Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army											Date: February 2015	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602303A / *Missile Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2014**	**FY 2015**	**FY 2016 Base**	**FY 2016 OCO**	**FY 2016 Total**	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**	**Cost To Complete**	**Total Cost**
Total Program Element	-	58.426	62.180	45.053	-	45.053	44.313	45.326	46.744	47.543	-	-
214: *Missile Technology*	-	50.426	46.180	45.053	-	45.053	44.313	45.326	46.744	47.543	-	-
G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*	-	8.000	16.000	-	-	-	-	-	-	-	-	-

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.

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	59.500	46.194	45.382	-	45.382
Current President's Budget	58.426	62.180	45.053	-	45.053
Total Adjustments	-1.074	15.986	-0.329	-	-0.329
• Congressional General Reductions	-	-0.014			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	16.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.074	-			
• Adjustments to Budget Years	-	-	-0.329	-	-0.329

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602303A / *Missile Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2014	FY 2015
Project: G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Program Increase*	8.000	16.000
Congressional Add Subtotals for Project: G05	8.000	16.000
Congressional Add Totals for all Projects	8.000	16.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602303A / *Missile Technology*	Project (Number/Name) 214 / *Missile Technology*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
214: *Missile Technology*	-	50.426	46.180	45.053	-	45.053	44.313	45.326	46.744	47.543	-	-

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 Lethality and C3I portfolios.

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 2014	FY 2015	FY 2016
Title: Smaller, Lighter, Cheaper Tactical Missile Technologies	6.294	8.809	-
Description: This effort designs and evaluates innovative smaller, lighter, and cheaper component technologies as well as system concepts to reduce ground tactical precision missile cost per kill and/or logistics burden to meet urban and emerging threats. These technologies transition to PE 0603313A for maturation.			
FY 2014 Accomplishments: Finalized design of a small, light weight, low power, robust navigation sensors developed for on-the-move targeting; completed integration and test of a lightweight composite housing for far target location systems; completed initial design of extended-range, reduced time-of-flight, smaller form-factor insensitive propulsion technology for multiple-mission applications; continued trade studies of the next-generation close-combat, precision weapon systems for performance against increased target sets (e. g., lethality, guidance); developed advanced sensor and tracking technologies for improved target acquisition.			
FY 2015 Plans: Complete design, fabricate, and test advanced composite housing for Javelin Light Weight Command Launch Unit (LW CLU); fabricate and test a small, light weight, low power inertial navigation sensor developed for robust man-portable close-combat targeting performance, and complete design of an increased accuracy modular inertial navigation sensor with reduced size,			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602303A / *Missile Technology*	**Project (Number/Name)** 214 / *Missile Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
weight, and power (SWaP) and on-the-move capabilities (both targeting and navigation); fabricate and test reduced SWaP, increased range acquisition sensor for Javelin LW CLU; integrate components into CLU housing and evaluate; continue trade studies of the next-generation close combat, precision weapon systems for performance against increased target sets; develop and test advanced guidance and tracking technologies for improved target acquisition at increased range; investigate, develop and evaluate applications for novel methods and tools to provide increased weapon precision and reduce target location error.			
Title: Missile Seeker Technology ***Description:*** This effort focuses on the design, fabrication and evaluation of missile seekers, sensors, and software. The goal is to increase affordability and performance of missile seekers through improvement of algorithms, imaging, and thermal management. ***FY 2014 Accomplishments:*** Integrated and demonstrated sub-components for beam steering, power generation, and thermal management of phased array seeker designs; developed, integrated, and evaluated affordable phased array seeker solutions that enable all-weather operation; completed fabrication and integration of seeker components for very small interceptors to counter unmanned aviation systems (UAS) and integrated into reduced-weight weapons to arm small U.S. UAS designs; characterized and field-tested novel infra-red camera microcooler technology with performance comparable to current uncooled seekers. ***FY 2015 Plans:*** Continue technology maturation of novel micro-cooler technologies for advanced infrared tactical seekers to increase range performance and improve size, weight, and power; test ultra small and low cost semi-active laser seeker technology for improved flexibility and use on a variety of missile platforms including aviation and long range fires missiles; integrate programmable laser proximity sensor components and filter algorithms that will maintain operation in the presence of obscurants; complete the development of advanced technologies for affordable phased array sensors that enable all-weather operation of missile seekers and fire control. ***FY 2016 Plans:*** Will fabricate, integrate, and begin testing of novel micro-cooler technologies, improving size, weight, power and reliability of advanced infrared tactical seekers; design and fabricate advanced ultra-small seeker components for integration into reduced-weight missiles, including aviation and long range fires missiles; develop and refine sensor and software algorithms to improve the detection and tracking of airborne threats.	8.744	7.631	3.757
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 (GPS) denied	6.874	6.809	6.437

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602303A / *Missile Technology*	**Project (Number/Name)** 214 / *Missile Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
environments; improved image processing; improved missile power systems; improved communication with ground and other systems; technologies to track and respond to threat and offensive munition swarms. ***FY 2014 Accomplishments:*** Continued the design, development, integration and evaluation of high-precision inertial components and systems that allow faster/higher-accuracy positional alignment of far target location systems, and missile navigation in environments of high dynamic-maneuvers as well as environments where reliance on the Global Positioning System (GPS) cannot be assured; developed and evaluated emerging low-cost terrain/stellar (celestial) navigation technologies (including algorithms) for application to precision long-range stand-off fires that have the capability to operate in an environment where reliance on the GPS is not assured; designed, and evaluated second-iteration embedded structural electronics that enable smaller, lower-cost airframe designs. ***FY 2015 Plans:*** Develop, integrate and evaluate navigation technologies and algorithms capable of providing accuracy in GPS available and GPS denied/challenged environments to include: vision-aided, enhanced navigation-grade gyros, accelerometers, unique inertial systems and GPS Anti-Jam /Anti-Spoofing systems; continue to develop, integrate and demonstrate state-of-the-art integration techniques for COTS inertial sensors representing low cost, high accuracy navigation systems for extremely dynamic missile environments; develop, integrate, and demonstrate inertial technologies aimed at reducing size, weight, power and cost, while increasing accuracy. ***FY 2016 Plans:*** Will develop initial navigation, position, and timing testbed architecture to accept input from multiple sensors to include inertial, visual, and GPS to refine robust navigation fusion algorithms that provide accuracy in GPS assisted/degraded/denied environments; continue development and evaluation of unique navigation technologies and algorithms aimed at reducing size, weight, power and cost, and dependence on the GPS while increasing or maintaining accuracy; design novel technology for high current, extended life power sources, to enable longer flight times and increased shelf life of small guided missiles.			
Title: Missile Fire Control Systems, Sustainment, Simulations, and Launchers ***Description:*** This effort designs and evaluates fire control and tracking sensor technologies for area protection and air defense, technologies to increase missile useful life and reliability, advanced simulations to increase performance and reduce size, weight, and cost of missile systems, and launcher technology to deliver effects from air and ground platforms. Fire control radar effort is in coordination with PE 0602270A, Project 906 and PE 0603772A, Project 243. ***FY 2014 Accomplishments:*** Developed application-ready missile health monitoring technologies for shelf-life sensing of high-payoff components that improves the quality and quantity of missile health source data, reduces missile sustainment costs, and increases readiness; further	3.316	2.888	5.473

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602303A / *Missile Technology*	**Project (Number/Name)** 214 / *Missile Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
developed the Non Cooperative Target combat identification algorithms and integrate into air defense radars; evaluated and quantified performance of Electronic Steered Arrays for air defense radars. ***FY 2015 Plans:*** Develop phased array radar technology for fire control systems and supporting thermal management, to include small, low-cost, lightweight designs using commercially-available components and commercial processes with integrated thermal structures to enable effective power levels; further develop target identification algorithms for integration with radar systems to increase targeting fidelity. Continue development of missile health monitoring unit to improve user interface to reduce sustainment costs and increases readiness; optimize health monitoring units for reduced cost, power, and volume and operation in dynamic vibration environments using micro-electromechanical systems (MEMS). ***FY 2016 Plans:*** Will design and fabricate critical phased array radar technology components for a novel radar testbed to support air defense activities such as threat identification and assessment and high-value asset protection; design and fabricate radar testbed critical components such as transmit/receive modules; further develop target identification and classification algorithms focusing on integrating infrared imagery and development of ground target feature extraction increasing targeting fidelity and situational awareness; analyze novel copper wire bond material properties and design methodology to define qualification and acceptance for missile electronics reliability; develop initial radio frequency (RF) predictive methodologies to create valid and reliable threat UAS RF models facilitating advanced simulations for air defense activities.			
Title: Missile Propulsion, Structures, Lethality, and Aerodynamic Technology ***Description:*** This effort designs, fabricates, evaluates and tests missile enabling technologies including: advanced missile propulsion with reduced launch signatures; increased lethality and range of lethality effects; improved structural integrity of light weight missile cases; and increased understanding of missile aerodynamics for improved performance. ***FY 2014 Accomplishments:*** Fully characterized the most promising minimum-signature propellants with enhanced cold temperature strain capability that can be used in operational-environment temperature extremes encountered by unmanned aviation systems; conducted static tests of advanced thermal barriers for pulsed-motors; designed novel ignition systems that reduce propulsion system ignition delay and increase the energy release efficiency; continued rocket motor survivability/reliability assessments and prediction modeling; evaluated high performance compact warhead designs in collaboration with the Armaments Research, Development, and Engineering Center. ***FY 2015 Plans:*** Test novel propulsion structures to increase missile range and decrease time of flight of minimum signature propulsion systems; develop vibration-induced material degradation models of propulsion systems for stockpile reliability models to extend missile life; develop new methodologies that accurately characterize base flow predictions for complex aft bodies to improve aerodynamic	5.032	5.951	6.069

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602303A / *Missile Technology*	**Project (Number/Name)** 214 / *Missile Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
predictability; continue modeling and analysis to determine the vulnerability of UASs to fragment impact and blast effects to enable the design of counter UAS missiles; continue to evaluate high performance compact warhead designs in collaboration with the Armaments Research, Development, and Engineering Center. ***FY 2016 Plans:*** Will continue test and refinement of novel propulsion systems to increase missile range and reduce time of flight for extended range propulsion systems; design and conduct performance testing of structurally optimized missile components developed using additive manufacturing techniques for reduced weight and improved strength missile components; fabricate and begin system integration tests of lightweight warhead case technologies to provide reinforced structure defeat capability; investigate, scale up and test emerging disruptive energetic material from U.S. Army Research Laboratory (ARL) in coordination with the Armaments Research Development and Engineering Center (ARDEC); design an experimental rocket motor intended to provide increased missile range via enhanced burning rate; create and evaluate novel aerodynamic structures to support extended range and maneuvering missile applications.			
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. Successful technologies are matured and demonstrated in PE 0603313A, Project 263. ***FY 2014 Accomplishments:*** Continued identification of critical component technology for next-generation air defense and long-range fires systems, conducted component performance trade studies and began the component designs, conducted initial laboratory evaluations of the component technologies, and finalized an integrated system architecture; updated the all-digital simulation to reflect new navigation component technology designs and propulsion energy management technologies for long-range stand-off missiles; completed evaluation of component designs for lightweight multi-role (air-to-ground/air-to-air) missiles that can be integrated onto all sizes of unmanned aviation systems as well as manned rotary wing platforms; performed laboratory testing to determine feasibility to support attack of a larger target set. ***FY 2015 Plans:*** Utilize data fusion to incorporate new navigation technologies into missile navigation algorithms aiding GPS and inertial navigation for operation in GPS-denied environments, evaluate propulsion energy management technologies, and perform trade studies of new payload technologies for long-range missiles; conduct component performance trade studies; continue laboratory testing of component designs for lightweight multi-role modular missiles that can be integrated onto various sizes of unmanned aviation systems as well as manned rotary wing platforms; investigate alternate component technologies for seeker and guidance	10.437	8.106	8.543

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602303A / *Missile Technology*	**Project (Number/Name)** 214 / *Missile Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
electronic unit design cost reduction and with no performance degradation; evaluate and assess new alternate lightweight/high strength materials to increase weapon survivability and reduce soldier weight burden. ***FY 2016 Plans:*** Will refine detailed trade studies identifying critical technologies for next-generation close combat, precision missile systems enabling increased range for a man portable system; develop and evaluate 3-dimensional precision targeting software for Soldier, maneuver and fire support weapon applications; perform requirements definition, component trade studies, and preliminary component designs for a precision, maneuverable missile to meet emerging mission needs; design and develop critical components (hardware and software) that support an open systems architecture to enable modular designs of guided and unguided missiles.			
Title: Large Long Range Future Fires ***Description:*** This effort evaluates and develops technologies and performs necessary trade studies to provide the key components for maturation and demonstration for a large long range future fires missile in PE 0603313A Project 263. ***FY 2014 Accomplishments:*** Developed a simulation and conduct analyses of large long-range fires propulsion system requirements; developed candidate propulsion system designs and performed trade studies to distinguish the most promising technologies; and developed detailed propulsion system design(s) of the most promising technology. ***FY 2015 Plans:*** Continue to update propulsion models and conduct analyses of large long-range fires propulsion system requirements; design, fabricate, and perform initial testing of propulsion sub-systems that will enable Large Long Range Future Fires capability.	4.879	2.994	-
Title: Micro Inertial Navigation Sensor for Networked Javelin Command Launch Unit (CLU) with External Far Target Locator (FTL) ***Description:*** This effort focuses on the design, fabrication, and evaluation of reduced size, weight, and power advanced inertial sensor technology for use in highly-accurate robust targeting by a man-portable system. ***FY 2014 Accomplishments:*** Finalized initial design of a small, light weight, low power navigation sensor developed for robust man-portable close-combat targeting performance with on-the-move capabilities (both targeting and navigation) to include operation in environments where reliance on the Global Positioning System cannot be assured.	2.000	-	-
Title: Air Defense Missile Technologies (formerly Counter Unmanned Aerial Systems and Counter Cruise Missile)	2.850	2.992	6.188

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602303A / *Missile Technology*	**Project (Number/Name)** 214 / *Missile Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: This effort evaluates and develops technologies and performs necessary trade studies to provide the key components for maturation and demonstration of air defense missiles to counter threats such as unmanned aerial systems (UAS) and cruise missile systems. This work supports efforts in PE 0603313A, Projects 263 & 704. ***FY 2014 Accomplishments:*** Identified, characterized, and tested effects of lethality mechanisms against potential UAS threats. Developed models based on results to predict effectiveness of lethal mechanisms against UAS. Evaluated other components, such as power sources, tracker algorithms, and fire control for counter UAS mission. ***FY 2015 Plans:*** Evaluate and analyze component technologies to support the counter UAS mission and expand efforts to include tactical level air threats with 360 degree coverage. Begin component level modeling and simulation and evaluate system architecture concepts. ***FY 2016 Plans:*** Will continue development of critical interceptor technologies and components such as seeker, control system, mission computer, power system, and propulsion; design and implement software application algorithms for maneuver and fire support weapon targeting including expanded sensor inputs, threat flight path predictions, and calculated interceptor flight time for counter UAS missions.			
Title: Affordable Precision Missile Enabling Technology ***Description:*** This effort focuses on the studies, design, development, fabrication, and evaluation of components and subsystems critical to produce affordable discriminate extended range precision missiles. Critical component technologies include: advanced propulsion, seekers/sensors, fire control, datalink, guidance, navigation and controls, and airframes. These technologies transition to PE 0603313A, Project 263 for maturation. ***FY 2016 Plans:*** Will conduct component/subsystem trade studies to determine subsystem requirements for an affordable discriminate extended range precision missile; begin design of critical component technologies identified through subsystem trade studies.	-	-	2.000
Title: Long Range Fires Enabling Technology ***Description:*** This effort focuses on performing the necessary trade studies, and designing, developing, fabricating and evaluating critical component technologies needed to support a long range fires capability. These technologies transition to PE 0603313A Project 263 for maturation. ***FY 2016 Plans:***	-	-	6.586

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602303A / *Missile Technology*	**Project (Number/Name)** 214 / *Missile Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Will design and begin fabrication of advanced solid rocket motors to increase range for long range fires missiles; explore novel navigation techniques specific to the timelines required for long range fires missiles in Global Position System (GPS) denied environments; integrate and conduct dynamic tests of a blast/fragmentation warhead and hardened multi-point fuze designed to produce effectiveness against both point and area targets, providing a single warhead variant for long range fires applications; conduct full scale tests against select military operations and urban terrain targets to characterize lethality.			
Accomplishments/Planned Programs Subtotals	50.426	46.180	45.053

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602303A / *Missile Technology*	Project (Number/Name) G05 / *MISSILE TECHNOLOGY INITIATIVES (CA)*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
G05: *MISSILE TECHNOLOGY INITIATIVES (CA)*	-	8.000	16.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This is a Congressional Interest Item.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Program Increase	8.000	16.000
FY 2014 Accomplishments: Supported efforts in Long Range Fires Enabling Technologies;: Counter-Unmanned Aerial Systems (C-UAS) Enabling Technologies; Modular Missile Technologies; and Energetic Materials for Propulsion.		
FY 2015 Plans: Program increase for missile technology research		
Congressional Adds Subtotals	8.000	16.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A