Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
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 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	48.092	67.079	49.383	-	49.383	43.650	49.038	38.660	39.064	Continuing	Continuing
214: *MISSILE TECHNOLOGY*	48.092	50.605	49.383	-	49.383	43.650	49.038	38.660	39.064	Continuing	Continuing
G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*	-	16.474	-	-	-	-	-	-	-	Continuing	Continuing

Note

FY12 funding increase is due to congressional add.

A. Mission Description and Budget Item Justification

This program element (PE) designs, fabricates and evaluates advanced component technologies for tactical missiles, rockets, guided munitions, and their launch systems in order to increase lethality, precision, and effectiveness under adverse battlefield conditions while reducing system cost, size and weight. Major goals in Project 214 include enhancing the survivability of the munition, launch and fire control systems; and increasing kill probabilities against diverse targets.

The work in this PE is complimentary to PE 0603313A (Missile and Rocket Advanced Technology), and fully coordinated with PE 0602307A (Advanced Weapons Technology), PE 0602618A (Ballistics Technology, Robotics Technology), PE 0602624A (Weapons and Munitions Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and PE 0708045A (End Item Industrial Preparedness Activities).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

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

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B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	49.525	50.685	50.822	-	50.822
Current President's Budget	48.092	67.079	49.383	-	49.383
Total Adjustments	-1.433	16.394	-1.439	-	-1.439
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	16.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.865	-			
• Adjustments to Budget Years	-	-	-1.439	-	-1.439
• Other Adjustments 1	-0.568	-0.106	-	-	-

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COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
214: *MISSILE TECHNOLOGY*	48.092	50.605	49.383	-	49.383	43.650	49.038	38.660	39.064	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project designs, fabricates, and evaluates missile and rocket component technologies that support demonstration of affordable, lightweight, highly lethal missiles and rockets. Major areas of research include: guidance, navigation, and controls; target acquisition systems; multi-spectral seekers; high-fidelity simulations; sustainment; aerodynamics and structures; launch systems, fire control technologies; payloads; and propulsion including research to help solve the insensitive munitions requirements. A theme embedded throughout the efforts in this project is smaller, lighter, and cheaper (SLC) missile technology to reduce the cost and logistics burden of precision munitions.

This project supports the ground portfolio.

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 science and technology priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Smaller, Lighter, Cheaper Tactical Missile Technologies	8.301	12.744	12.187
Description: This effort designs and evaluates innovative smaller, lighter, and cheaper component technologies as well as system 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.			
FY 2011 Accomplishments: Designed, fabricated, and evaluated sample composite mounting brackets with integrated electrical conductivity to increase strength and reduce weight; tailored common electronic safe and arm device (ESAD) design for upgrades to Tube-launched, Optically-tracked, Wire-guided (TOW) and Javelin missiles; completed small ESAD design, fabrication and component evaluation for small lightweight precision munitions; designed and evaluated candidate small height of burst sensor (HOBS) and single chip inertial sensor designs for small precision munitions.			
FY 2012 Plans: Perform trade studies and begin initial critical component design for a small, light, low power navigation-grade sensor package that can detect and maintain track of the direction north; conduct initial packaging of single chip inertial sensor module; conduct			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
trade studies for small, low cost components for precision munitions; design component technologies for the next generation of precision weapon systems including: 1) reduced cost, advanced light weight materials; 2) reduced cost, advanced seeker technologies for increased detection range; 3) lethality technologies for performance against increased target sets; and 4) advanced propulsion and controls technology for multiple mission capabilities. ***FY 2013 Plans:*** Will continue design and development of a small, light weight, low power navigation sensor for applications such as precision targeting and miniature precision munitions, and single chip Inertial Measurement Units; based on trade studies for low cost, precision munition components and system concepts, design, fabricate, and evaluate component technologies for the next generation of precision weapon systems including reduced cost, advanced light weight materials; lethality technologies for performance against increased target sets; advanced sensor and tracking technologies for improved target acquisition, and advanced propulsion for multiple mission scenarios.			
Title: Target Classification Sensors, Advanced Fuzing Technology and Warhead Integration ***Description:*** This effort designs and demonstrates a low cost inertial sensor capable of identifying the target material class (heavy armor, light armor, concrete, sand, aluminum, and brick) on impact, and advanced fuzing technology to use target classification sensor data for optimizing the warhead effectiveness based on target class. The determination of the different target classifications will be derived from the collaborative Multi-Mode, Multi-Effect warhead effort designed in PE 0602624A Weapons and Munitions Technology. ***FY 2011 Accomplishments:*** Determined the ability of the third generation target classification sensor to identify the six target classes defined in collaboration with the Armaments Research, Development, and Engineering Center (ARDEC). Integrated the improved third generation target classification sensor with miniaturized electronics to reduce the sensor footprint in a hardened package that can operate in real-time. Integrated sensor with advanced fuzing technology and demonstrated in the lab with explosively driven reverse ballistic hardware and/or an air gun to impact the sensor with target materials.	3.705	-	-
Title: Missile Seeker Technology ***Description:*** This effort focuses on the design and maturation of missile seekers, sensors, and software. The goal is to increase performance of missile seekers through improvement of algorithms, imaging, and thermal management. Beginning in FY13, Fire control seeker technology will be captured in the Sustainment, Simulations, Launchers, and Fire Control Systems effort below. ***FY 2011 Accomplishments:***	9.663	9.140	10.525

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Designed and evaluated affordable phased array and next-generation imaging seeker components to enable affordable all-weather missile fire control sensors, tactical seekers, and data links; matured technologies to monitor missile system health to extend missile shelf-life; and validated low cost synthetic aperture radar (SAR) seeker evaluation results. ***FY 2012 Plans:*** Begin to address thermal issues for affordable phased array seeker technologies; continue optimization of phased array seeker operating power levels; begin integration of affordable phased array technologies to demonstrate a seeker array with appropriate power levels and in a form factor for missile applications; continue design of the next-generation imaging seeker components including technologies for thermal loading reduction to minimize cool-down time and significantly reduce the cost of infrared seekers; evaluate missile system health monitor performance in a relevant environment; design reconfigurable SAR evaluation test-bed for demonstration of tactical missile applications. ***FY 2013 Plans:*** Will address thermal issues for phased array seekers; optimize operating power levels; integrate components into seeker sub-arrays; design, fabricate, and demonstrate lower cost imaging infrared seekers with advanced cooling technologies; design and fabricate an autonomous radar frequency seeker for miniature guided munitions and evaluate in a laboratory; fabricate evaluation test-bed to demonstrate radio frequency seekers in tactical missile applications; design algorithms to improve image processing, tracking, and handover from air platform capabilities for missile seekers; and evaluate nanotechnology for power storage, sensors, and guidance in small guided munitions.			
Title: Missile Guidance, Navigation and Controls Technologies ***Description:*** This effort designs, fabricates and evaluates guidance, navigation, and control systems and software, as well as information and signal processing systems for rocket and missile applications. Goals of this effort include more affordable missile guidance; miniaturization of guidance electronics; maintaining performance in global positioning system denied environments; improved image processing; improved missile power systems; improved communication with ground and other systems; technologies to track and respond to swarms of incoming and outgoing munitions; and electrical connections embedded in missile structures. Beginning in FY13, the Structural Electronics effort below will be included in this effort. ***FY 2011 Accomplishments:*** Designed image gyro system using camera imagery and terrain databases to provide a navigation solution when data is not available from the global positioning system; developed miniaturized guidance electronics; simulated imagery and image feature data combination for infrared and millimeter wave multi-mode seeker algorithm development; and completed evaluation of inertial navigation systems developed under the Enhanced Deeply Integrated Guidance and Navigation Unit effort previously completed in this Project. ***FY 2012 Plans:***	6.760	7.416	7.052

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Integrate image gyro system hardware and software for captive flight demonstration; complete laboratory and limited environmental evaluation of a one-piece, integrated optical data pipe module; design enhanced miniaturized image stabilization hardware module for transition to the Small Organic Precision Munition effort in PE 0603313 Project 263; investigate technologies for increased accuracy and precision of acceleration measurements for navigation in a Global Positioning System denied environment; and complete data combination for infrared and millimeter wave multi-mode seeker algorithm development. ***FY 2013 Plans:*** Will evaluate and demonstrate the image gyro navigation solution for image based navigation; continue design of an enhanced miniaturized image stabilization and tracker hardware module; evaluate reduced size, weight, and power inertial navigation systems with increased accuracy and guidance technologies to reduce reliance on global positioning system for missiles; and continue to design and develop structural electronics in missile subsystems and apply to the missile as a whole.			
Title: Missile Sustainment, Simulations, Launchers, and Fire Control Systems	2.848	3.054	5.480
Description: This effort designs and evaluates advanced health monitoring technologies to increase missile useful life; advanced simulations to increase performance and reduce size, weight, and cost in missile systems; launchers to deliver effects from the air and ground platforms; and fire control systems for area protection and air defense. Beginning in FY13, Fire Control efforts from the Missile Seeker Technologies will be captured in this effort and the Missile Aerodynamics efforts will be presented in the Missile Propulsion, Structures, Lethality, and Aerodynamic Technology section below. ***FY 2011 Accomplishments:*** Continued improving methods for subsonic airfoil design and characterization as well as completed updates to aerodynamic prediction codes; collected wind tunnel data on multiple airframe designs to validate and improve aerodynamic prediction models and techniques; designed advanced simulation technologies to enable missile component trade studies; and designed technologies to enable more reliable micro-electromechanical missile components. ***FY 2012 Plans:*** Design aerodynamic prediction codes for hypersonic flight, dynamic damping derivatives prediction methods, airfoil section enhancements, and inlet aerodynamics; design integrated baseline system engineering tool for system-level simulations linking missile component models to system capability; design and evaluate health monitoring technologies for current and future missile systems. ***FY 2013 Plans:*** Will continue development of integrated missile design tool for system-level analysis; design, evaluate, and demonstrate next generation of health monitoring technologies for current fielded applications and future missile system needs; analyze advanced interfaces between launcher and weapon to provide more targeting information to the missile; design and demonstrate small			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
signature, slow air target classification algorithms for fire control radars; and integrate and demonstrate a state-of-the-art, affordable active electronically steered aperture architecture with enhanced target range and classification into a radar test bed.			
Title: Missile Propulsion, Structures, Lethality, and Aerodynamic Technology ***Description:*** This effort designs, fabricates, evaluates, and demonstrates missile enabling technologies including: advanced missile propulsion with reduced launch signatures; increased lethality and range of lethality options; improved structural integrity of light weight missile cases; and beginning in FY13, increased understanding of missile aerodynamic interactions previously captured under the High Fidelity Simulation effort above. ***FY 2011 Accomplishments:*** Performed a flight demonstration of a variable yield warhead against a representative concrete target and transitioned to Guided Multiple Launch Rocket System; investigated feasibility of using existing and new propellant ingredients in missile and rocket propulsion to regain performance while maintaining insensitive munitions compliance. ***FY 2012 Plans:*** Demonstrate high performance propellants; perform signature evaluations of current Army ignition materials as a baseline for the signature metrics; and develop, screen for sensitivity, and characterize candidate ignition materials. ***FY 2013 Plans:*** Will formulate, synthesize, and evaluate higher performance energetic materials for minimum smoke missile propulsion while improving insensitive munitions performance; design, fabricate, and evaluate lightweight thermal barriers for next generation extended range propulsion systems; evaluate and simulate the integration of first iteration variable effects warhead in a missile system form factor; evaluate energetic technologies to enable effects against electronic devices; continue design, fabrication, and evaluation of composite structural components for missile systems and their launchers; continue to design simulations to evaluate high speed missile aerodynamics and separation effects of missiles on weaponized unmanned aircraft.	4.821	4.194	6.239
Title: Multi-Role Missile Technology ***Description:*** This effort evaluates critical technology and designs component for future affordable rockets and missiles to provide overwhelming defeat of conventional and asymmetrical threats in all environments. Beginning in FY13, the Swarming Missiles Technologies effort below will be captured here. Successful technologies are matured and demonstrated in PE 603313A Project 263. ***FY 2011 Accomplishments:***	9.257	9.838	7.900

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Refined, fabricated, and evaluated components and subsystems including: 1) miniaturization/packaging of sensors, guidance, and electronics; 2) more efficient, advanced propulsion; 3) warhead integration and lethal effects including non-lethal payload options; performed trade studies to determine the component technologies to support improved precision fire engagements. ***FY 2012 Plans:*** Continue to evaluate components and subsystem technologies including: 1) miniaturized and reduced cost guidance electronics, seekers, and sensors; 2) more efficient and insensitive munitions compliant propulsion systems for small guided munitions; 3) warhead integration for effects against diverse targets; and 4) fire control using hardware-in-the-loop evaluation, live-fire evaluation, and, appropriate test-beds to determine component and subsystem performance as well as suitability to various missions; and continue trade studies to optimize component, subsystem, and system design. ***FY 2013 Plans:*** Will perform system and component level trade studies to design a long range missile; design and evaluate modular components for a lightweight missile system with multiple configurations launched from manned and unmanned aircraft, and refine the design of the lightweight air launched missile based on evaluation of critical components and begin integration for a system-level demonstration; and design and evaluate guidance and tracking algorithms as well as sensor technology to support attack of a large array of targets.			
Title: Swarming Missile Technology ***Description:*** This effort evaluates advanced sensors, guidance, control, and fire control components for employing low-cost swarming missile concepts against individual as well as large arrays of air and ground targets. Beginning in FY13, this effort will be captured in Multi-Role Missile Technology. ***FY 2011 Accomplishments:*** Defined swarming missile mission concepts to derive and define key performance parameters for these missions; identified key component technologies for design and demonstration. ***FY 2012 Plans:*** Finalize key component technology identification based on trade studies performed; begin key component technology design; begin guidance and control algorithm design to support attack of large arrays of targets; evaluate options for low cost advanced sensor design for tracking of large arrays of targets.	1.661	2.913	-
Title: Structural Electronics ***Description:*** This effort investigates innovative processes to embed electrical connections into the missile case structure for use in smaller missile designs. Beginning in FY13, this effort is captured in Missile Guidance, Navigation, and Control Technology above.	1.076	1.306	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Investigated mechanical and electrical properties of emerging approaches to embed electrical connections in curved forms regarding their applicability to missile structure and component design. ***FY 2012 Plans:*** Fabricate and evaluate sample missile electronics subsystems based on prior year results; evaluate suitability for missile system application; and document design guidelines based on results.			
Accomplishments/Planned Programs Subtotals	48.092	50.605	49.383

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.

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COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*	-	16.474	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013
Title: Missile Lethality and Precision Research	-	16.474	-
Description: This is a Congressional Interest Item.			
FY 2012 Plans: Congressional add funding for Missile Lethality and Precision Research.			
Accomplishments/Planned Programs Subtotals	-	16.474	-

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.