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 0602303A MISSILE 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	67.097	56.747	50.716						Continuing	Continuing
G04: AIR DEFENSE TECHNOLOGIES (CA)	.000	2.552	.000						Continuing	Continuing
G05: MISSILE TECHNOLOGY INITIATIVES (CA)	3.383	1.396	.000						Continuing	Continuing
G06: UNMANNED SYSTEMS TECHNOLOGIES (CA)	1.546	.000	.000						Continuing	Continuing
214: MISSILE TECHNOLOGY	51.734	48.015	50.716						Continuing	Continuing
223: AERO-PROPULSION TECHNOLOGY	10.434	4.784	.000						Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) designs and develops advanced component technologies for missiles, rockets, and launch systems in order to increase the lethality and effectiveness of tactical missiles and guided interceptors under adverse battlefield conditions, enhance the survivability of launch systems, increase kill probabilities against diverse targets, and provide advanced simulation and virtual prototyping analysis tools.

The work in this PE is related to, and fully coordinated with, with PE 0603313A (Missile and Rocket Advanced Technology), PE 0602624A (Weapons and Munitions Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and PE 0602618A (Ballistics Technology, Robotics 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.

The work in this PE is performed by the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

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 0602303A MISSILE TECHNOLOGY

B. Program Change Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011
Previous President's Budget	60.935	48.174	48.194	
Current BES/President's Budget	67.097	56.747	50.716	
Total Adjustments	6.162	8.573	2.522	
Congressional Program Reductions	.000	-.187		
Congressional Rescissions	.000	.000		
Total Congressional Increases	.000	8.760		
Total Reprogrammings	7.375	.000		
SBIR/STTR Transfer	-1.213	.000		

Change Summary Explanation

FY08 funding increased due to transfer of congressional interest items for proper execution from PE 0602307A.
FY09 funding increase is 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 0602303A MISSILE TECHNOLOGY					PROJECT NUMBER G04	
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**
G04: AIR DEFENSE TECHNOLOGIES (CA)	.000	2.552	.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 2008	FY 2009	FY 2010	FY 2011
SBIR/STTR	.000	.072	.000	
D-NET: Electrically Charged Mesh (ECM) Defense Net Troop Protection System	.000	2.480	.000	
Total	.000	2.552	.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 0602303A MISSILE TECHNOLOGY					PROJECT NUMBER G05	
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**
G05: MISSILE TECHNOLOGY INITIATIVES (CA)	3.383	1.396	.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 2008	FY 2009	FY 2010	FY 2011
Materials Applications Research Center	.967	.775	.000	
Center of Excellence in Integrated Sensor Systems (CEISS)	.000	.581	.000	
SBIR/STTR	.000	.040	.000	
Jam Resistent Technology for INS/GPS Precision	1.449	.000	.000	
Novel Lightweight Armor Material for Insensitive Munitions Protection of Tactical Missiles	.967	.000	.000	
Total	3.383	1.396	.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 0602303A MISSILE TECHNOLOGY					PROJECT NUMBER G06	
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**
G06: UNMANNED SYSTEMS TECHNOLOGIES (CA)	1.546	.000	.000						Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Unmanned Systems Technologies applied research.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Unmanned Systems Initiative at AMRDEC	1.546	.000	.000	
Total	1.546	.000	.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 0602303A MISSILE TECHNOLOGY					PROJECT NUMBER 214	
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**
214: MISSILE TECHNOLOGY	51.734	48.015	50.716						Continuing	Continuing

A. Mission Description and Budget Item Justification

This project designs and develops missile and rocket component technologies that support demonstration of lightweight, highly lethal missiles. Major areas of research include missile guidance components and subsystems; air defense target acquisition systems; multi-spectral seekers; high-fidelity simulations; missile aerodynamics and structures; and missile propulsion including research to help solve the insensitive munitions requirements. A theme embedded throughout the efforts in this project is developing smaller, lighter, and cheaper (SLC) missile technology to reduce the cost and logistics burden of precision munitions. Major products of this PE transition to PE 0603313A (Missile and Rocket 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 Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Smart, Stealthy, Smokeless Missile Propulsion, Smart Structures and Enhanced Lethality: The effort is developing enabling technologies to advance missile propulsion, lethality, structural integrity and reduce launch signatures. In FY08, investigated new propellant formulations that operate efficiently over extreme temperature ranges. Demonstrated a fully integrated dynamic Hardened Combined Effects Warhead with enhanced blast and fragmentation characteristics against heavy armor and Military Operations on Urban Terrain (MOUT) targets. Designed, fabricated, and tested distributed thermal ignition concept and grain surface energetic coating schemes in order to improve engagement timeline and accuracy through prompt and repeatable rocket motor ignition with reasonable cost, weight, and volume in support of Active Protection Systems. In FY09, develop propellant candidates designed to operate efficiently in extreme temperature ranges in coordination with PE 0602624A. Investigate multi-mode warhead characteristics using multi-point initiation concepts to control the energy deposited on the target; and variable yield warhead technologies to vary the effects on target and minimize collateral	7.021	6.973	5.694	

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APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602303A MISSILE TECHNOLOGY		PROJECT NUMBER 214		
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
damage. Develop safe and arm logic to integrate with target classification sensor and investigate selectable multi-point firing control. In FY10, will demonstrate and validate missile control thruster analysis tools and design concepts for small diameter applications and will fabricate multi-point initiation warheads and conduct tests to determine the energy deposition effect of the warhead.					
Multi-Role Missile Engine and Missile Component Design: This effort focuses on critical technology and component design to provide a diverse and versatile mix of fires and fused effects capabilities for force protection and overwhelming defeat of conventional and asymmetrical threats in all environments. Successful technologies developed will transition to system development activities in PE 603313A project 263. In FY09, design and develop new ground and air defense missile concepts based on the integration of breakthrough component tests. Demonstrate critical underlying component technologies (e.g. seeker, propulsion, and lethal mechanisms) in laboratory and field environments. In FY10, will investigate, design and develop critical technologies to: enable miniaturization/packaging of sensors, guidance packages and electronics; develop more efficient, advanced propulsion; and explore advanced warhead integration and lethal effects and non-lethal payload options. Will perform high-fidelity modeling and simulation to support trade-studies, requirements definition, and performance evaluations of the specific technologies and components as they apply to various tactical missions.		.000	4.877	7.482	
Small Business Innovative Research/Small Business Technology Transfer Programs		.000	.795	.000	
Insensitive Munitions (IM) Research: The effort is developing missile propellant formulations and explosive mitigating technologies to enable missiles to meet IM requirements. In FY08, conducted ballistic/aging evaluation on new propellant formulations. Developed integrated passive venting designs and characterized performance of lightweight barrier concepts to impact and thermal threats.		1.065	1.073	.000	

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APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602303A MISSILE TECHNOLOGY		PROJECT NUMBER 214		
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY09, demonstrate improved IM response of a minimum smoke motor with new propellant formulation and integrated venting to bullet impact, fragment impact, fast cook off, and slow cook off environments. Demonstrate improved IM response to thermal threats of high performance motor with new propellant formulation and integrated venting and evaluate endothermic barrier materials.					
Defense against Rockets, Artillery and Mortars (RAM) - Interceptor Development: This effort designs and develops enabling component missile technologies to transition to defense against rockets, artillery, and mortars efforts in PE 0603313A. In FY08, completed testing of sensors and control systems, updated system simulations, developed preliminary integrated interceptor design. In FY09, begin bench level testing of component technologies and begin integration into RAM interceptor design and update error budgets and system level simulations with results. Exercise the simulations to evaluate interceptor performance in expected operational scenarios. In FY10, will complete bench level testing and integration of component technologies and perform Hardware-in-the-Loop testing and develop and integrate flight guidance and control software into RAM interceptor in support of planned live fire testing under PE 0603313A.		9.386	6.828	2.994	
Missile Guidance Systems and Seeker Technology: This effort is focused on the design and development of missile seekers and sensors; guidance, navigation, and control technologies and software; and information and signal processing. In FY08, transitioned target algorithm software to Non-Line of Sight Launch System and initiated Human Tracking Technology development for anti-personnel weapon systems. Built and tested Phased Arrays for Tactical Seekers sub-arrays. In FY09, incorporate threat target and environment simulation scenes for infrared (IR) and millimeter wave (MMW) multi-mode seeker algorithm, tracker, and Aided Target Acquisition/Recognition (ATA/R) development, data fusion, and transition ATA/R and Synthetic Aperture Radar (SAR) image resolution to unmanned aviation system and missile		16.028	12.350	11.773	

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 0602303A MISSILE TECHNOLOGY		PROJECT NUMBER 214		
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
developers. Fabricate an IR seeker with electronically stabilized imager Complete initial design and fabrication of target material classifying sensor based on lab testing. In FY10, will initiate the development of IR and MMW target acquisition and tracking algorithms combining imagery and image feature data. Will complete the SAR design and begin testing; and design and develop a vision based navigation system, the Image Gyro (IG) system. The IG concept will develop an independent navigation solution using camera imagery and terrain databases to provide geo-location data when GPS navigation data is not available.					
High Fidelity System Level Simulations and Aerodynamics: The use of advanced simulation and aerodynamics tools promises to reduce size, lighten the weight, and reduce cost in missile systems. Solar exposure simulation and testing is an enabling technology to evaluate infrared (IR) missile seeker performance due to solar effects in or out of the field of view. In FY08, completed infrared solar spectrum requirements analysis and feasibility studies to fill the gap that exists in missile solar exposure simulation and testing. Installed and tested Hardware-in-the-loop (HWIL) simulation control software in a range of simulation capabilities (including waveform generator and scene generation interface software) and extended aerodynamic prediction techniques for evaluating novel aerodynamic shapes. In FY09, complete initial spectral and optics/platform designs and begin IR radiation component development for solar exposure simulation and test. Extend HWIL simulation control software to improve user capabilities and extend aerodynamic prediction techniques to address fully turbulent, short correlation length, unsteady flows. In FY10, will transition initial solar infrared simulator components to PE 0603313A missile simulation technology program for the system level development. Will continue extension of aerodynamic prediction codes and will initiate an effort to develop improved methods for missile subsonic airfoil design and characterization.		2.917	3.288	1.967	
Smaller, Lighter, Cheaper (SLC) Tactical Missile Technologies: SLC designs and develops innovative smaller, lighter, and cheaper component technologies and concepts to reduce precision missile cost per kill and/or logistics burden to meet urban and emerging threats. These technologies transition to PE 0603313A for maturation.		6.773	5.365	7.926	

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 0602303A MISSILE TECHNOLOGY		PROJECT NUMBER 214	
B. Accomplishments/Planned Program ($ in Millions)	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY08, completed component testing of Multi-Purpose Warhead (MPW) designs. Finalized design, fabricated, and tested miniaturized Guidance Electronic Unit for insertion into precision weapon systems. Identified requirements, conducted trade studies, and completed a rate sensor design package for a form, fit and function upgrade to the TOW missile Gyro. In FY09, leverage latest in nano/advanced technology composite materials for lighter and stronger missile components and electronics packaging to achieve small, light, missile form factors; begin development of advanced image-based stabilization and people tracking; assess light-weight propulsion solutions to safely fire from enclosure (FFE).Will conduct trades, build prototype designs and test SLC components in relevant environments. In FY10, will develop designs for nano/advanced composite missile structures; conduct requirements definition and trade studies for a small height of burst sensor (HOBS) design that provides lethality against soft targets; continue electronics packaging and image stabilization and tracking algorithm development; Initiate scale-up of common MPW for TOW; evaluate common Electronic Safe and Arm Device (ESAD) architecture for application to Close Combat Missile Systems (CCMS); and complete initial designs and testing for FFE insensitive munition compliant motor.				
High-G Microelectromechanical Systems (MEMS) Inertial Measurement Unit (IMU): This effort designs and develops high gravitational force, low cost Micro electromechanical Systems Inertial Measurement Units capable of supporting precision guidance requirements of Department of Defense missile and gun launched precision munitions programs. This effort was performed in 3 Phases, with incremental improvements in size, precision and gun hardening. The Phase 3 design requirements include 2.0 cubic inch volume, 1 degree per hour sensitivity, and gun hardened to 20kG. In FY08, performed laboratory characterization testing and a missile and munition flight test of the Phase 3 IMUs, and current DIGNU design, including anti-jam (A/J) capability, and further miniaturized the A/J module, inertial sensor, deep integration algorithms, Global Positioning System receiver, and their interaction.	3.100	.000	.000	
Embedded Deeply Integrated Guidance & Navigation Unit (eDIGNU) Technology Advancements: This effort builds on previous High-G MEMS IMU and DIGNU research. The Embedded DIGNU incorporates the following: a next generation Selective Availability Anti-Spoofing Module (SAASM); enhanced anti-jam (A/J) capability; full system-on-a-chip (SOC)	5.444	6.466	7.490	

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APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602303A MISSILE TECHNOLOGY		PROJECT NUMBER 214		
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
technology for processor and memory to reduce size; more robust deep integration algorithms; and improved inertial performance. This task is conducted in Phases A and B to provide incremental improvements in inertial performance, electronics, and packaging. In FY08, performed design, fabrication, field tests, and laboratory characterization of Phase A DIGNU design, including A/J capability, and further miniaturized the A/J module. Component development focused on reducing errors due to vibration, improving performance, and minimizing size. The current DIGNU was tested against the following requirements: gyro bias less than 1 deg/hr; volume less than 6 cubic inches; acceleration bias less than 1 milli-G; jamming-to-signal ratio greater than 90 db; and gun-hardened to 20KG. In FY09, fabricate and test gyro and accelerometer sensors, test different platforms, dynamics, and mission envelopes; conduct test flight scenarios with hardware-in-the-loop; conduct government test of 12 Phase A deliverable IMUs and 2 DIGNUs of inertial sensor, deep integration algorithms, A/J capability, Global Positioning System (GPS) receiver, and their interaction. In FY10, will complete test of the final inertial sensor assembly design and the Phase B integrated eDIGNU to verify requirements are met. Twelve IMU deliverables will include new gyro and accelerometer sensors, electronics iteration improvements, and packaging improvements. Eight DIGNU Phase B deliverables will include a full SOC module; increased A/J capability; updated code for the new inertial sensor assembly; and deep integration and Kalman Filter algorithm improvements.					
Target Classification Sensors, Advanced Fuzing Technology (AFT) and Warhead Integration: This effort is designing and developing a low cost sensor capable of identifying the target class on impact and advanced fuzing technology to modify the warhead effect based on target class. The determination of the different target classifications (e.g. heavy armor, light armor, Military Operations on Urban Terrain) will be derived from the collaborative Multi-Mode, Multi-Effect (MMME) warhead effort at ARDEC (PE 0602624). In FY10, will complete the design and fabrication of the second generation target classifying sensor and integrate with miniaturized electronics. Will evaluate the inertial sensors ability to identify three different target classes through lab testing and begin preliminary design and fabrication of the improved sensor which will identify six different target classes. Will develop an integrated fuze design and bench test equipment for sensor test against target materials; conduct		.000	.000	5.390	

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
preliminary fuze-level safety tests in preparation for warhead integration tests; perform static tests with warheads to assess fuze performance and perform inert tests with air gun or similar test equipment to demonstrate sensor function.				
Total	51.734	48.015	50.716	

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 0602303A MISSILE TECHNOLOGY					PROJECT NUMBER 223	
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**
223: AERO-PROPULSION TECHNOLOGY	10.434	4.784	.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 2008	FY 2009	FY 2010	FY 2011
Mariah II Hypersonic Wind Tunnel Develpment Program	3.865	3.101	.000	
LENS XX Hypervelocity Ground Testing	.774	1.550	.000	
Missile Aero-Propulsion Computer System Modernization	5.795	.000	.000	
SBIR/STTR	.000	.133	.000	
Total	10.434	4.784	.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.