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 0602105A: *MATERIALS 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	80.686	99.447	29.882	0.000	29.882	30.155	32.422	35.165	38.670	0	376.309
H7B: *Advanced Materials Initiatives (CA)*	56.036	72.383	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
H7G: *NANOMATERIALS APPLIED RESEARCH*	4.881	5.112	5.238	0.000	5.238	5.299	5.411	5.509	5.602	Continuing	Continuing
H84: *MATERIALS*	19.769	21.952	24.644	0.000	24.644	24.856	27.011	29.656	33.068	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.

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B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	80.937	27.206	29.812	0.000	29.812
Current President's Budget	80.686	99.447	29.882	0.000	29.882
Total Adjustments	-0.251	72.241	0.070	0.000	0.070
• Congressional General Reductions		-0.519			
• Congressional Directed Reductions					
• Congressional Rescissions		0.000			
• Congressional Adds		72.760			
• Congressional Directed Transfers					
• Reprogrammings	1.571	0.000			
• SBIR/STTR Transfer	-1.822	0.000			
• Adjustments to Budget Years	0.000	0.000	0.070	0.000	0.070

Change Summary Explanation

FY10 Congressionally directed increases.

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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
H7B: *Advanced Materials Initiatives (CA)*	56.036	72.383	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 Materials Initiatives.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	6.379	7.162	0.000	0.000	0.000
Future Affordable Multi-Utility Materials for the Army Future Combat Systems. In FY09 this Congressional Interest Item developed a rapid composite manufacturing process for vehicle materials, UAVs and prosthetics fabrication. *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	0.498	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
Control System for Laser Powder Deposition. This Congressional Interest Item developed a model-driven, feed-forward control system algorithm for form part fabrication during laser powder deposition that minimizes post process residual stresses and optimizes manufacturing turnaround times. *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 Improvised Explosive Device Simulation in Different Soils. This Congressional Interest Item investigated the effects of different types of soils and soil conditions on the blast output of shallow buried explosives. *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

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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 Nanomanufacturing of Multifunctional Sensors. In FY09 this Congressional Interest Item developed materials and process methodologies for affordably producing nano- to micro- scale multifunctional chemical/biological warfare agent sensors and structural health monitoring 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	0.997	3.979	0.000	0.000	0.000
Program #5 Nickel Boron Coating-Technology for Army Weapons. This Congressional Interest Item explored the feasibility of the Nickel-Boron (UltraCem) coating technology to improve combatant craft and tactical vehicles' operational reliability and availability. *FY 2009 Accomplishments:* FY 2009	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
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 Novel Extremity Body Armor. This Congressional Interest Item developed and characterized both penetration and blast effects on extremity armor and head gear systems, with a special emphasis on highly novel methods for secondary protection and mitigation of resulting impacts and effects of primary adverse loads. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.598	0.000	0.000	0.000	0.000
Program #7	1.196	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
Project Kryptolite. This Congressional Interest Item developed blast protection coatings and infrared enhanced coatings for the range of military 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 #8 Ultra-Endurance Coating. This Congressional Interest Item upgraded and enhanced technological coating processes and scaled-up its coating systems capabilities to enable a broader and larger range of components to be viable candidates for advanced coatings solutions. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	3.589	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
OCO FY 2011 Plans: FY 2011 OCO					
Program #9 One-Step JP-8 Bio Diesel Fuel. In FY09 this Congressional Interest Item researched and developed a means for producing JP-8 biodiesel in a single step using enzymatic or chemical methods from northern climate plants to provide reliable, safe, cost-effective, and energy efficient fuel source for the US armed forces. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.595	1.592	0.000	0.000	0.000
Program #10 Composite Applied Research and Technology for FCS and Tactical Vehicle Survivability. In FY09, this Congressional Interest Item added to promising research, which has a potential to assist in the future development of advanced lightweight multifunctional composites for combat, tactical and air manned and unmanned vehicles and individual soldier systems for the Future Force. *FY 2009 Accomplishments:* FY 2009	2.990	3.182	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
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #11 Capability Expansion of Spinel Transparent Armor Manufacturing. In FY09 this Congressional Interest Item produced a 12" by 12", low cost magnesium aluminate (MgAl2O4) spinel transparent armor plate for potential application to future lightweight tactical 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	5.103	1.591	0.000	0.000	0.000
Program #12	1.195	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
Ultrasonic Consolidation for Armor Applications. This Congressional Interest Item manufactured intermetallic hybrid laminates using ultrasonic consolidation fabrication for development of Ti/TiAl3/Al laminated blast kits with performance superior to that of titanium. *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 #13 Ultrasonic Impact Technology. In FY09 this Congressional Interest Item tested and evaluated a portable device that uses ultrasonic impact technology to restore residual comprehensive stresses in materials. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	1.195	1.990	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
OCO FY 2011 Plans: FY 2011 OCO					
Program #14 Lightweight Transparent Armor for Force Protection. This Congressional Interest Item investigated novel urethane polymer materials for advanced ballistic 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	1.994	0.000	0.000	0.000	0.000
Program #15 Next Generation Protective Seat. This Congressional Interest Item explored next generation seat concepts to mitigate the multiple shock events that are prevalent during warfare. *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 #16 Dual Stage Variable Energy Absorber. In FY09 this Congressional Interest Item investigated energy absorbing technologies capable of managing the blast energy and subsequently the loads and accelerations sustained by occupants traveling in ground vehicles subjected to mine and IED blast. *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	2.388	0.000	0.000	0.000
Program #17 Unmanned Ground Vehicle Advanced Technology Development. This Congressional Interest Item developed advanced lightweight materials, modified, hardened, and made production-ready payloads, to include extendable lift systems and robotic manipulators, that could operate as stand-alone systems or be integrated on unmanned	2.492	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
platforms to help develop the next generation payloads for increased reliability and provide insights on production ready units at an affordable cost. *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 #18 Modeling and Testing of Next Generation Body Armor. In FY09 this Congressional Interest Item developed multi-scale modeling capabilities related to personnel protective materials that enable fundamental understanding of high-rate interactions between lightweight protective materials and the body. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	1.994	1.990	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
OCO FY 2011 Plans: FY 2011 OCO					
Program #19 Development of Improved Lighter-Weight IED/EFP Armor Solutions. In FY09 this Congressional Interest Item used a novel 25 kiloton press to form an integrated armor system consisting of metals and composites that could potentially be used to meet ballistic performance criteria of lightweight tactical 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	0.997	1.592	0.000	0.000	0.000
Program #20 Advanced Conductivity Program (ACP). In FY09 this Congressional Interest Item fabricated transparent,conductive coatings that reflect in the infrared. Evaluated coatings for durability in transparent composites and tailored for optimum performance. *FY 2009 Accomplishments:* FY 2009	3.489	0.995	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
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #21 Affordable Light-Weight Metal Matrix Composite Armor. In FY09 this Congressional Interest Item established an affordable and scalable lightweight metal matrix composite (MMC) production facility to manufacture MMC ingot, and large scale rolled & squeeze cast Al MMC plates for potential use in vehicular armor solutions and accelerates the production of MMCs for other commercial industries. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.595	2.487	0.000	0.000	0.000
Program #22	3.189	3.183	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
Ballistic Armor Research. In FY09 this Congressional Interest Item conducted collaborative research to incorporate polyurethanes and select other polymeric materials into advanced lightweight multifunctional composites for combat, tactical vehicles and other damage-tolerant applications for individual soldier systems for the Future Force. *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 #23 Lattice Block Structures for AM2 Matting Replacement. In FY09 this Congressional Interest Item developed a lightweight, strong and easy to install replacement for AM-2 matting which has the potential to enable rapid expansion of parking aprons, taxiways and runways for austere airfields *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	2.492	1.592	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 #24 Lightweight Anti-Ballistic Protection for Aircraft. This Congressional Interest Item investigated the use of silicon carbide and boron carbide shaped-insert components for National Institute of Justice Level III armor systems derived from Kennon's material systems that are used to enhance the usability and performance of thermoacoustic insulation for rotorcraft. These composite constructions should be readily adaptable to various military aviation needs, as well as other applications where lightweight deployable structures are required. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.399	0.000	0.000	0.000	0.000
Program #25 Moldable Fabric Armor. In FY09 this Congressional Interest Item developed moldable fabric technology, a thermoplastic polypropylene fabric, for prospective high-performance ballistic armor applications that	1.197	2.228	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
complemented the Army's efforts to enhance the survivability of lightweight tactical vehicles and weapons systems. *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 #26 Renewable Jet Fuel from Lignocellulosic Feedstocks. In FY09 this Congressional Interest Item developed an economically efficient bio-oil production process using lignocellulosic materials as the raw feed through the use of ionic liquid pretreatment/processing and fast pyrolysis. The bio-oil has the potential to then be converted into JP-8, diesel, and gasoline using known refining processes. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	3.189	2.388	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 #27 Dev, Opt, & Trf of Reliable Test Tech for Materials Designed to Protect WF Agnst Toxic Chem Agents. 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	0.478	0.000	0.000	0.000
Program #28 Ultra Lightweight Metallic Armor. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009	0.000	0.796	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
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #29 Aluminum Armor Project. 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	0.836	0.000	0.000	0.000
Program #30 Smart Integrated Systems: Materials, Manufacturing Methods, and Structures. This is a Congressional Interest Item.	0.000	0.995	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
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 #31 Reactive Materials. 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	1.194	0.000	0.000	0.000
Program #32	0.000	1.194	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
Large-Scale Manufacturing of Revolutionary Nanostructured Materials. 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 #33 Next Generation Lightweight Electric Drive Systems for Army Weapons. 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

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #34	0.000	1.592	0.000	0.000	0.000
Next Generation High Strength Glass Fibers for Ballistic Armor Applications. 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 #35	0.000	1.592	0.000	0.000	0.000
High Strength Glass Production and Qualification for Armor Applications. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base					

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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 #36 Advanced Nanocomposite Materials for Lightweight Integrated Armor Systems. 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 #37 Materials Technology for LED Lighting Applications. 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 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H7B: *Advanced Materials Initiatives (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 #38 Distributed, Networked, Unmanned Ground Systems for Enhanced RSTA. 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	3.183	0.000	0.000	0.000
Program #39 Fused Silica for Large-Format Transparent Armor. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009	0.000	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 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H7B: *Advanced Materials Initiatives (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 #40 Lightweight Metal Alloy Foam for 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	0.000	3.183	0.000	0.000	0.000
Program #41 Advanced Composite Research for Vehicles. This is a Congressional Interest Item.	0.000	3.979	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 0602105A: *MATERIALS TECHNOLOGY*	**PROJECT** H7B: *Advanced Materials Initiatives (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 #42 Nanoelectronic Memory, Sensor and Energy Devices. 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	6.267	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	56.036	72.383	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 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H7B: *Advanced Materials Initiatives (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 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H7G: *NANOMATERIALS 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
H7G: *NANOMATERIALS APPLIED RESEARCH*	4.881	5.112	5.238	0.000	5.238	5.299	5.411	5.509	5.602	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 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	4.881	4.994	5.238	0.000	5.238
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. In FY09, validated performance enhancements (survivability, lethality, sustainability) enabled through insertion of nanomaterials constituents in scalable processes. In FY10, examine concepts for the absorption of energy in personnel protection applications. In FY11, will research novel materials and hybridization of materials for personnel protection in ballistic environments.					
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 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	0.118	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	4.881	5.112	5.238	0.000	5.238

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 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H7G: *NANOMATERIALS APPLIED 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 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H84: *MATERIALS*	

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
H84: *MATERIALS*	19.769	21.952	24.644	0.000	24.644	24.856	27.011	29.656	33.068	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 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	5.002	5.225	5.913	0.000	5.913
Structural Armor: Optimize lightweight armor materials/structures, processing methodology, and modeling and simulation tools to enable formulation of lightweight, frontal, and structural armors. In FY09, evaluated transparent armors and multi-layer/hybrid materials options against current and emerging threats; provided 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, optimize glass-ceramic laminate transparent composite materials at reduced weight; and examine interlaminar properties of multilaminate materials to optimize performance and reduce weight. In FY11, will determine candidate materials and configurations for ceramic only transparent armor solutions; and characterize materials properties and microstructures to determine optimal configurations for ballistic protection.					

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 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H84: *MATERIALS*

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 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 FY09, increased fidelity of simulation capability and transitioned second generation protection/lethality concepts to development community. In FY10, 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. In FY11, will develop new, mass-efficient, protection materials and technologies to mitigate energy from both ballistic and blast events. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	2.730	2.779	3.150	0.000	3.150

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	4.198	4.118	4.533	0.000	4.533
Composites: 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 FY09, designed material system to provide the desired multi-functional capability to enhance damage on relevant targets and conducted benchmark testing with that material system. In FY10, develop novel nano-micro-structures in metallic materials; characterize microstructures and high and low rate properties; and identify effect of parameters leading to shear in plastically deformed metals. In FY11, will establish a complete set of parameters that will lead to adiabatic (no heat given off or absorbed) shear behavior of fully dense pure metals; and will scale processing approach and produce samples of sufficient size to permit sub-scale ballistic evaluation. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					

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 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H84: *MATERIALS*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #4	0.500	0.497	0.500	0.000	0.500
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 FY09, developed unique growth process science to achieve compositionally graded ferroelectric oxide thin film materials and integrated the material into a specialized device structure. In FY10, develop methodologies to enable low defect synthesis of ferroelectric oxide thin film materials for high quality factor/low insertion loss devices; evaluate and develop methodologies to enable materials for Complementary Metal-Oxide Semiconductor (CMOS) compatible low cost integration; and employ theoretical formalisms to aid the design of materials for tunable device components. In FY11, will advance optimization methodologies to enable low defect synthesis of ferroelectric oxide thin film materials; and will perform optimization of low temperature synthesis of ferroelectric oxide thin film materials for CMOS compatibility and integration. *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	1.346	1.390	1.486	0.000	1.486
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					

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 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H84: *MATERIALS*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
for individual Soldier protection in project H7G. In FY09, scaled-up the process methodology for fabricating fully-dense, boron carbide plates; performed microstructural and mechanical property characterization. In FY10, develop relationships between scaled-up processing of nanoscale materials and processing; characterize reactive materials and provide feedback to model developers. In FY11, will develop new reactive structural material compositions and optimize microstructures based on models and testing; and will characterize nanoscale structures using analytical microscopy tools. *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 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, investigated composite ceramic materials to increase body armor performance while reducing weight. For ground combat and tactical wheeled vehicles, designed and assessed materials for reactive armor effectors to reduce fratricide and increase performance. For electromagnetic armors: developed materials capabilities for better coils and field adaptability to reduce weight and increase performance. Designed and developed multifunctional materials for hybrid armor systems that provide dual threat protection capability against kinetic energy and chemical energy threats. In	5.993	7.746	9.062	0.000	9.062

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 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H84: *MATERIALS*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY10, characterize ceramic materials for high strain rate/shock properties; examine the tradeoff of stiffness versus damage tolerance in materials systems by quantifying constitutive property behaviors; and complete investigation/ design of material properties for reactive armor effectors and electromagnetic armors coils. In FY11, will perform failure mode characterization of passive and active armor materials; will determine propagation fracture toughness in ceramics and measure and model residual stress in metal matrix composite armor materials; will develop scale up processes for multi-modal materials microstructures; will examine novel metallic structures to reduce weight and manage ballistic impact loads. *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 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	0.197	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 0602105A: *MATERIALS TECHNOLOGY*	PROJECT H84: *MATERIALS*

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	19.769	21.952	24.644	0.000	24.644

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.