMRDEC) in Huntsville, AL, and the High Energy Laser Systems Test Facility (HELSTF), at White Sands Missile Range, NM.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	1.453	2.456	2.925	0.000	2.925
Solid State Laser (SSL) Effects: This effort provides the underlying data required to support system engineering designs for laser weapon systems. In FY09, continued assessing the effectiveness of SSLs against Rocket, Artillery, and Mortar (RAM) warheads and fuses and began expanding the program to emphasize targets other than RAM, such as Unmanned Aerial System (UAS) components, Man Portable Air Defense Systems (MANPADS), Anti-Tank Guided Missiles, and Rocket Propelled Grenades (RPGs). Used results to improve and validate the target vulnerability models for use in Army engagement simulation codes such as Extended Air Defense Simulation (EADSIM), Interactive Distributed Early Entry Analysis Simulation (IDEEAS), and other distributed interactive simulation tools. In FY10, conduct expanded full scale static SSL lethality testing					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602307A: *ADVANCED WEAPONS TECHNOLOGY*	PROJECT 042: *HIGH ENERGY LASER TECHNOLOGY*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
against RAM targets, UASs, and other high priority threats to determine the laser energy required to defeat them under various engagement ranges. In FY11, will determine SSL effectiveness against targets of interest in both static and dynamic test scenarios to assess a broad spectrum of mission applications and validate Modeling and Simulation (M&S) tools that support analysis of alternatives, HEL power levels, and associated ranges across multiple mission sets. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Solid State Laser (SSL) Development, Phase 3 - 100 kW: The goal of this Joint High Power Solid State Laser (JHPSSL) Phase 3 effort is to develop and demonstrate 100-kW-class, near-diffraction-limited diode-pumped solid-state lasers that have architectures favorable for tactical weapon applications. In FY09, leveraging joint and other Service funding:1) completed integration and performance testing of two 100 kW SSL devices; 2) selected the most promising laser and component technologies for use in the High Energy Laser Technology Demonstrator (HEL TD) risk reduction activities; 3) supported systems engineering of the selected SSL Phase 3 technology for use on the mobile HEL TD platform; and 4) began integration of one of the down-selected devices with an existing beam control subsystem (BCS) at HELSTF to evaluate high power SSL performance at tactical ranges of interest. In FY10, complete integration of the selected laser device with the existing BCS and begin evaluation	11.784	4.601	1.950	0.000	1.950

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602307A: *ADVANCED WEAPONS TECHNOLOGY*	PROJECT 042: *HIGH ENERGY LASER TECHNOLOGY*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
of high power SSL performance against a variety of target types at tactical ranges of interest as a risk reduction activity for the HEL TD. In FY11, a 100kW SSL will be integrated with the mobile HEL TD BCS to demonstrate potential mission applications, including Counter-RAM (CRAM), and explore performance of the HEL TD BCS. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Advanced Beam Control Component Development: This effort investigates technologies to enable lighter, more agile beam control systems that are robust enough to be used in Army ground platforms. This work is done in collaboration with the HEL JTO and other Services. In FY09, researched and demonstrated beam control components suitable for integration into an existing beam control system. This includes development and field testing of adaptive optics (AO) consisting of deformable mirrors (DMs) with high stroke and bandwidth to overcome ground-level atmospheric degradation. In FY10, design advanced architectures for beam control systems and develop component technologies that improve compactness, pointing accuracy, and agility of beam directors for improved compatibility with future all-electric tactical platforms. This includes AO to engage threats at longer ranges and low-absorbing HEL windows, shared aperture optics, and mirror coatings to minimize system losses. In FY11, will begin fabrication and assembly of advanced beam control components that can be integrated into the HEL TD beam control system, such as AO, to increase the effective range of the system.	4.844	4.991	2.620	0.000	2.620

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4 High Efficiency Laser Development: This effort develops component technologies that lead to increased SSL wall-plug efficiencies that greatly improve the ability to integrate SSL systems onto mobile Army weapon platforms. In FY09, initiated design of components, such as diode arrays, high throughput optical elements, and fiber optic/ceramic slab gain media, for developing high efficiency (greater than 30% wall-plug efficiency) SSLs. In FY10, in cooperation with the HEL JTO and other Services, continue to design and develop reliable electric laser component technologies that improve SSL efficiencies, such as improved gain media, pump power sources, optical elements, and diode arrays; and begin to explore thermal management technologies. In FY11, in continued partnership with the HEL JTO and other Services,: 1) will begin assembly and integration of two 25 kW high efficiency breadboards using alternative technical approaches; 2) will begin the design of a 100 kW class high efficiency device based on the most promising approach; 3) will initiate the development of multiple eye-safe laboratory demonstrations with greater than 30% efficiency; and 4) will continue to develop thermal management technologies specific to high efficiency lasers that minimize thermal distortions, alignment errors, and beam quality degradation.	0.969	6.558	9.720	0.000	9.720

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #5 HEL Research and Development Laboratory: This effort focuses on developing in-house expertise through SSL assessments. In FY10, in cooperation with the AMRDEC, conduct low-to-medium power studies on a 600-meter test range to investigate SSL atmospheric propagation and target interaction phenomenology. Initiate data analysis and model development to support atmospheric correction algorithm development and to provide validated inputs for wargaming modeling and simulation efforts. In FY11, will investigate new deformable mirror designs to identify those with lower cost and sufficient performance; will investigate causes of poor beam quality in SSLs to determine where investments can advance the technology for Army applications. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	0.489	0.975	0.000	0.975

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.481	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	19.050	19.576	18.190	0.000	18.190

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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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.

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COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
NA5: *Advanced Weapons Components (CA)*	3.588	2.388	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Advanced Weapons Components applied research.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	1.595	0.000	0.000	0.000	0.000
Army Missile and Space Technology Initiative: In FY09, completed an architecture study for an Intelligence, Surveillance, and Reconnaissance (ISR) test-bed aboard an airship and development of an associated payload utilizing previously developed sensors. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2	1.993	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Remote Video Weapon Sight, USSOCOM Phase III: In FY09, developed a weapon sight that provides video images to remote locations. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Integrated Family of Test Equipment V6 Product Improvement Program: This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	2.388	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Accomplishments/Planned Programs Subtotals	3.588	2.388	0.000	0.000	0.000

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-2, PB 2011 Army RDT&E Budget Item Justification											DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*							
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**Base FY 2011 Estimate**	**OCO FY 2011 Estimate**	**Total FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	18.205	27.330	20.582	0.000	20.582	18.128	18.481	18.814	21.135	0	163.257
C90: *Advanced Distributed Simulation*	10.867	11.405	14.503	0.000	14.503	11.931	12.168	12.390	14.607	Continuing	Continuing
D01: *PHOTONICS RESEARCH*	0.000	4.775	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
D02: *MODELING & SIMULATION FOR TRAINING AND DESIGN*	5.743	5.977	6.079	0.000	6.079	6.197	6.313	6.424	6.528	Continuing	Continuing
D14: *Advanced Modeling and Simulation Initiatives (CA)*	1.595	5.173	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Efforts in this program element (PE) design and develop enabling technologies to create effective training capabilities for the Warfighter. The PE supports the underpinning technologies and understanding to establish architecture standards and interfaces necessary for realizing the Army vision of creating a realistic synthetic "electronic battlefield" environment for use across the spectrum of doctrine, organization, training, leader development, materiel, personnel, and facilities (DOTLM-PF). The Advanced Distributed Simulation (project C90), focuses on advancing component technologies required for real time interactive linking within and among constructive, virtual, and live simulation and training by refining technologies for advanced distributed interactive simulation. The Modeling and Simulation for Training and Design (project D02), further develops concepts for immersive training and learning environments with the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. Photonics Research and Advanced Modeling and Simulation Initiatives (projects D01 and D14) fund congressional special interest items. Work in this PE is related to and fully coordinated with efforts in PE 0601104A (University and Industry Research Centers), PE 0602785 (Manpower/Personnel/Training Technology), PE 0602787A (Medical Technology), PE 0603007A (Manpower, Personnel and Training Advance Technology), and PE 0603015A (Next Generation Training & Simulation Systems). 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 PE is performed by the Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

Exhibit R-2, PB 2011 Army RDT&E Budget Item Justification	DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	21.778	17.473	17.753	0.000	17.753
Current President's Budget	18.205	27.330	20.582	0.000	20.582
Total Adjustments	-3.573	9.857	2.829	0.000	2.829
• Congressional General Reductions		-0.143			
• Congressional Directed Reductions					
• Congressional Rescissions		0.000			
• Congressional Adds		10.000			
• Congressional Directed Transfers					
• Reprogrammings	-3.056	0.000			
• SBIR/STTR Transfer	-0.517	0.000			
• Adjustments to Budget Years	0.000	0.000	2.829	0.000	2.829

Change Summary Explanation

FY09 funding decrease is due to reprogramming of congressional interest item for proper execution.FY10 Congressionally directed increases.FY11 funding increases for Distributive Training technology efforts.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT C90: *Advanced Distributed Simulation*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
C90: *Advanced Distributed Simulation*	10.867	11.405	14.503	0.000	14.503	11.931	12.168	12.390	14.607	Continuing	Continuing

A. Mission Description and Budget Item Justification

Efforts in this project develop enabling technologies for advancing distributed interactive simulation in synthetic environments such as networking of models, complex data interchange, and collaborative training. The project researches and develops the ability to create a virtual representation of combined arms environments with the Warfighter-in-the-loop that constructive (event driven) simulation cannot provide. The efforts in this project leverage and are coordinated with work at the Army Research Institute, the Army Research Laboratory, and the Medical Research Materiel Command. 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 Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	4.711	3.130	3.716	0.000	3.716
Live, Virtual, Constructive (LVC) Simulations: This effort investigates the combination of Live, Virtual and Constructive (LVC) training technologies into a seamless event. Live training refers to personnel and systems performing an exercise mission; virtual training refers to personnel using simulators; and constructive training refers to computer-aided simulations that introduce a wider control of virtual forces. Developed methods and technologies are transitioned to PE 0603015A/project S29. In FY09, developed physics-based real-time dynamic situations for LVC training to provide realistic environments (lethality, causality assessment, mobility, etc.) by integrating live sensor components to enable live training and a virtual/constructive mission rehearsal capability onto both Soldier and combat vehicle embedded training devices; conducted laboratory experiments in an operational environment with an embedded training device to develop display technology for combat vehicle embedded training. In FY10, investigate use of predictive technologies and artificial intelligence in constructive training to provide behaviors and reasoning for computer-generated forces in asymmetric warfare simulations; continue technology improvements of sensor components for physics-based real-time dynamic environments for LVC training. In FY11, will continue investigations in predictive technologies for behaviors and reasoning of					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT C90: *Advanced Distributed Simulation*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
computer generated forces; will complete development of real-time physics-based rendering of asymmetric forces in urban environments to support asymmetric warfare simulations in embedded training for LVC training. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Modeling and Simulation Training Technologies: This effort investigates and evaluates military medical training technologies and their effectiveness. The effort also conducts applied research to develop training technologies and techniques for Soldiers with unmanned systems. In FY09, conducted tests with patient trauma demonstrators to assess Army medical training effectiveness; designed and developed a mobile immersive training environment that included the appropriate combination of man-worn systems, locomotion systems, intelligent tutors, human computer interfaces, and the ability to control autonomous systems for team training. In FY10, investigate methods and technologies to increase medical simulation capabilities for surgical training to include initial designs for a surgical simulator; develop simulations to support the safe operations of unmanned systems in complex environments. In FY11, will investigate methods and technologies to emulate live tissue replacement and conduct experiments to assess training effectiveness; will initiate structured research and conduct testing with medical holograms and virtual patients; will develop low-cost, rugged man-worn immersive systems for dismounted soldier training as well as tracking systems and hand-held devices to support dismounted training exercises.	3.903	3.887	3.969	0.000	3.969

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT C90: *Advanced Distributed Simulation*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Collaborative and Immersive Environment Technologies: This effort investigates adaptive learning environments with social simulations to conduct non-kinetic asymmetric warfare training. In FY09, conducted experiments utilizing game-based technologies to evaluate training methods and mission planning/rehearsal tools in a Joint, Interagency, Intergovernmental, Multi-National (JIIM) simulation environment; expanded multi-sensory capabilities in adaptive learning environments to enable virtual human and intelligent decision components to incorporate awareness of trainee actions; expanded training development tools to rapidly portray additional representative cultures; and expanded non-kinetic simulation capability to squad/team level for training. In FY10, continue development of JIIM environment for squad team level training using distributed simulations and after action reviews; develop immersive environments to support infantry training and mission rehearsal; investigate the algorithms and methodologies to enhance the realism of simulation environments for battle command training and decision making. In FY11, will continue development of infantry immersive simulation and learning environments to include intelligent tutoring feedback; will develop the enhanced realism of simulation environment to support the battle command training and decision making; will validate algorithms and methodologies through user assessments; will investigate and develop virtual world and gaming technologies	2.253	4.158	6.818	0.000	6.818

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT C90: *Advanced Distributed Simulation*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
to accomplish multi-player, large scale, distributed training and learning; will evaluate the technologies and the impact on human performance. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.230	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT C90: *Advanced Distributed Simulation*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Accomplishments/Planned Programs Subtotals	10.867	11.405	14.503	0.000	14.503

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT D01: *PHOTONICS RESEARCH*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
D01: *PHOTONICS RESEARCH*	0.000	4.775	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for applied research in Photonics.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	0.000	4.775	0.000	0.000	0.000
Compact Biothreat Rapid Analysis Concept. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	0.000	4.775	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT D01: *PHOTONICS RESEARCH*

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT D02: *MODELING & SIMULATION FOR TRAINING AND DESIGN*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
D02: *MODELING & SIMULATION FOR TRAINING AND DESIGN*	5.743	5.977	6.079	0.000	6.079	6.197	6.313	6.424	6.528	Continuing	Continuing

A. Mission Description and Budget Item Justification

Efforts in this project develop training applications that enable the Army to train any time and any place. Efforts include designing virtual humans that embody natural language, speech recognition in noisy environments, gesture, gaze, and conversational speech and then assess techniques and methods for integrating different sensory cues into virtual environments that result in enhanced training and leader development. The project leverages the capabilities of industry and the research and development community through the synthesis of creativity and technology including work at the Army Research Institute and the Army Research Laboratory. 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 Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.700	2.710	2.916	0.000	2.916
Immersive Technology Environments: This effort performs research and develops technologies that enable responsive and reconfigurable simulations that immerse human senses such as sight, sound, and touch in mixed reality environments (consist of physical elements you can touch and feel (such as walls and obstacles) combined with virtual imagery). Developed technologies and techniques are transitioned for maturation and demonstration to PE 0603015A/project S28. In FY09, created a mixed-reality immersive environment that uses sensors to provide near real-time perspective of the surrounding real world allowing a user and the world model to share a common view of the environment for high fidelity training environments; designed and developed new and flexible display technologies for development of new training environments. In FY10, design and develop approaches for rapidly inserting virtual content into large-scale, real-world training environments that can be rapidly reconfigured. In FY11, will investigate technologies to make mixed reality training (combines real and imagined images) environments more portable and affordable.					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT D02: *MODELING & SIMULATION FOR TRAINING AND DESIGN*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Immersive Technology Techniques: This effort develops tools, techniques and technologies for improving the immersion of human senses within simulation environments, creating enhanced realism. In FY09, explored techniques for developing distributed asymmetric warfare tutoring and coaching methods to support team training, performance assessment, and team after-action reviews; and investigated/developed methods and technologies to expand single student tutoring capabilities to distributed multi-student team assessments and after action reviews. In FY10, develop software tools for rapidly creating automated tutoring systems that can be tailored to multiple training applications/needs and support team training, performance assessment, and team after-action reviews. In FY11, will investigate and develop technologies and techniques to implement high-quality video and interactive experiences on mobile hand-held devices; will evaluate developed research technologies and components for supporting interactive learning. *FY 2009 Accomplishments:* FY 2009	3.043	3.100	3.163	0.000	3.163

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT D02: *MODELING & SIMULATION FOR TRAINING AND DESIGN*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.167	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	5.743	5.977	6.079	0.000	6.079

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT D02: *MODELING & SIMULATION FOR TRAINING AND DESIGN*

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT D14: *Advanced Modeling and Simulation Initiatives (CA)*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
D14: *Advanced Modeling and Simulation Initiatives (CA)*	1.595	5.173	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for applied research in Advanced Modeling and Simulation.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	1.595	2.785	0.000	0.000	0.000
Advanced Live, Virtual and Constructive (LWC) Training Systems. In FY09, evaluated different algorithms for geometric pairing using a cave environment and the use of intelligent tutoring to accelerate the scenario generation for live, virtual and constructive experimentation. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2	0.000	0.796	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT D14: *Advanced Modeling and Simulation Initiatives (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Protective Gear Development through Man-In-Stimulant-Test Chamber. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Cognitive Based Modeling and Simulation for Tactical Decision Support. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	1.592	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602308A: *Advanced Concepts and Simulation*	PROJECT D14: *Advanced Modeling and Simulation Initiatives (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Accomplishments/Planned Programs Subtotals	1.595	5.173	0.000	0.000	0.000

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-2, PB 2011 Army RDT&E Budget Item Justification											DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*							
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**Base FY 2011 Estimate**	**OCO FY 2011 Estimate**	**Total FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	84.436	78.923	64.740	0.000	64.740	62.571	67.212	71.936	79.652	0	574.210
C05: *ARMOR APPLIED RESEARCH*	15.050	19.698	25.660	0.000	25.660	23.379	25.120	27.030	30.921	Continuing	Continuing
H77: *National Automotive Center*	14.002	14.465	16.515	0.000	16.515	15.144	15.489	15.785	16.082	Continuing	Continuing
H91: *Ground Vehicle Technology*	25.382	21.482	22.565	0.000	22.565	24.048	26.603	29.121	32.649	Continuing	Continuing
T26: *Ground Vehicle Technologies (CA)*	26.812	21.687	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
T31: *NAT'L AUTO CENTER APP RES INIT (CA)*	3.190	1.591	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) researches and develops automotive technologies that enable Army transformation. The PE supports the research and development of components and subsystems for ground combat/tactical vehicles in the areas of survivability (project C05), advanced automotive technology (project H77), and tank and automotive technology (project H91). Projects T26 and T31 fund congressional special interest items. Work in this PE is related to, and fully coordinated with, PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0602618A (Ballistics Technology, Robotics Technology, 0602105A (Materials Technology), and PE 0602705A (Electronics and Electronic Devices). Work in this PE is coordinated with the U.S. Marine Corps , the Naval Surface Warfare Center, and other ground vehicle developers within the Defense Advanced Research Projects Agency (DARPA) and the Departments of Energy, Commerce, and Transportation. 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 PE is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI.

Exhibit R-2, PB 2011 Army RDT&E Budget Item Justification	DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602601A: *Combat Vehicle and Automotive Technology*

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	89.036	55.937	62.831	0.000	62.831
Current President's Budget	84.436	78.923	64.740	0.000	64.740
Total Adjustments	-4.600	22.986	1.909	0.000	1.909
• Congressional General Reductions		-0.414			
• Congressional Directed Reductions					
• Congressional Rescissions		0.000			
• Congressional Adds		23.400			
• Congressional Directed Transfers					
• Reprogrammings	-3.031	0.000			
• SBIR/STTR Transfer	-1.569	0.000			
• Adjustments to Budget Years	0.000	0.000	1.909	0.000	1.909

Change Summary Explanation

FY10 Congressional directed increases.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT C05: *ARMOR APPLIED RESEARCH*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
C05: *ARMOR APPLIED RESEARCH*	15.050	19.698	25.660	0.000	25.660	23.379	25.120	27.030	30.921	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates, designs, and evaluates advanced armor concepts, ballistic defeat mechanisms, and armor packaging concepts to achieve lightweight, ballistically-superior armors/structures for combat and tactical vehicles. Armors are being investigated to meet anticipated ground combat and tactical vehicle survivability objectives. Additionally, this project focuses on analysis, modeling, and characterization of potential survivability solutions that could protect against existing and emerging threats. This analysis is used to aid in the down select of technologies entering maturation and development in PE 0603005A/project 221. 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 Tank Automotive Research, Development, and Engineering Center (TARDEC) Warren, MI and is fully coordinated with work at the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	8.916	9.703	10.881	0.000	10.881
Vehicle Armor Protection for Lightweight Combat Systems: This effort designs, fabricates, and investigates add-on lightweight armor packages to protect combat systems against projectiles, warheads, penetrators and blast fragments. In FY09, developed enhancements to ground vehicle armor and third generation mine kits to reduce weight and meet objective and emerging threats; conducted and reported armor space and weight trade studies to support design of next generation add-on armor solutions; assessed blast modeling and simulation tool(s) capability for full level simulation, including impact on crew; and performed material and hull design attachment analysis and developed non-destructive inspection techniques. In FY10, perform initial testing of ground vehicle armor and third generation mine kits to meet emerging threats; analyze and evaluate material/recipes performance for various armor/mine protection areas; and provide initial characterization of next generation armor materials to identify risks for maturation; and mature improved ballistic performance armor with embedded health monitoring. In FY11, will perform armor recipe optimization to establish armor efficiency; will complete ballistic testing of selected armor systems to validate the armor design; will downselect materials/armor systems for entire vehicle protection and procure long lead items for future demonstration builds; and will mature and validate performance					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT C05: *ARMOR APPLIED RESEARCH*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
of multifunctional armor. This work is done in conjunction with program elements 0602105A, 0602618A, and 0603005A. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Armor for Tactical Vehicle Survivability: The objective of this effort is to develop structural and add-on armors for tactical vehicles and investigate and characterize effects of mine blasts on lightweight vehicles through modeling and simulation. In FY09, conducted final armor assessments of potential candidates such as Reliability, Availability, Maintainability (RAM) analysis, and thermal modeling for maturation and transition using demonstration vehicles; integrated test bed to assess the survivability suite by conducting analysis of the operational effectiveness modeling. Conducted electrical bench tests to study electrical integration impacts such as electromagnetic (EM) compatibility and interference caused by integration of survivability suite(s) onto vehicles. *FY 2009 Accomplishments:* FY 2009	0.631	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT C05: *ARMOR APPLIED RESEARCH*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Advanced Armor Development: The objective of this effort is to investigate advanced armors for combat and tactical vehicle applications to defeat single and multiple chemical and kinetic energy (CE and KE) emerging threats. In FY09, assessed reactive armor and electromagnetic armor concepts developed under PE 0602618/ Project H80 for defeat of emerging CE and KE threats. Investigated tools and techniques for non destructive evaluation (NDE)/non destructive inspection (NDI) of dissimilar composite armor material joints. Assessed and validated modeling and simulation tools for vehicle level analysis of combat vehicles in collisions and blast threats. In FY10, continue investigation and maturation of candidate reactive and passive armor concepts for single emerging threat(s) (KE) and downselect solutions for maturation with respect to capability, weight, and ease of integration. In FY11, will validate advanced armor designs at the panel level while reducing armor weight; will improve armor recipe to meet threshold areal density while defeating threshold threat. This work is done in conjunction with program elements 0602105A, 0602618A and 0603005A. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	5.503	4.583	8.772	0.000	8.772

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT C05: *ARMOR APPLIED RESEARCH*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4 Blast Mitigation: This effort matures modeling and simulation (M&S) tools and blast mitigation technologies to improve ground vehicle structural performance against blast threats. Tests are conducted to validate the M&S tools. In FY10, develop advanced crew protection technologies for land mine/explosive events; investigate potential techniques for 3-dimensional vehicle models and crew protection methods for land mine/explosive events; validate survivability enhancements of integral fuel tanks against objective threats; begin development of external fire suppression methods to address fuel, track, and stowage fire vulnerabilities for combat vehicles; and improve blast tolerance of automatic fire extinguishing systems. In FY11, will develop techniques for complete vehicle structure design and crew protection methods for landmine/explosive events; will investigate performance and integration of extinguishing mechanisms; will enhance fire M&S tools to incorporate new extinguishing agents, delivery systems, and predictive capabilities for ballistic events; and will increase cook-off resistance of small arms ammunition via improved stowage without compromising accessibility. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	0.000	4.861	6.007	0.000	6.007

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT C05: *ARMOR APPLIED RESEARCH*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #5 Small Business Innovative Research/Small Business Technology Transfer Programs. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.551	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	15.050	19.698	25.660	0.000	25.660

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT H77: *National Automotive Center*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H77: *National Automotive Center*	14.002	14.465	16.515	0.000	16.515	15.144	15.489	15.785	16.082	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project researches and develops automotive component technologies to meet ground combat and tactical vehicle objectives. The project funds the National Automotive Center (NAC), which conducts shared government and industry technology programs to leverage commercial investments in automotive technology research and development for Army ground combat and tactical vehicle applications. 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 Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, Michigan and is coordinated with PE 0602705A (Electronics and Electronic Devices).

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #2	8.401	8.494	8.859	0.000	8.859
Alternative Energy: This effort leverages opportunities from industry to develop alternative energy technologies for Army applications. In FY09, investigated thermoelectric power modules on Tactical Wheeled Vehicle (TWV) platforms; continued to conduct experiments for alternative fuels qualification program for ground vehicle systems; expanded mobile micro-grid technology development program with large scale technology experiments; evaluated dual-use advanced automotive technologies on ultra-light, light, medium, and heavy tactical vehicles. Leveraged developments in 3D terrain topology modeling and verification of vehicle design tools in support of a distributed simulation capability. In FY10, investigate waste to energy technologies for application in power generation devices; pursue dual-use power and energy component development; investigate vehicle platform with high output power capabilities tied to power grid and the modeling tools needed to understand this interaction; expand development and commercialization of dual-use simulation-based tools that incorporate 3D terrain topology modeling for validation and verification of vehicle designs; and design and develop an energy storage system on hybrid electric vehicles for forward operations applications utilizing renewable energy sources and/or generator set(s).In FY11, will continue development of waste to energy technologies to reduce fuel consumption in power generation; will continue to conduct experiments with synthetic and renewable fuel blends for alternative					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT H77: *National Automotive Center*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
fuels qualification program for ground vehicle systems; will expand development and commercialization of dual-use Modeling and Simulation (M&S) tools by conducting high-density hybrid engine modeling and vehicle thermal management modeling. This work is done in conjunction with program element 0602705A. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Conditioned Based Maintenance (CBM) and Intelligent Systems: This effort advances condition based maintenance and intelligent systems technologies for dual use applications, including the investigation of commercial hybrid electric non-tactical vehicles on military bases to gather performance, reliability and maintainability data. In FY09, continued crash modeling and safety design for TWV's; developed and evaluated dual-use condition-based maintenance/intelligent systems M&S tools. Investigated new data collection and analysis methods for ground vehicles as systems of systems with an emphasis on robustness and focusing on creation of comprehensive vehicle CBM M&S tools. In FY10, continue to develop and evaluate dual-use CBM tools by conducting lithium-ion and lead acid battery characterization experiments and thermo electric power unit studies. In FY11, will expand development and investigation of dual-use CBM tools by developing battery prognostics and diagnostics M&S tools, as well as investigating on-board vehicle health awareness tools	2.100	2.170	2.212	0.000	2.212

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT H77: *National Automotive Center*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4 Power, Energy and Mobility: This effort investigates dual use power, energy, and mobility technologies. In FY09, conducted detailed technology investigation of fuel cell Auxiliary Power Unit (APU); conducted military specification comparison of micro-grid hardware and software; expanded energy capacity range of mobile micro-grid power control module; pursued dual-use power and energy component development including motor and generator concepts; and developed a vehicle platform with high output power capabilities tied to power grid with new vehicle based output controller strategy. Expanded development and commercialization of high-density diesel engine and vehicle thermal management Modeling & Simulation (M&S) tools and investigated new energy conversion options and propulsion system architectures. In FY10, investigate performance capabilities of commercially available technologies applied to military ground vehicle platforms in suspension, torque vectoring differentials, batteries, brakes, electrical subsystems, and alternative chassis structures; develop hybrid electric vehicle requirements and software integration to facilitate the design and development of a communication system between vehicle and the power control using intelligent software; and continue M&S efforts by modeling advanced diesel and hybrid powertrains by developing predictive M&S tools and validating methodologies. In FY11, will develop dual-use automotive subsystems and components that can be modified for application to military platforms and alternative chassis structures; will pursue power and energy component development;	3.501	3.616	3.690	0.000	3.690

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
will design high-yield renewable energy generation technology architecture and prepare distributed generation transition criteria for PM Mobile Electric Power, and will expand development of methodologies to validate and explore true potential of proposed advanced engine technologies. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #5 Joint Recovery and Distribution System (JRaDS): In FY11, funding for DoD Joint Recovery and Distribution System (JRaDS) Joint Capability Technology Demonstration (JCTD) will reduce risk by enabling the purchase of additional prototype trailer systems and support the broader scoped Operational Military Utility Assessment. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	0.000	1.754	0.000	1.754

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 Small Business Innovative Research/Small Business Technology Transfer Programs. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.185	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	14.002	14.465	16.515	0.000	16.515

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT H91: *Ground Vehicle Technology*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H91: *Ground Vehicle Technology*	25.382	21.482	22.565	0.000	22.565	24.048	26.603	29.121	32.649	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project designs, develops, and evaluates a variety of innovative and enabling technologies in the areas of vehicle concepts, virtual prototyping, power, thermal management, propulsion, mobility, survivability, vehicle diagnostics, fuels, lubricants, water purification, intelligent systems, and other component technologies for application to combat and tactical vehicles. 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 Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, Michigan. Efforts in this project are closely coordinated with the Army Research Laboratory (ARL), the Defense Advanced Research Projects Agency (DARPA), the U.S. Army Engineer Research, Development, and Engineering Center, Edgewood Chemical Biological Center, and the Army Medical Department.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	3.276	6.549	6.123	0.000	6.123
Pulse Power: This effort focuses on developing technology for compact, high frequency/high energy/high power density components and devices, which are enablers for several advanced electric-based weapon systems. In FY09, evaluated pulse switches, power converters, power and energy storage, and evaluated Si-based Super Gate Turn-Off (SGTO) versus SiC-based thyristors for capability to meet power density and switching speeds required for directed energy weapons. In FY10, design and develop improved gate and bus structure design for high power applications; design and develop SGTO switch technology using SiC for high power applications. In FY11, will investigate full up Si and SiC based SGTO applications such as high power microwaves, electrified armors, and directed energy weapons applications.					
FY 2009 Accomplishments: FY 2009					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 JP-8 Reformation for Military Fuel Cells: This effort investigates JP-8 reformer and desulfurization technologies so that JP-8 may be utilized as a fuel source for fuel cells used in future military vehicle power applications. In FY09, completed integration of fuel reformer for JP-8; conducted endurance and environmental experiments on a JP-8 reformer connected to fuel cell to produce power suitable for auxiliary and light robotic platform propulsion requirements. In FY10, begin tracking sulfur handling capacity and operational temperatures of JP-8 reformer, desulfurization devices, and fuel cell system; and begin design and development on all major reformer fuel cell system components to determine functionality within the claim space limitations. In FY11, will begin maturing major JP-8 reforming fuel cell system components performance and interoperability; will design and develop balance of components for the JP-8 reforming fuel cell system and ensure program specifications meet user capability requirements. This effort is done in coordination with efforts in 0603005A. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	2.404	2.065	2.104	0.000	2.104

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Propulsion-Prime Power: The goal of this effort is to design and develop engines and generators and their components with significantly improved performance characteristics, efficiencies, and power densities. In FY09, matured hybrid electric power components for tactical wheeled vehicles; optimized control strategy for higher system power density engine design. In FY10, investigate the performance of modified commercial diesel engines with a control strategy to enable JP-8 fuel operation; and assess compact, high power density hybrid electric components performance. In FY11, will complete common rail fuel pump development and conduct durability experiments with JP-8; will complete the design and fabrication of closed-loop fuel injection system; will conduct initial fuel injection system performance tests; will begin advanced drivetrain efficiency design and development; and will advance powertrain noise abatement technology development. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	2.032	2.018	1.834	0.000	1.834

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #4	4.384	2.605	0.000	0.000	0.000
Non-primary Power System (NPS): This effort investigates component technologies for energy storage and generation. In FY09, investigated strategy combining energy storage and power generation components into a non-primary power system.In FY10, develop system controls for advanced power and energy system demonstrator; investigate strategies to reduce non-primary power generation system exhaust noise; and develop techniques to mitigate safety challenges for advanced energy storage devices on vehicles. This effort is done in coordination with efforts in 0603005A. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #5	4.507	3.094	6.295	0.000	6.295
Power & Thermal Management: This effort investigates power and thermal management components, including traction motors, inverters, dc-dc converters, new motor and generator concepts and control strategies to meet objective power requirements.In FY09, developed, verified, and validated power and thermal management models and simulations; designed and developed intelligent power and thermal components; and generated test and evaluation methods for intelligent power and thermal management. In FY10, develop combined power and thermal management system level architecture from modeling and simulation toolset; design and develop integrated electronic power and thermal management device/component level technology; and investigate					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
advanced intelligent (learning and adaptive) power management control algorithms using artificial intelligence techniques.In FY11, will develop advanced intelligent (learning and adaptive) control architecture to control multiple vehicular power sources and loads; will initiate development of reliable, cost effective, high temperature power electronic components to reduce system cooling burden. This effort is done in coordination with efforts in 0603005A. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 Mobility: This effort focuses on improving drive component performance and reliability through elastomer component development, to reduce the logistics burden associated with the sustainment of manned and unmanned tactical and combat vehicles. In FY09, reformulated, modeled, redesigned, and fabricated high performance track bushings; baselined the improved bushings on standard Abrams track; and initiated laboratory testing of high performance track bushings. In FY10, validate high performance bushings on a standard Abrams track through simulated endurance testing. *FY 2009 Accomplishments:* FY 2009	1.870	1.015	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #7 Force Projection: This effort focuses on reducing the logistics footprint by developing water generation, recovery, and purification technologies. In FY09, investigated a water from air prototype system on a mobile platform; assessed in-line and hand-held water monitoring technology to determine the capability to monitor biological and chemical contaminants; formulated and prepared single lubricant product and conducted laboratory assessment of key properties; and created fire resistant fuel formulation for JP-8 with an antimist agent and developed laboratory methods to assess key fire resistant fuel properties. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	2.605	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT H91: *Ground Vehicle Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #8	0.000	2.894	4.628	0.000	4.628
Intelligent Systems Technology Research: This effort assesses improved operations of manned platforms through the application of sensing and autonomy technologies developed for unmanned systems. In FY10, determine the sensor data required to allow for safe unmanned system operations in an urban environment; develop embedded real-time dynamic mobility models that predict manned and unmanned vehicle responses and prevent unsafe mobility situations while under robotic control. In FY11, will analyze the integration of robotic sensor data into a network communication model to validate accurate vehicle operations; will develop algorithms from the fused sensor data that will allow more accurate and precise vehicle manipulation within various virtual environments and predict vehicle payload effects; will develop and evaluate approaches to enhance the capabilities for unmanned systems to work in a dynamic environment; and will develop interoperability profiles and architectures to facilitate command and control of the unmanned systems from a common warfighter machine interface. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #9	4.304	1.242	1.581	0.000	1.581
Diagnostics/Prognostics for Condition Based Maintenance: This effort focuses on reduction of maintenance time and cost by developing the tools to gather data from ground vehicles to allow more accurate diagnoses of problems, leading to prediction of failures before they occur. In FY09, developed diagnostic and prognostics					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
systems capabilities to monitor and anticipate component and system failures and faults; identified root-cause of failures for critical power train components on Abrams and Bradley engine and transmission; and identified and evaluated commercial monitoring sensor capabilities. Investigated capability to integrate sensors to provide more accurate diagnostics/prognostics as well as architecture to integrate into wireless networks to enable remote monitoring capability. In FY10, develop and evaluate engine and transmission algorithms to determine component and system state of health; and develop and assess engine and transmission algorithms to predict failures and report remaining useful life. In FY11, will leverage past algorithm development to create diagnostics and prognostics on power and energy components (batteries, power converters, alternators). This includes failure mode effects and analysis development, model development, root cause analysis, and algorithm updates. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	25.382	21.482	22.565	0.000	22.565

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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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.

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COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
T26: *Ground Vehicle Technologies (CA)*	26.812	21.687	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Ground Vehicle Technology applied research.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	1.196	0.000	0.000	0.000	0.000
Institute for Advanced Materials and Manufacturing Strategies (IAMMS): This Congressional Interest Item conducted research to develop advanced manufacturing methods and materials and produced innovative products for potential use by the military. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2	1.595	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
DoD Hydrogen PEM Fuel Cell Medium/Heavy Duty Vehicle Demonstration Program: This one-year Congressional Add conducted root cause failure analysis of the fuel cells powering six transit buses nationwide. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Rapid Up-Armor Synthesis and Crashworthiness Design for Improved Soldier Survivability: This Congressional Interest Item developed numerical tools to design multi-scale materials for structural applications, and investigated new computational design methodologies for improved soldier survivability. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	1.196	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #4 Nanofluids for Advanced Military Mobility: In FY09 this Congressional Interest Item investigated military grade petroleum, lubricant and oil products with nanoparticles for improvements to properties. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.797	0.497	0.000	0.000	0.000
Program #5 HEV Battery System for Future Combat System: This Congressional Interest Item investigated reduced weight and volume Li-Ion batteries. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	1.595	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 Condition Based Maintenance and Mission Assuredness for Ground Vehicles: This Congressional Interest Item developed neural network based simulation models for condition based management. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	2.392	0.000	0.000	0.000	0.000
Program #7 Improved EFP & IED Prot, Testing, Modeling & Proving Using Lithia Alumina Silica (LAS) Glass Ceramics: This Congressional Interest Item developed lightweight ceramic crystallite-reinforced glass for lighter weight, lower cost ballistic windows to protect against IEDs and EFPs.	2.392	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #8 Remote Unmanned Vehicle Checkpoint System: This Congressional Interest Item developed a system to exploit ultra-wideband technology to provide tracking and autonomous robotic vehicle navigation in enclosed spaces. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.997	0.000	0.000	0.000	0.000
Program #9	2.492	3.183	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Turbo Fuel Cell Engine: In FY09 this Congressional Interest Item investigated a turbo that uses the exhaust heat from the fuel cell to improve fuel cell engine performance. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #10 Integrated Vehicle Health Monitoring System: This Congressional Interest Item investigated an embedded sensor integration module to collect performance data with the capability host prognostic/diagnostic algorithms. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	1.595	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #11 Automotive Tribology Center. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	1.592	0.000	0.000	0.000
Program #12 Smart Oil Sensor. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	2.388	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #13 Automotive Technology Tactical Metal Fabrication System. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	2.487	0.000	0.000	0.000
Program #14 Advanced Composite Materials Research for Air and Ground Vehicles. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009	0.000	2.785	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #15 Vehicle Systems Engineering and Integration Activities. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	7.959	0.000	0.000	0.000
Program #16 Center for Advanced Vehicle Design and Simulation. This is a Congressional Interest Item.	0.797	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #17 Center for Advanced Vehicle Technology and Fuel Development: This Congressional Interest Item developed new materials to be used in Li-ion batteries focused on advanced material chemistry. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.797	0.000	0.000	0.000	0.000
Program #18	0.997	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Extended Lifecycle Management Environment: This Congressional Interest Item extended the existing Data Management (DM) capabilities within the TARDEC Advanced Collaborative Environment (ACE), by providing enhanced program data management of requirements documents. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #19 Globally Accessible Manufacturing Activity (GAMMA) for Military Repair Parts. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	1.595	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #20 Tactical Metal Fabrication System (TacFab): In FY09, this Congressional Interest Item researched the possibility of casting parts in the field faster by reverse engineering broken parts into a 3D model needed to create a new part. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.993	0.796	0.000	0.000	0.000
Program #21 Illinois Center for Defense Manufacturing: This Congressional Interest Item researched and developed advanced manufacturing processes and technologies for Army benefit. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	1.994	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #22 Advanced Manufacture of Lightweight Materials and Components: This Congressional Interest Item researched and developed manufacturing processes for lightweight, self-healing and self-lubricating materials for potential Army vehicle applications. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	2.392	0.000	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	26.812	21.687	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T26: *Ground Vehicle Technologies (CA)*

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T31: *NAT'L AUTO CENTER APP RES INIT (CA)*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
T31: *NAT'L AUTO CENTER APP RES INIT (CA)*	3.190	1.591	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for National Automotive Center applied research.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	1.595	0.000	0.000	0.000	0.000
Military Fuels Research: In FY09, this Congressional Interest Item researched technology for production of military fuels from non-petroleum sources and employing Fischer-Tropsch (FT). *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2	1.595	1.591	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602601A: *Combat Vehicle and Automotive Technology*	PROJECT T31: *NAT'L AUTO CENTER APP RES INIT (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Ultra Light Weight Transmission for FCS: In FY09, this Congressional Interest Item investigated an ultra light weight transmission for combat vehicles. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	3.190	1.591	0.000	0.000	0.000

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-2, PB 2011 Army RDT&E Budget Item Justification											DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*							
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**Base FY 2011 Estimate**	**OCO FY 2011 Estimate**	**Total FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	84.827	78.034	60.342	0.000	60.342	59.623	62.176	65.816	70.640	0	541.800
H03: *ROBOTICS TECHNOLOGY*	15.929	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
H75: *ELECTRIC GUN TECHNOLOGY*	4.465	4.065	0.032	0.000	0.032	0.045	0.065	0.072	0.092	Continuing	Continuing
H80: *Survivability and Lethality Technology*	50.367	57.456	60.310	0.000	60.310	59.578	62.111	65.744	70.548	Continuing	Continuing
HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*	14.066	16.513	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) provides ballistic technologies required for armaments and armor that will enable enhanced lethality and survivability for the Soldier. The PE supports applied research on autonomous mobility technology for future land combat systems (project H03); applied research on technologies for electric armaments and penetrators that offer the potential to achieve leap-ahead lethality capability by providing hypervelocity and hyper-energy launch well above the ability of the conventional cannon (project H75); and applied research on lightweight armors and structures for the Soldier and vehicles, kinetic energy active protection, crew and component protection from ballistic shock and mine-blast, insensitive propellants/munitions, novel multi-function warhead concepts, affordable precision munitions technologies, and physics-based techniques, methodologies, and models to analyze combat effectiveness of future technologies (project H80). Project HB1 funds congressional special interest items. Work in this PE is related to and fully coordinated with efforts in PE 0602105A (Materials Technology), PE 0602120A (Sensors and Electronic Survivability), PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602705A (Electronics and Electronic Devices), PE 0602716A (Human Factors Engineering), PE 0602782A (Command, Control, Communications Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and PE 0603005A (Combat Vehicle Advanced Technology). 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 PE is performed by the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD and Hampton, VA.

Exhibit R-2, PB 2011 Army RDT&E Budget Item Justification	DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602618A: *BALLISTICS TECHNOLOGY*

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	87.960	61.843	62.140	0.000	62.140
Current President's Budget	84.827	78.034	60.342	0.000	60.342
Total Adjustments	-3.133	16.191	-1.798	0.000	-1.798
• Congressional General Reductions		-0.409			
• Congressional Directed Reductions					
• Congressional Rescissions		0.000			
• Congressional Adds		16.600			
• Congressional Directed Transfers					
• Reprogrammings	-1.610	0.000			
• SBIR/STTR Transfer	-1.523	0.000			
• Adjustments to Budget Years	0.000	0.000	-1.798	0.000	-1.798

Change Summary Explanation

FY10 Congressional directed increases.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H03: *ROBOTICS TECHNOLOGY*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H03: *ROBOTICS TECHNOLOGY*	15.929	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

THIS PROJECT MOVED TO PE 0602120A/PROJECT TS2 BEGINNNING IN FY10.This project funds applied research on autonomous mobility. The research focuses on investigation of advanced perception for autonomous ground mobility, intelligent vehicle control and behaviors; and human supervision of unmanned ground systems. Research results will enable both semi-autonomous and near autonomous unmanned ground vehicles (UGVs) with products transitioning to advanced development efforts. The work within this project provides the basis for the Collaborative Technology Alliance (CTA) in robotics. The applied research conducted in this program will be transitioned to technology development, demonstration, and materiel acquisition programs being conducted by the Office of the Secretary of Defense Joint Robotics Program and each of the Services. Work in this PE is related to and fully coordinated with efforts in PE 0603005A (Combat Vehicle Advanced Technology). 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), Aberdeen Proving Ground, MD and Hampton, VA.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	7.220	0.000	0.000	0.000	0.000
CTA: Execute CTA for advanced perception, control/behavior, and man-machine interface technology required for high-speed mobility (including robotic-follower operations) and basic tactical behaviors common to multiple military missions. Research focuses on new sensor and sensor processing algorithms for rapid detection and classification of objects in the environment enabling safe high-speed mobility and intelligent tactical behavior by future unmanned systems; implementing adaptive control strategies that will enable unmanned systems to display intelligent tactical behavior, and development of human-robot interaction (HRI) scalable, intuitive, multi-modal control interfaces that will minimize the additional cognitive workload for Soldiers controlling unmanned assets. In FY09, developed technology for scene understanding and autonomous tactical behavior in the context of reconnaissance mission scenarios.					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H03: *ROBOTICS TECHNOLOGY*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Perception and Intelligent Control: Develop perception and intelligent control technologies required to meet objective capabilities for the armed robotic vehicles and to transition this technology to advanced development programs being conducted under PE 0603005A (Combat Vehicle Advanced Technology) project 515 for integration into test bed systems. Leverage Defense Advanced Research Projects Agency (DARPA) sponsored research for control of collaborating agents to enable mixed teams (manned/unmanned) to conduct military missions. In FY09, developed robotics technology that will permit unmanned vehicles to adapt to dynamic situations found in tactical environments. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	4.722	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H03: *ROBOTICS TECHNOLOGY*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 UGV Integration: Integrate technology on unmanned ground vehicle (UGV) test beds and conduct extensive field testing and technology characterization to establish improved capability for near autonomous UGVs. Leverage algorithms being conducted under DARPA sponsored research, e.g., learning applied to ground robotics (LAGR). Conduct regular, periodic testing at Ft. Indiantown Gap, PA, and other military facilities that will test the technology in complex environments. The results of the tests will be used to further focus CTA sponsored research, assess performance, and provide the opportunity for US Army Training and Doctrine Command to engage in the early development of the tactics, techniques, and procedures required for successful utilization of unmanned systems in future conflicts. In FY09, evaluated the ability of unmanned ground vehicles to autonomously adapt to dynamic tactical environments. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	3.987	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H03: *ROBOTICS TECHNOLOGY*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Accomplishments/Planned Programs Subtotals	15.929	0.000	0.000	0.000	0.000

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H75: *ELECTRIC GUN TECHNOLOGY*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H75: *ELECTRIC GUN TECHNOLOGY*	4.465	4.065	0.032	0.000	0.032	0.045	0.065	0.072	0.092	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts applied research for Electromagnetic (EM) Guns. This project builds upon the EM Gun technology transitioned from PE 0601104A/Project H62 (Institute for Advanced Technology) and evaluates the potential of EM guns to provide such leap-ahead armaments capabilities that are fully integrated with electric propulsion and electromagnetic armor systems to provide the efficient, highly mobile, and deployable armored force. Focus is placed on addressing advanced materials for pulsed power; robust, compact, and lightweight launchers; full-scale, hypervelocity utility of novel kinetic energy penetrators (NKEPs) against a range of present and future threats; and efficient high energy launch packages. The results are transitioned to the Armament Research, Development, and Engineering Center (ARDEC), Picatinny Arsenal, New Jersey.In FY10 and beyond, applied research for EM Gun technology is redirected to conduct research to determine the effect of velocity and novel penetrator design on lethality, advanced propulsion concepts to achieve velocities above current ordnance velocities, and advanced energetics to increase penetrator performance. In FY11, this research will be funded under PE 0602618, Project H80.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), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	1.742	1.880	0.000	0.000	0.000
EM Pulse Power: Evolve the high strength composite materials critical for compact pulsed alternators. In FY09, studied advanced materials (bandings, conductors, and switches) to reduce pulsed alternator size and mass. In FY10, investigate advanced propulsion concepts. In FY11, research effort transitions to PE 626128, Project H80.					
FY 2009 Accomplishments: FY 2009					
FY 2010 Plans: FY 2010					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H75: *ELECTRIC GUN TECHNOLOGY*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Launcher/Projectile: Research technologies needed to incorporate high strength, low density materials necessary for a long life, field-worthy EM cannon and develop lethal mechanisms that take advantage of the hypervelocity capability of EM guns and provide the armature and sabot technologies needed for accurate, low parasitic mass launch packages. In FY09, demonstrated large-caliber (>5 MJ) kinetic energy and multipurpose projectiles launched from an EM gun. In FY10, investigate advanced energetics to increase projectile performance, perform analysis of novel penetrator effects on advanced targets. In FY11, research effort transitions to PE 62618, Project H80. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.400	1.601	0.000	0.000	0.000
Program #3	0.850	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H75: *ELECTRIC GUN TECHNOLOGY*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Full-Scale Hypervelocity Lethality: In FY09, demonstrated full scale (>5MJ muzzle energy) reactive materials (RM) warhead and transitioned to ARDEC. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4 EM Gun Analysis: In FY09, defined the guidance and control parameters needed to increase hypervelocity hit probability. In FY10, analyze and document the EM armament system technical barriers. In FY11, research effort transitions to PE 62618, Project H80. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	0.473	0.509	0.032	0.000	0.032

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H75: *ELECTRIC GUN TECHNOLOGY*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #5 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.075	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	4.465	4.065	0.032	0.000	0.032

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H80: *Survivability and Lethality Technology*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H80: *Survivability and Lethality Technology*	50.367	57.456	60.310	0.000	60.310	59.578	62.111	65.744	70.548	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project provides materials and armor/anti-armor terminal ballistic mechanisms that will provide better armor and armaments. Specific technology thrusts include: lightweight armors (Soldier/vehicle) and structures; active protection systems (APS); crew and component protection from ballistic shock, mine-blast; insensitive high energy propellants/munitions to increase lethality and reduce propellant/munitions vulnerability to attack; novel kinetic energy (KE) penetrator concepts to maintain/improve lethality; novel multi-function warhead concepts to enable defeat of full-spectrum of targets (anti-armor, bunker, helicopter, troops); and physics-based techniques, methodologies, and models to analyze combat effectiveness of future technologies for improved ballistic lethality and survivability. Work in this PE builds on the materials research transitioned from PE 0601102A (Defense Research Sciences): project H42 (Materials and Mechanics) and project H43 (Ballistics); and PE 0602105A (Materials Technology) and applies it to specific Army platforms and the individual Soldier. The work is related to and fully coordinated with efforts in PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602786A (Warfighter Technology), PE 0603001A (Warfighter Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle Advanced Technology), and PE 0708045A (Manufacturing Technology).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), Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	11.808	12.128	12.890	0.000	12.890
Structural Armor: Optimize advanced lightweight structural, ceramic, and electromagnetic armor technologies for transition to current and future tactical and combat vehicle designers. In FY09, proved performance of passive armor designs (second generation) that defeat future tactical vehicle threats with further density reductions; validated objective threat defeat at goal vehicle weights; coupled modeling and simulation with ballistic characterization to validate third generation armor concepts for future threats. In FY10, confirm multi-hit capability of third generation armor concepts designed from emerging materials in PE 0602105/project H84 at goal weights against objective threats for vehicles. Validate Electrical Protection System (EPS) performance for tactical vehicles, both computationally and with tests in relevant environment. In FY11, will validate the					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H80: *Survivability and Lethality Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
performance of third generation armor concepts under realistic environmental conditions through testing coupled with modeling and simulation. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Mine Blast Protection: Develop mine blast, ballistic shock mitigation, and crew protection technologies to enable survivability of current and future platforms, ground tactical vehicles, and the individual Soldier. In FY09, devised models for mine protection using advanced-electromagnetic armor (A-EMA) and support validation of A-EMA mine kits; proved full-scale explosive loading with test apparatus to simulate vehicle borne or roadside blast fragment loading; transitioned second generation flexible protection equipment for individual Soldier development community. In FY10, analyze the ballistic shock effects of objective threat defeat on future vehicles. Computationally address the interaction of blast waves from objective blast threat with magnetic plate materials investigated in PE 0602105A/project H84. In FY11, will test and computationally validate advanced mine protection concepts at goal weights for threshold threat defeat and will prove performance under relevant environmental conditions.	3.550	4.012	3.844	0.000	3.844

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H80: *Survivability and Lethality Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Precision Munitions: Develop advanced technologies to enable a broad spectrum of affordable precision munitions. Develop a multi-disciplinary approach to munitions system design by coupling physics-based models of interior ballistics, launch dynamics, flight mechanics, and high-G guidance, navigation, and control (GN&C) technologies to enable smaller, cheaper, and lighter low-collateral-damage precision munitions for future asymmetric operations in military operations on urban terrain (MOUT). In FY09, addressed technology that enables precision fires for small unit MOUT operations. In FY10, validate reduced state GN&C methods that will significantly reduce cost of precision munitions. Validate low cost robust actuator technology for indirect fire application. In FY11, will show feasibility of non-GPS guidance technologies. Will provide technology assessment of precision hit technology across munition size and domain. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	4.200	4.456	4.488	0.000	4.488

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H80: *Survivability and Lethality Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4 Energetics: Develop propulsion and energetics technologies. Evaluate, select, and validate novel/nanostructural insensitive energetic materials concepts that exploit managed energy release and are required for improving the effectiveness and reducing the vulnerability of future gun/missile systems and warheads. In FY09, applied ballistic modeling and simulation to evaluate low-vulnerability propulsion charge configurations at reduced caliber for MOUT and gun launched rockets; applied reactive materials and nano-structured materials to enhance energy output with less propellant and explosive material; derived and applied chemical and physical mechanisms to reduce erosion via dynamic nitriding; determined the effects of physical modification and compartment packing design of munitions on the vulnerability of propellants and explosives to fast and slow cook-off, bullet and fragment impact, shaped charge jet impact; evaluated performance of advanced enhanced blast explosive formulations and munitions. In FY10, provide technology assessment of reactive material as structural components for Army munition systems. Incorporate reactive materials into structural components for Army munition systems and test the performance of the system. Transition hypergolic rocket motor and understanding to RDECs. In FY11, will study green energetic material formulation and will study feasibility of replacing Hexahydro-Trinitro-Triazine (RDX). *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	4.450	4.606	4.650	0.000	4.650

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H80: *Survivability and Lethality Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #5 Advanced Munitions: Develop advanced ammunition and lethality technologies. Identify and model preferred options to reduce energy/mass required to defeat emerging armor threats and to provide multi-purpose capabilities for revolutionary future lethality. In addition, investigate technology options for scaling warhead lethality to enhance MOUT war fighting including control of collateral damage. In FY09, proved integrated scalable warhead technology for blast, fragmentation, and penetration effects in urban environments. In FY10, research advanced scalability concepts for medium and large caliber projectiles and missiles. In FY11, will conduct tests and document advances in scalable effects on targets. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	3.575	3.863	3.800	0.000	3.800
Program #6	6.810	7.602	5.350	0.000	5.350

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Survivability/Lethality Analyses: Devise state-of-the-art survivability/lethality/vulnerability (SLV) methodologies to dynamically model the interaction of conventional ballistic threats versus future systems. In FY09, developed novel blast and combined-effects methodologies for non-traditional, emerging synergistic threats; demonstrated an early Modular UNIX-based Vulnerability Estimation Suite (MUVES) 3 analysis capability, and delivered advanced crew-casualty metrics for assessing body armor. In FY10, investigate alignment of methodology development to the coupling of emerging and predicted threats with advancing armor materials/recipes and medical community inputs. In FY11, will complete integration of ballistics effects into a system-of-systems context with other threat classes including electronic and information warfare. Perform improvements to tools, techniques, and methodologies for ballistic survivability/lethality analysis to ensure analysis tools are relevant and credible for developmental army systems using new lethality and survivability technologies. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #7 Armor Formulations: In FY09, researched and investigated composite ceramic materials (from PE 0602105A/ project H84) to increase body armor performance while reducing weight. For ground combat vehicles, designed and developed reactive armor and electromagnetic armor solutions for defeat of emerging kinetic energy (KE)	15.974	20.048	21.203	0.000	21.203

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H80: *Survivability and Lethality Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
and chemical energy (CE) threats. Assessed new explosive materials for reactive armors (RA) with modeling, simulation, and tests to characterize performance as well as sensitivity. Conducted modeling and simulation and experiments of lightweight brass board electromagnetic (EM) armor solutions using advanced materials to include hybrid armor designs that provided dual threat protection capability. In FY10, continue composite ceramic materials investigations for personnel protection applications; conduct tests with candidate single and dual-threat (CE & KE) defeat armor components (RA and EM) to design vehicle armor concepts; conduct first proof of principle test with hybrid armor components (combines RA and EM technologies) for dual threat defeat; develop new test methodologies, diagnostics, and modeling and simulation tools to better support active and hybrid armor development. In FY11, will determine and refine candidate dual threat defeat armor solution candidates for maturation in PE 0602601A/project C05; will validate the testing and computational tools that will be used to design and develop active and hybrid armors concepts and prove the feasibility of using a hybrid armor in a multi-threat scenario with component level proof of principle testing in relevant environments. Personal protection concepts will utilize material technologies from PE 0602105A/projects H84/H7G and will be assessed and refined in PE 0602786A/project H98. Reactive armor and electromagnetic armor design solutions will utilize material technologies from PE 0602105A/project H84 and be assessed and refined in PE 0602601A/project C05. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #8	0.000	0.000	4.085	0.000	4.085

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H80: *Survivability and Lethality Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Penetrator Lethality research. This research effort is transitioned from PE62618 Project H75. In FY11, will validate effects on lethality of velocity - ranging from ordnance velocity to hypervelocity - and also the effect of novel penetrator designs. Will complete validation and assessment of benefits of novel penetrator effects at ordnance velocity, will conduct initial validation of most promising novel penetrator designs at hypervelocity, and will improve penetration and lethality models based on novel penetrator data. Will investigate advanced propulsion system concepts to achieve velocities above current ordnance velocities. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #9 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	0.741	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H80: *Survivability and Lethality Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	50.367	57.456	60.310	0.000	60.310

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*	14.066	16.513	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

These are Congressional Interest Items

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	3.989	0.000	0.000	0.000	0.000
Laser Based Explosives and Chem/Bio Standoff and Point Detector. This Congressional Interest Item Investigated laser-based approach for detection of unknown substances in the field for military and First Responder applications *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2	0.797	0.795	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Beneficial Infrastructure for Rotorcraft Risk Reduction Demonstrations (BIRRRD). In FY09, Investigated Vehicle Management System (VMS) to support combat medic unmanned aerial vehicle applications *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Small Unmanned Aerial Vehicles (UAVs) and Sensors. In FY09, this Congressional Interest Item investigated vehicle technology that can be used to support Reconnaissance, Intelligence, Surveillance, and Target Acquisition on small military Unmanned Aerial Vehicles, using penetrating radar to search buildings and structures. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	0.498	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #4 Super High Accuracy Range Kit - 105mm Artillery Technology. In FY09, this Congressional Interest Item investigated an accuracy improvement technology for application to artillery ammunition through the use of GPS and an electro-mechanical control actuation system. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	3.592	3.979	0.000	0.000	0.000
Program #5 Advanced Composite Armor For Force Protection. In FY09, this Congressional Interest Item investigated advanced composite materials tailored to defeat evolving ballistic and IED fragmentation threats. *FY 2009 Accomplishments:* FY 2009	1.597	1.592	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 Next Generation Lightweight Electric Drive Systems for Army Weapons. In FY09, this Congressional Interest Item developed software for the analysis of the electric drive and transitioned it to Dakota Power. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.597	0.000	0.000	0.000	0.000
Program #7 Eye-Safe Standoff Fusion Detection of CBE Threats. In FY09, this Congressional Interest Item researched eye-safe standoff detection approaches for chemical, biological, and explosive theats.	1.996	1.990	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #8 5.56mm Aluminum Cartridge Case, Lake City Army Ammunition Plant. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	1.592	0.000	0.000	0.000
Program #9	0.000	0.796	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Flexible Solar Cell for Man Portable Power Generator. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #10 Direct Carbon Fuel Cell. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	2.785	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #11	0.000	2.984	0.000	0.000	0.000
Enabling Optimization of Reactive Armor. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	14.066	16.513	0.000	0.000	0.000

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-2, PB 2011 Army RDT&E Budget Item Justification											DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*					R-1 ITEM NOMENCLATURE PE 0602622A: *Chemical, Smoke and Equipment Defeating Technology*						
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**Base FY 2011 Estimate**	**OCO FY 2011 Estimate**	**Total FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	8.873	13.622	5.324	0.000	5.324	4.877	5.434	6.476	7.535	0	57.465
552: *SMOKE/NOVEL EFFECT MUN*	2.256	5.266	5.324	0.000	5.324	4.877	5.434	6.476	7.535	Continuing	Continuing
BA1: *Protection Technologies (CA)*	6.617	8.356	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this program element (PE) is to investigate and evaluate obscurant technologies to increase personnel and platform survivability and develop and validate forensic analysis methods for military and homemade explosive devices, including their precursors and residue. This PE pursues research in materials science and dissemination methodologies and mechanisms and technologies and techniques to enable forensic analysis of explosive signatures (project 552). Work in this PE is related to, and fully coordinated with, PE 0603004A/project L97 (Smoke and Obscurants Advanced Technology) and PE 0603606A/project 608 (Countermine & Barrier Development). 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. This work is performed by the Army Research, Development, and Engineering Command (RDECOM), Edgewood Chemical Biological Center (ECBC), Edgewood, MD.

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	8.906	5.293	5.311	0.000	5.311
Current President's Budget	8.873	13.622	5.324	0.000	5.324
Total Adjustments	-0.033	8.329	0.013	0.000	0.013
• Congressional General Reductions		-0.071			
• Congressional Directed Reductions					
• Congressional Rescissions		0.000			
• Congressional Adds		8.400			
• Congressional Directed Transfers					
• Reprogrammings	0.185	0.000			
• SBIR/STTR Transfer	-0.218	0.000			
• Adjustments to Budget Years	0.000	0.000	0.013	0.000	0.013

Change Summary Explanation

FY10 Congressionally directed increases.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602622A: *Chemical, Smoke and Equipment Defeating Technology*	PROJECT 552: *SMOKE/NOVEL EFFECT MUN*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
552: *SMOKE/NOVEL EFFECT MUN*	2.256	5.266	5.324	0.000	5.324	4.877	5.434	6.476	7.535	Continuing	Continuing

A. Mission Description and Budget Item Justification

The project investigates and evaluates obscurant technologies that degrade threat force surveillance sensors and defeat the enemy's target acquisition devices, missile guidance, and directed energy weapons. This project investigates advanced infra-red (IR) and multi-spectral obscurant materials that provide effective, affordable, and efficient screening of deployed forces, while being safe and environmentally acceptable. Additionally, it researches and investigates forensic analysis technology in explosives and explosives-related chemical signatures, and develops and validates field sampling and forensics methods for use in a forward-deployed laboratory. 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 (RDECOM), Edgewood Chemical Biological Center (ECBC), Edgewood, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	1.381	1.424	1.400	0.000	1.400
Advanced Obscurants: This effort investigates technologies which enable safe, effective screening of personnel and equipment. In FY09, expanded existing theory for advanced obscurants across the entire spectrum of interest (visual, IR and microwave regions); examined alternate theoretical approaches; determined particle characteristics based upon theory; and initiated investigation of new high performing, low toxicity visual obscurants. Conducted studies of bi-spectral (visual thru Far IR) obscurant concepts. In FY10, investigate, through chamber and field evaluation, bi-spectral packaging and dissemination concepts to improve overall obscuration performance. In FY11, will develop, refine and optimize bi-spectral packaging and dissemination concepts through testing and modifications to make them suitable for weaponization.					
FY 2009 Accomplishments: FY 2009					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Obscurant Enabling Technology: This effort investigates distribution technologies for various obscurants. In FY09, conducted studies of dissemination techniques for low toxicity bi-spectral obscurants and new bi-spectral obscurants. In FY10, conduct modeling and chamber evaluation studies to examine performance improvements possible for low hazard visual obscurants. In FY11, will conduct studies of dissemination techniques for low hazard visual obscurants to increase their obscuration performance and to make them suitable for weaponization. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.875	0.845	0.904	0.000	0.904
Program #3	0.000	2.882	3.020	0.000	3.020

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Forensic Analysis of Explosive Signatures: This effort investigates the detection and chemical analysis of explosive material signatures. In FY10, will conduct experiments to determine the surface/vapor characterization of military high explosives (HEs); and common materials used in homemade explosives (HMEs); will determine the signatures required to provide improved point, proximity, and stand-off detection of explosives and precursor materials; will investigate the environmental persistence, fate and transport of explosives relevant to counter HE and HME sensing operations; will conduct experiments to develop novel forensic methods that determine the components in HMEs. In FY11, will establish and validate forensic sampling protocols for sensing explosives on surfaces; will identify the differences in instrumentation used in theater and within continental United States (CONUS) based laboratories; will continue fate and transport studies of trace energetics and chemical components focusing on surface residues; will evaluate and determine decomposition patterns and pathways to provide additional signature markers; will identify chemical signatures for sensing, leveraging data from DARPA Portable Open Source Security Elements (POSSE) Program; will investigate the ability to combine chemical and explosive hazard detection; and will utilize findings to help guide detector/detection specifications. Will transition technologies to PE (0603004A/Project L97 (Smoke and Obscurants Advanced Technology). *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4	0.000	0.115	0.000	0.000	0.000

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	2.256	5.266	5.324	0.000	5.324

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, PB 2011 Army RDT&E Project Justification			DATE: February 2010
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COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
BA1: *Protection Technologies (CA)*	6.617	8.356	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Protection Technologies applied research.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.631	0.000	0.000	0.000	0.000
Systems Biology Biomarker Molecular Toxicology Initiative: This Congressional Interest Item investigated specific diagnostic markers necessary to quickly indicate diseased states in the event of a chemical or biological terrorist attack or exposure to such agents. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2	1.594	0.000	0.000	0.000	0.000

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Rapid and Accurate Pathogen Identification/Detection (RAPID) Program: This Congressional Interest Item developed a sensitive and specific detection platform for biological agents that employed micropatterned arrays of unique chemotactic signaling compounds specific for each target threat. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Enhanced Vapor Aeration Capabilities (EVAC): This Congressional Interest Item investigated the utilization of thermal enhancement of gaseous decontamination systems to lift chemical and biological agents from a surface in order to decontaminate more quickly and effectively than current capabilities. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	2.392	0.000	0.000	0.000	0.000

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4 Highlander Electro-Optical Sensors. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	1.591	0.000	0.000	0.000
Program #5 Missouri Multi-Threat Detection Initiative (M2TDI). This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009	0.000	1.990	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 Locating and Tracking Explosive Threats with Wireless Sensors and Networks. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	4.775	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	6.617	8.356	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
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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.