Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					R-1 ITEM NOMENCLATURE PE 0602105A MATERIALS TECHNOLOGY					
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	60.261	80.937	27.206						Continuing	Continuing
H7B: Advanced Materials Initiatives (CA)	41.876	56.035	.000						Continuing	Continuing
H7G: NANOMATERIALS APPLIED RESEARCH	4.763	4.993	5.138						Continuing	Continuing
H84: MATERIALS	13.622	19.909	22.068						Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this program element (PE) is to provide materials for lighter weight and more survivable armor and more lethal armaments. This PE supports the design, development, and evaluation of nanostructure materials (project H7G); design, development and evaluation of materials for more survivable and lighter weight armor and armaments (project H84). Project H7B funds congressional special interest items.

Work in this PE builds on the materials research transitioned from PE 0601102A (Defense Research Sciences), project H42 (Materials and Mechanics) and PE 0601104A (University and Industry Research Centers), project J12 (Institute for Soldier Nanotechnologies) and applies it to specific Army platforms and the individual Soldier.

The work is related to and fully coordinated with efforts in PE 0602618A (Ballistics Technology), PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602782A (Command, Control, Communications Technology), PE 0602786A (Warfighter Technology), PE 0603001A (Warfighter Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle Advanced Technology), PE 0603008A (Command, Control, Communications 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 is performed by the Army Research Laboratory (ARL), Adelphi, MD and Aberdeen Proving Ground, MD.

Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification	DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	**R-1 ITEM NOMENCLATURE** PE 0602105A MATERIALS TECHNOLOGY

B. Program Change Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011
Previous President's Budget	64.517	26.985	28.384	
Current BES/President's Budget	60.261	80.937	27.206	
Total Adjustments	-4.256	53.952	-1.178	
Congressional Program Reductions	.000	-2.268		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	56.220		
Total Reprogrammings	-2.854	.000		
SBIR/STTR Transfer	-1.402	.000		

Change Summary Explanation

FY 2009 increases are due to congressional adds.

Exhibit R-2a, PB 2010 Army RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602105A MATERIALS TECHNOLOGY					PROJECT NUMBER H7B	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
H7B: Advanced Materials Initiatives (CA)	41.876	56.035	.000						Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Advanced Materials Initiatives.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Future Affordable Multi-Utility Materials for the Army Future Combat Systems	6.183	6.200	.000	
Cold Spray Wear Coating for FCS	.966	.000	.000	
Dual Stage Variable Energy Absorber	.000	2.325	.000	
Affordable Light-Weight Metal Matrix Composite Armor	.000	1.550	.000	
Lightweight Anti-Ballistic Protection for Aircraft	.000	.388	.000	
Control System for Laser Powder Deposition	.386	.484	.000	
Advanced Ceramic Surface Engineering for Helicopter Compressor Blades	2.318	.000	.000	
Improvised Explosive Device Simulation in Different Soils	.386	.484	.000	
Nanomanufacturing of Multifunctional Sensors	1.546	.969	.000	
Advanced Lightweight Transparent Armor for Tactical Wheeled Vehicles and Force Protection	.773	.000	.000	
Advanced Materials Development and Manufacturing of Body Armor	1.932	.000	.000	
3D Woven Ballistic Materials for Future Combat Systems	1.932	.000	.000	
Protection Against Improvised Explosive Devices	3.864	.000	.000	
Lightweight Motors for the Future Combat System	1.546	.000	.000	
Nickel Boron Coating-Technology for Army Weapons	2.319	2.325	.000	
Novel Extremity Body Armor	.465	.581	.000	

Exhibit R-2a, PB 2010 Army RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602105A MATERIALS TECHNOLOGY	PROJECT NUMBER H7B

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Polymer Center of Excellence for Blast-Ballistic Protective Armor	1.933	.000	.000	
Project Kryptolite	1.160	1.163	.000	
Ultra Lightweight Metallic Armor	1.546	.000	.000	
Ultra-Endurance Coating	2.319	3.488	.000	
Complex-shaped Armor for Soldier Torso and Extremity Protection	1.933	.000	.000	
Multi-scale Modeling of Impact Resistant Materials for Body Armor	1.450	.000	.000	
Titanium Fabrication for Military/Industrial Equipment	1.306	.000	.000	
One-Step JP-8 Bio Diesel Fuel	4.348	1.550	.000	
Nanotechnologies Initiative	1.265	.000	.000	
Composite Applied Research and Technology for FCS and Tactical Vehicle Survivability	.000	2.906	.000	
Capability Expansion of Spinel Transparent Armor Manufacturing	.000	4.960	.000	
Ultrasonic Consolidation for Armor Applications	.000	1.162	.000	
Ultrasonic Impact Technology	.000	1.162	.000	
Lightweight Transparent Armor for Force Protection	.000	1.938	.000	
Next Generation Protective Seat	.000	2.325	.000	
Unmanned Ground Vehicle Advanced Technology Development	.000	2.422	.000	
Development of Improved Lighter-Weight IED/EFP Armor Solutions	.000	.969	.000	
Modeling and Testing of Next Generation Body Armor	.000	1.938	.000	
Advanced Conductivity Program (ACP)	.000	3.391	.000	
Ballistic Armor Research	.000	3.100	.000	
Lattice Block Structures for AM2 Matting Replacement	.000	2.422	.000	
Moldable Fabric Armor	.000	1.164	.000	

Exhibit R-2a, PB 2010 Army RDT&E Project Justification		DATE: May 2009
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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Renewable Jet Fuel from Lignocellulosic Feedstocks	.000	3.100	.000	
SBIR/STTR	.000	1.569	.000	
Total	41.876	56.035	.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 2010 Army RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602105A MATERIALS TECHNOLOGY					PROJECT NUMBER H7G	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
H7G: NANOMATERIALS APPLIED RESEARCH	4.763	4.993	5.138						Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this project is to support the design, development, and evaluation of nanostructure materials that improve the Soldier's survivability, lethality, and sustainability. This project funds collaborative applied research and integration of government, academic, and industry scientific research on nanomaterials derived from PE 0601104A/project J12 (Institute for Soldier Nanotechnologies (ISN)) to advance innovative capabilities.

The work is a collaborative effort between the ISN at the Massachusetts Institute of Technology, the Army Laboratories and Research, Development, and Engineering Centers, and the ISN industrial partners.

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

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

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Nanomaterials Applied Research: Devise and validate improved, physics-based, materials property models, and concepts for multifunctional, lightweight and responsive hierarchical material technologies, and exploit breakthroughs in nanomaterials and multifunctional fiber processing technologies (e.g., scale-up of processes and fabrication into woven materials) to enable revolutionary future Soldier program's protection capabilities. Coordinated research program conducted internally by ARL and externally through a collaborative effort with ISN and ISN industry partners. FY08: researched technologies to enable multifunctional designs utilizing multiple nanomaterial constituents. FY09: validate performance enhancements (survivability, lethality, sustainability) enabled through insertion of nanomaterials constituents in scalable processes. FY10: will examine concepts for the absorption of energy in personnel protection applications.	4.763	4.880	5.138	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.113	.000	
Total	4.763	4.993	5.138	

Exhibit R-2a, PB 2010 Army RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602105A MATERIALS TECHNOLOGY	PROJECT NUMBER H7G

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 2010 Army RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602105A MATERIALS TECHNOLOGY					PROJECT NUMBER H84	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
H84: MATERIALS	13.622	19.909	22.068						Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this project is to support the design, development and evaluation of materials for more survivable and lighter weight armor and armaments. This project provides the technical foundation for materials technology in metals, ceramics, polymers, and composites. This project will address the needs for more survivability and lighter weight armaments through: nanomaterials research across the spectrum of applications to improve performance; improved, physics-based, material, mechanical, and structural models; high strain rate material characterization techniques; non-destructive inspection/evaluation technologies; new high strength/temperature materials and coatings; and advanced fabrication/processing methodologies. Applied research efforts are focused on armor/armament materials, as well as lightweight structural/electronic materials and materials affording protection against chemical, biological, or directed energy threats. Overarching goals of this material research are to provide optimized lightweight armor structures, improved affordable processing methods, and the development of modeling and simulation tools to facilitate future design efforts in support of current and future force 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.

The work is conducted by the Army Research Laboratory (ARL), at its Aberdeen Proving Ground, MD, and Hampton, VA, locations.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Nanomaterials: Mature and scale-up nanomaterials processes, fabrication, characterization and performance measures to enable revolutionary concepts for future force lethality and survivability beyond those addressed for individual Soldier protection in project H7G. In FY08, performed parametric processing studies of advanced nanomaterial compositions; applied modeling results to the maturation of reactive materials; assessed and validated performance of nanoengineered composite materials for survivability and lethality applications. In FY09, scale-up the process methodology for fabricating fully-dense, boron carbide plates; perform microstructural and mechanical property characterization. In FY10, will develop relationships between scaled-up processing of nanoscale materials and processing; will characterize reactive materials and will provide feedback to model developers.	1.260	1.346	1.390	
Composites:	4.165	4.198	4.118	

Exhibit R-2a, PB 2010 Army RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602105A MATERIALS TECHNOLOGY		PROJECT NUMBER H84		
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
Design, validate, and optimize advanced materials (ceramic, composite, polymers, lightweight and high-strength metals) and processing techniques for smaller but more lethal penetrators/warheads and affordable, lightweight high performance armaments for revolutionary weapons effectiveness in urban and irregular operations. In FY08, explored micro-mechanics effects of blast and impact shock on prospective warhead and projectile materials; examined methods for controlled fragmentation of projectile body materials; fabricated long metal matrix composite (MMC) sections with advanced liner material and performed full scale validation of MMC tube. In FY09, design material system to provide the desired multi-functional capability to enhance damage on relevant targets and conduct benchmark testing with that material system. In FY10, will develop novel nano-micro-structures in metallic materials; will characterize microstructures and high and low rate properties; and will identify effect of parameters leading to shear in plastically deformed metals.					
Electronic Materials: Design and optimize electro-ceramic materials and processing techniques for integration by the Communications and Electronics Research, Development, and Engineering Command (CERDEC) into advanced antennas that will enable affordable and reliable command, control and communications (C3) for current and future force platforms. In FY08, designed and proved a materials reactor to grow thin films for tunable devices; characterized microstructural, interfacial and surface properties of the grown films. In FY09, develop unique growth process science to achieve compositionally graded ferroelectric oxide thin film materials and integrate the material into a specialized device structure. In FY10, will develop methodologies to enable low defect synthesis of ferroelectric oxide thin film materials for high quality factor/low insertion loss devices; will evaluate and develop methodologies to enable materials for Complementary Metal-Oxide Semiconductor (CMOS) compatible low cost integration; and will employ theoretical formalisms to aid the design of materials for tunable device components.		.500	.500	.497	
Structural Armor: Optimize lightweight armor materials/structures, processing methodology, and modeling and simulation tools to enable formulation of lightweight, frontal, and structural armors. In FY08, devised processing capabilities to fabricate multi-layer and hybrid materials; proved ballistic multi-hit capability while maintaining single hit performance; showed capability to fabricate constant-radius, curved, transparent ceramic plates, and applied advanced polishing techniques.		5.047	5.002	5.341	

Exhibit R-2a, PB 2010 Army RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602105A MATERIALS TECHNOLOGY			PROJECT NUMBER H84	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY09, evaluate transparent armors and multi-layer/hybrid materials options against current and emerging threats; provide computational models and simulations of lightweight air supported structures that allow for improved planning, and reduce the number of test coupons needed to develop new lightweight highly mobile medical tent systems. In FY10, will optimize glass-ceramic laminate transparent composite materials at reduced weight; and will examine interlaminar properties of multilaminate materials to optimize performance and reduce weight.					
Soldier Borne Armor: Optimize lightweight armor materials and defeat mechanisms against emerging threats to enable affordable design of multifunctional ballistic protective systems for the future Soldier. Provide quantitative scientific basis for modeling and simulation that result in new lethal mechanisms/protection schemes for the individual warfighter. In FY08, showed simulation capability for multiple density target with complex projectile failures; and incorporated low density surrogate and multi-density range targets into assessment methodology. In FY09, increase fidelity of simulation capability and transition second generation protection/lethality concepts to development community. In FY10, will develop and formulate materials that allow for optimal ballistic performance from low, intermediate, and high velocity impacts and blast waves and refine three dimensional reinforcement concepts for composite materials.		2.650	2.730	2.779	
Small Business Innovative Research/Small Business Technology Transfer Programs		.000	.140	.000	
Multifunctional Armor: Armor Materials (Material technologies for Soldier personnel protection will be transitioned to PE 0602786/project H98, materials for reactive armor and electromagnetic armor concepts will be used in PE 0602618/project H80, and refined in PE 0602601/project C05): In FY09, investigate composite ceramic materials to increase body armor performance while reducing weight. For ground combat and tactical wheeled vehicles, design and assess materials for reactive armor effectors to reduce fratricide and increase performance. For electromagnetic armors: develop materials capabilities for better coils and field adaptability to reduce weight and increase performance. Design and develop multifunctional materials for hybrid armor systems that provide dual threat protection capability against kinetic energy and chemical energy threats. In FY10, will characterize ceramic materials for high strain rate/shock properties; will examine the tradeoff of stiffness versus damage tolerance in materials systems by quantifying constitutive property behaviors; and will complete investigation/design of material properties for reactive armor effectors and electromagnetic armors coils.		.000	5.993	7.943	

Exhibit R-2a, PB 2010 Army RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602105A MATERIALS TECHNOLOGY	PROJECT NUMBER H84

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Total	13.622	19.909	22.068	

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.