Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Army										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	73.456	60.342	59.214	-	59.214	58.340	59.346	61.758	65.827	Continuing	Continuing
H75: *ELECTRIC GUN TECHNOLOGY*	3.973	0.032	-	-	-	-	-	-	-	Continuing	Continuing
H80: *Survivability and Lethality Technology*	56.551	60.310	59.214	-	59.214	58.340	59.346	61.758	65.827	Continuing	Continuing
HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*	12.932	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) investigates and evaluates materials and ballistic technologies required for armaments and armor that will enable enhanced lethality and survivability. The PE supports applied research on lightweight armors and protective structures for the Soldier and vehicles; kinetic energy active protection for crew and components protection from ballistic shock and mine-blast; insensitive propellants/munitions formulations, novel multi-function warhead concepts; affordable precision munitions design; and physics-based techniques, methodologies, and models to analyze combat effectiveness of future technologies (project H80). Project H75 completed in FY10.

Work in this PE complements and is 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 0603004A (Weapons and Munitions Advanced Technology), and PE 0603005A (Combat Vehicle Advanced Technology).

Project HB1 funds Congressional Interest Items.

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

Work in this PE is performed by the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD and Hampton, VA.

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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 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	78.034	60.342	59.623	-	59.623
Current President's Budget	73.456	60.342	59.214	-	59.214
Total Adjustments	-4.578	-	-0.409	-	-0.409
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-3.581	-			
• SBIR/STTR Transfer	-0.997	-			
• Adjustments to Budget Years	-	-	-0.409	-	-0.409

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H75: *ELECTRIC GUN TECHNOLOGY*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H75: *ELECTRIC GUN TECHNOLOGY*	3.973	0.032	-	-	-	-	-	-	-	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

In FY10, applied research for Electronic Gun (EM) Gun technology was to determine the effect of velocity and novel penetrator design on lethality; investigate advanced propulsion concepts to achieve velocities above current ordnance velocities; and research advanced energetics to increase penetrator performance.

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 Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: EM Pulse Power ***Description:*** Evolve the high strength composite materials critical for compact pulsed alternators. ***FY 2010 Accomplishments:*** Investigated advanced propulsion concepts.	1.863	-	-
Title: Launcher/Projectile ***Description:*** 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. ***FY 2010 Accomplishments:*** Investigated advanced energetics to increase projectile performance, and performed analysis of novel penetrator effects on advanced targets. Starting in FY11, research effort transitions to PE 0602618A, Project H80.	1.601	-	-
Title: EM Gun Analysis ***Description:*** EM Gun Analysis	0.509	0.032	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H75: *ELECTRIC GUN TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: Analyzed and documented the EM armament system technical barriers. ***FY 2011 Plans:*** Research effort transitions to PE 0602618A, Project H80.			
Accomplishments/Planned Programs Subtotals	3.973	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, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H80: *Survivability and Lethality Technology*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
H80: *Survivability and Lethality Technology*	56.551	60.310	59.214	-	59.214	58.340	59.346	61.758	65.827	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project investigates materials and design for armor/anti-armor formulations that provide advanced protection through tailored terminal ballistic mechanisms. Specific technology thrusts include: lightweight armors and protective structures; crew and component protection from ballistic shock and/or 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 a 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 complements and is 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 Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Structural Armor	12.128	12.890	9.640
Description: Optimize advanced lightweight structural, ceramic, and electromagnetic armor technologies for transition to current and future tactical and combat vehicle designers.			
FY 2010 Accomplishments:			

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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 Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Confirmed 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; validated Electrical Protection System performance for tactical vehicles, both computationally and with experiments, in relevant environment. ***FY 2011 Plans:*** Validate the performance of third generation armor concepts under realistic environmental conditions, through testing coupled with modeling and simulation with emphasis on ceramic-composite and encapsulated ceramic technologies. ***FY 2012 Plans:*** Will investigate third generation structural armor performance incorporating most promising ceramic-composite and encapsulated ceramic materials technologies; will evaluate novel mechanisms against objective level future threats and transition validated concepts to the United States Army Tank Automotive Research, Development and Engineering Center (TARDEC) (PE 0602601A/ project C05); will use modeling and simulation coupled with experimentation to validate emerging ballistic defeat mechanisms that couple structural materials w/energy absorbing mechanisms against future threats.			
Title: Mine Blast Protection ***Description:*** 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. ***FY 2010 Accomplishments:*** Analyzed the ballistic shock effects of objective threat defeat on future vehicles; computationally addressed the interaction of blast waves from objective blast threat with magnetic plate materials investigated in PE 0602105A/project H84. ***FY 2011 Plans:*** Assess and computationally validate advanced mine protection concepts (to include active seating) at goal weights for threshold threat defeat, and prove performance under relevant environmental conditions. ***FY 2012 Plans:*** Will incorporate computationally representative energy absorbing seats and local soil characteristics into models and simulations of full-scale blast events in order to refine simulations for system design optimization by TARDEC in PE 0603005A; and will experimentally validate the simulated results for mine blast events.	4.012	3.844	5.407
Title: Precision Munitions ***Description:*** 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	4.456	4.488	4.833

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
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). ***FY 2010 Accomplishments:*** Validated reduced state GN&C methods that will significantly reduce cost of precision munitions; validated low cost robust actuator technology for indirect fire application. ***FY 2011 Plans:*** Show feasibility of non-GPS guidance technologies. Provide technology assessment of precision hit technology across munition size and domain. ***FY 2012 Plans:*** Will combine reduced state GN&C methods, robust actuators, novel guidance technologies, with understanding of interior and exterior ballistics to computationally and experimentally validate accuracy improvements for direct fire individual soldier and weapons platforms.			
Title: Energetics ***Description:*** Develop propulsion and energetics technologies. Evaluate, select, and validate novel/nanostructural insensitive energetic materials concepts that exploit managed energy release required for improving the effectiveness and reducing the vulnerability of future gun/missile systems and warheads. ***FY 2010 Accomplishments:*** Provided technology assessment of reactive material as structural components for Army munition systems; incorporated reactive materials into structural components for Army munition systems and validated the performance of the system; as well as transitioned hypergolic rocket motor and understanding to Research, Development & Engineering Centers (RDECs). ***FY 2011 Plans:*** Study green energetic material formulation and investigate feasibility of replacing Hexahydro-Trinitro-Triazine (RDX) in novel energetics. ***FY 2012 Plans:*** Will validate ability to characterize energetic materials through multiscale modeling; will provide understanding to synthesizers and formulators; will support hypergolic propulsion demonstration at the U. S. Army Aviation and Missile Research Development and Engineering Center (AMRDEC) through insertion of green energetics into effort; and will investigate solid rocket throttleable propulsion.	4.606	4.650	5.496
Title: Advanced Munitions	3.863	3.800	3.087

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT H80: *Survivability and Lethality Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: 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. ***FY 2010 Accomplishments:*** Researched advanced scalability concepts for medium and large caliber projectiles and missiles. ***FY 2011 Plans:*** Conduct assessments and document advances in scalable effects on targets. ***FY 2012 Plans:*** Will identify next level in scalability, which expands past blast and fragmentation munitions and offers potential to defeat a range of threats with a single munition (i.e. collapse calibers); and will research and prove novel lethal mechanisms for defeat of expanding target set, which includes vehicles, buildings and soldiers.			
Title: Survivability/Lethality Analyses ***Description:*** Devise state-of-the-art survivability/lethality/vulnerability methodologies to dynamically model the interaction of conventional ballistic threats versus future systems. ***FY 2010 Accomplishments:*** Investigated alignment of methodology development to the coupling of emerging and predicted threats with advancing armor materials/recipes and medical community inputs. ***FY 2011 Plans:*** 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 2012 Plans:*** Will develop new methodologies for assessing soldier/platform occupant injury probabilities in support of efforts to develop a new military specific anthropomorphic test device (WIAMAn); will continue advanced experimentation and simulation to improve biofidelic characterization and injury correlation of helmet back face deformation; will integrate an enhanced shot-line viewer, virtual components, active protection systems and multiple threat functionalities to Modular UNIX-based Vulnerability Estimation Suite (MUVES) 3.	7.602	5.350	4.219
Title: Armor Formulations	19.884	21.203	22.363

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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 Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: Devise and mature multi-threat hybrid armor technologies incorporating both active and passive mechanisms for ground vehicle systems that are effective against future conventional weapons and evolving improvised threats. ***FY 2010 Accomplishments:*** Continued composite ceramic materials investigations developed in PE 060215A/project H84 for personnel protection applications; conducted experiments with candidate single and dual-threat (chemical and kinetic energy) defeat armor components (reactive armor (RA) and electromagnetic (EM)) to design vehicle armor concepts; conducted first proof of principle experiments with hybrid armor components (combines RA and EM technologies) for dual threat defeat; and developed new validation methodologies, diagnostics, and modeling and simulation tools to better support active and hybrid armor development. ***FY 2011 Plans:*** Determine and refine candidate dual threat defeat armor solution candidates for maturation in PE 0602601A/project C05; validate the assessment 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 validation in relevant environments. ***FY 2012 Plans:*** Will downselect most promising multi-threat armor concepts and transition technology to TARDEC (PE 0602601A/project C05); will investigate advanced reactive and EM physics for defeat of multiple threat types to include development of algorithms that capture the symbiotic relationships between the mechanisms; will develop multi-disciplinary physics-based modeling tools that connect personal protection technologies to Soldier performance and survivability; and will develop experimentally validated constitutive material mechanics models that capture high-rate human tissue mechanics.			
Title: Penetrator Lethality research. ***Description:*** Evaluate effects on lethality of velocity and also the effect of novel penetrator designs. ***FY 2011 Plans:*** Validate effects on lethality of velocity - ranging from ordnance velocity to hypervelocity - and also the effect of novel penetrator designs; complete validation and assessment of benefits of novel penetrator effects at ordnance velocity; conduct initial validation of most promising novel penetrator designs at hypervelocity, and improve penetration and lethality models based on novel penetrator data; and investigate advanced propulsion system concepts to achieve velocities above current ordnance velocities. ***FY 2012 Plans:***	-	4.085	4.169

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Will prove benefit of novel penetrator technology at both ordnance and hypervelocities and transition technology approaches to RDECs for both gun and missile application; and will validate concepts that overcome current propulsion technology limitation of muzzle pressure that enables use of next generation propellants.			
Accomplishments/Planned Programs Subtotals	56.551	60.310	59.214

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

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

Exhibit R-2A, RDT&E Project Justification: PB 2012 Army			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602618A: *BALLISTICS TECHNOLOGY*	PROJECT HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
HB1: *SURVIVABILITY AND LETHALITY TECHNOLOGIES (CA)*	12.932	-	-	-	-	-	-	-	-	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

These are Congressional Interest Items

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Beneficial Infrastructure for Rotorcraft Risk Reduction Demonstrations (BIRRRD) ***Description:*** This is a Congressional Special Interest Item. ***FY 2010 Accomplishments:*** Investigated options for Unmanned Aerial Vehicles (UAVs) to deliver medical supplies to forward areas.	0.795	-	-
Title: Super High Accuracy Range Kit - 105mm Artillery Technology ***Description:*** This is a Congressional Special Interest Item. ***FY 2010 Accomplishments:*** Investigated technology to improve accuracy of artillery ammunition through the use of Global Positioning System (GPS) and an electro-mechanical control actuation system.	3.979	-	-
Title: Advanced Composite Armor For Force Protection ***Description:*** This is a Congressional Special Interest Item. ***FY 2010 Accomplishments:*** Investigated advanced composite materials for ballistic threat protection.	1.592	-	-
Title: Eye-Safe Standoff Fusion Detection of CBE Threats ***Description:*** This is a Congressional Special Interest Item. ***FY 2010 Accomplishments:***	1.990	-	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Investigated technologies for eye-safe standoff detection of CBE threats.			
Title: Enabling Optimization of Reactive Armor ***Description:*** This is a Congressional Special Interest Item. ***FY 2010 Accomplishments:*** Investigated technology enhancements for vehicle survivability.	2.984	-	-
Title: Next Generation Lightweight Electric Drive Systems for Army Weapons ***Description:*** This is a Congressional Interest Item. ***FY 2010 Accomplishments:*** Assessed technologies to reduce the weight and enhance efficiency of electric drive and power generation systems.	1.592	-	-
Accomplishments/Planned Programs Subtotals	12.932	-	-

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.