Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army											Date: February 2016	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602624A *I Weapons and Munitions Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	62.131	83.340	53.581	-	53.581	50.022	61.509	63.213	65.739	-	-
H18: *Weapons & Munitions Technologies*	-	18.346	20.974	21.749	-	21.749	23.480	27.907	25.269	29.600	-	-
H19: *Asymmetric & Counter Measure Technologies*	-	6.761	13.212	14.924	-	14.924	9.482	13.904	20.002	17.834	-	-
H1A: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE*	-	25.000	35.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
H28: *Warheads/ Energetics Technologies*	-	12.024	14.154	16.908	-	16.908	17.060	19.698	17.942	18.305	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE) investigates, designs and evaluates enabling technologies to develop lethal and nonlethal weapons and munitions with increased performance and the potential for lower weight, reduced size, and improved affordability. Project H18 focuses on weapons and munitions development. Project H19 researches technologies to maintain the lethality of United States weapons as well as directed energy (DE) capabilities and subsystems to support the weaponization of High Power Radio Frequency (RF) systems. Project H28 evaluates munition components such as fuzes, power, warheads with tailorable effects, and insensitive munition compliant energetic materials.

Work in this PE is related to, and fully coordinated with, PE 0602303A (Missile Technology), PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0602772A (Advanced Tactical Computer Science and Sensor Technology), PE 0602782A (Command, Control, Communications Technology), and PE 0603004A (Weapons and Munitions Advanced Technology).

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

Work in this PE is primarily performed by the Armament Research, Development, and Engineering Center (ARDEC) at Picatinny Arsenal, NJ, in cooperation with the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD; the Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Belvoir, VA; the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI; and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army					Date: February 2016
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*		R-1 Program Element (Number/Name) PE 0602624A *I Weapons and Munitions Technology*			
B. Program Change Summary ($ in Millions)	**FY 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**
Previous President's Budget	63.057	48.340	57.038	-	57.038
Current President's Budget	62.131	83.340	53.581	-	53.581
Total Adjustments	-0.926	35.000	-3.457	-	-3.457
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	35.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.034	-			
• SBIR/STTR Transfer	-0.892	-			
• Adjustments to Budget Years	-	-	-3.457	-	-3.457

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: H1A: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE*		
Congressional Add: *Program Increase*	25.000	35.000
Congressional Add Subtotals for Project: H1A	25.000	35.000
Congressional Add Totals for all Projects	25.000	35.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army			Date: February 2016
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / *Weapons and Munitions Technology*	Project (Number/Name) H18 / *Weapons & Munitions Technologies*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
H18: *Weapons & Munitions Technologies*	-	18.346	20.974	21.749	-	21.749	23.480	27.907	25.269	29.600	-	-

A. Mission Description and Budget Item Justification

This project designs, investigates, and evaluates component technologies to enable affordable precision munitions as well as provide increased lethality and performance with reduced logistics and advanced direct/indirect fire capabilities for soldier, ground vehicle and aviation platforms, and for protection of platforms.

Efforts in this Program Element)PE) support the Army Science and Technology Lethality Portfolio.

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

Work in this project is performed by the Armament Research, Development, and Engineering Center (ARDEC), at Picatinny Arsenal, NJ (in collaboration with a the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD; the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL; and the Communications-Electronics Research, Development, and Engineering Center (CERDEC), Fort Belvoir, VA.)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Novel Propulsion Technology for the Future	3.614	3.856	3.388
Description: This effort explores propellant technologies such as powder coextrusion and grain coatings, while retaining insensitive properties, for employment in gun launch environments as well as directional thrusters including those that deliver a broad spectrum of effects. It also conducts experiments with these propellants to increase the range of artillery and mortar rocket assisted projectiles.			
FY 2015 Accomplishments: Conducted initial experiments on non-ammonium perchlorate propellant formulations for rocket assisted projectile indirect fire solutions; designed and developed propellant technologies for next generation artillery and tank applications; scaled up materials for advanced propellants, igniters and combustible materials for propellant charges.			
FY 2016 Plans: Conduct evaluation of extended range 120mm mortar fire in a round designed to double (2x) the range; produce co-extruded gun propellant for direct and indirect fire applications; perform 30mm fires of coated propellant for improved ballistic performance and extended range with lower sensitivity to temperature; increase the burn rate at low temperature and maintain high temp burn rate			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602624A / *Weapons and Munitions Technology*	**Project (Number/Name)** H18 / *Weapons & Munitions Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
resulting in more range over the temp spectrum and increased accuracy due to less propellant variation; formulate new materials for extended range artillery applications. ***FY 2017 Plans:*** Will evaluate novel and innovative gun propellant materials for the implementation of three-dimensional (3D) printed charge development; develop next generation charge concepts and prototypes using 3D printing technology for medium caliber up to large caliber charges for tank, artillery and mortar systems; develop engineering tools to design and model 3D printed charges using the novel materials and novel charge concepts.			
Title: Advanced Weapons Technology ***Description:*** This effort investigates innovative weapon technologies such as recoil energy mitigation, affordable precision, extended range/guided technologies, and advanced propellant for future medium caliber direct fire systems that could provide similar or greater lethality than current systems. ***FY 2015 Accomplishments:*** Investigated multiple promising innovative weapon technologies that could provide greater lethality; developed weapon technologies that incorporated emerging materials (e.g. nanotechnology, additive manufacturing); developed weapon, munition and fire control technologies that support advanced forms of engagement, such as collaborative munitions. ***FY 2016 Plans:*** Continue to investigate innovative weapon technologies that could provide lethality improvements such as nanostructured materials for high strain rate applications and counter Unmaned Aeriel Systems (UAS) system analysis; develop weapon technologies that incorporate new materials (e.g. nanotechnology, additive manufacturing); develop weapon, munition and fire control technologies that support advanced forms of engagement, such as collaborative multi-role weapons and munitions. ***FY 2017 Plans:*** Will investigate novel weapon technologies that provide lethality improvements in confined, complex, constrained environments; investigate aviation armament technologies that support lighter, more lethal armaments for the family of rotary wing aircrafts.	2.130	1.409	1.497
Title: Extended Range Projectile Technology ***Description:*** This effort develops various methods of low cost extended range technologies for mortar and artillery applications. Projectile lift and surface control technologies will be investigated for survivability and functionality through component level research and modeling and simulation. The Warfighter will be able to use these technologies coupled with handheld devices to engage Beyond Line-of-Sight (BLOS) targets and guide the projectile in flight. ***FY 2015 Accomplishments:***	0.991	0.988	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602624A / *Weapons and Munitions Technology*	**Project (Number/Name)** H18 / *Weapons & Munitions Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Matured and validated the improved aerodynamic shapes, propellant, guidance, navigation and control, auto pilot and low pressure gas technologies, into 60mm/120mm mortar projectiles with a goal of up to a 75% increase in range with guidance; conducted an experimental flight of a guide to hit projectile at 75% increased range. ***FY 2016 Plans:*** Investigate hybrid (155mm projectile with the incorporation of base fins and lifts/control surfaces) technologies for artillery indirect fire application; design control surfaces to achieve extended ranges; conduct bench top testing of control actuation mechanisms such as (power sources, motors and canards) capable to maintain structural integrity.			
Title: Affordable Precision Technologies ***Description:*** This effort investigates technologies that provide affordable precision capabilities for projectiles fired into Global Positioning System (GPS) denied environments. ***FY 2015 Accomplishments:*** Validated inertial sensor array design and processing algorithms developed; conducted various experiments with the long-wave/ near-infrared (IR) imagers used for terminal guidance in GPS denied environments. Nature of the experiments was to collect real time imagery data for the purpose of navigation algorithm development. This effort was conducted in collaboration with AMRDEC through the Aided Target Recognition (ATR) Working Group and with ARL through a technology transition agreement. This effort spun out component technologies that will be evaluated and matured in the fully coordinated effort of the same name in PE/ Project 0603004A/232. ***FY 2016 Plans:*** Continue subsystem evaluation of the optics to include laying out the tactical imager and electronics form factor as well as begin high-g survivability testing of the optics; perform evaluation of the image processing navigation algorithm using the modeling and simulation developed. This effort is being conducted in collaboration with AMRDEC through the Aided Target Recognition (ATR) Working Group and with ARL through a technology transition agreement. . ***FY 2017 Plans:*** Will validate the algorithm development for the imager based terminal guidance concepts through extensive modeling and simulation efforts; conduct experiments in order to verify the survivability and maturity of the candidate imager technologies in a high G environment.	3.282	2.675	2.962
Title: Enabling Printed Explosives, Power Sources & Electronics for Munitions ***Description:*** This effort designs and evaluates the state-of-the-art in materials printing, direct write, flexible electronics, and conformal systems for the Warfighter.	0.694	0.747	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602624A / *Weapons and Munitions Technology*	**Project (Number/Name)** H18 / *Weapons & Munitions Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
FY 2015 Accomplishments: Investigated, designed, developed and validated printed electronics, energetics, and power sources for Munitions and other armament applications; matured materials and printing techniques to add capabilities to munitions and fuze systems, while reducing the size, weight, and cost of conventional electronics; conducted experiments to determine applicability of printing techniques for antennas, sensors, electrical components, and other components printed onto windscreens, radomes, munitions, and weapon systems. This effort was conducted in collaboration with CERDEC, AMRDEC and ARL through both the integrated project team and technical working groups. ***FY 2016 Plans:*** Investigate, design and adopt commercial-off-the-shelf (COTS) hardware to print electronics and energetics for use in munitions and power sources for munitions and other armament applications; establish materials and printing techniques to add capabilities to munitions and fuze systems, while reducing the size, weight, and cost of conventional electronics; conduct experiments to determine applicability of printing techniques for antennas, sensors, electrical components, and other components printed onto windscreens, radomes, munitions, and weapon systems. This effort is being conducted in collaboration with CERDEC, AMRDEC and ARL through both an integrated project team and technical working groups.			
Title: Extended Range Indirect Fire Weapon Technology ***Description:*** This effort initially investigates and determines the viability of candidate extended range indirect fire weapon technologies that facilitate light weight armaments with launch velocities resulting in ranges of 70km and beyond with emerging ammunition. Technologies will be applied at the system and sub-system level to address technology gaps. ***FY 2015 Accomplishments:*** Matured the concepts of an extended range armament system; continued the investigation of unconventional materials and processes to allow a new system to have no significant weight increase compared to existing systems; developed a detailed design of a lightweight armament system for use in extended range weapons that addressed the current Army capability gaps with minimal system impact. ***FY 2016 Plans:*** Continue to mature the concepts of an extended range armament system; conduct initial verification of models through lab scale prototypes and testing; and evaluate the various technology concepts based on the capabilities the integrated system provides. ***FY 2017 Plans:***	1.021	2.287	2.814

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Will mature and integrate extended range armament component technologies further; continue to validate technology concepts in an integrated environment to assess impacts to current systems; determine technologies that provide weight reduction potential while supporting increased velocities needed for ranges beyond the current capability of self-propelled artillery (M109A7) howitzer.			
Title: Force Protection Technologies ***Description:*** This effort accelerates the development of disruptive technologies that enable transformational protection capabilities for vital assets, forces and civilian populations, increasing safety, decreasing collateral damage and minimizing fratricide. ***FY 2015 Accomplishments:*** Investigated and developed armament technologies to provide protection to vital National assets including vehicles, facilities, weapons, and personnel; developed precision weapons, munitions and fire control technologies to reduce collateral damage to non-combatants; developed armament technologies that provide greater standoff distance between incoming threats and vital assets. ***FY 2016 Plans:*** Continue to investigate and design armament technologies to provide protection to vehicles, facilities, weapons, and personnel; develop precision weapons, munitions and fire control technologies to reduce collateral damage to non-combatants while providing greater standoff distance between incoming threats and vital assets. ***FY 2017 Plans:*** Will investigate and develop armament technologies capable of providing non-kinetic, High-Powered /Radio Frequency Directed Energy, lethal effects against Unmanned Aerial systems, precision Rocket, Artillery, Mortar and other potential threats.	2.840	3.512	0.588
Title: Long Range Gun Technology Development ***Description:*** This effort investigates and develops candidate extended range artillery weapon system and projectile technologies that increase the range up to 2x with increased precision. Resulting component technologies will be evaluated and matured in the fully coordinated effort of the same name in PE/Project 0603004A/232 ***FY 2015 Accomplishments:*** Investigated candidate projectile and weapon systems technologies that provided extended range by leveraging novel materials, innovative propulsion technologies and advanced design concepts. ***FY 2016 Plans:***	1.887	3.500	2.500

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
This effort is being conducted in concert with the Extended Range Indirect Fire Weapon Technology effort mentioned above. These new technologies apply to light weight common armament, advanced micro-common fire control, novel post launch propulsion methods, and advanced projectile lifting surfaces. ***FY 2017 Plans:*** This effort will be conducted in concert with the Extended Range Indirect Fire Weapon Technology effort; determine weight reduction of common 155mm armament concepts integrated with advanced micro-common fire control concepts to achieve extended range for demonstration mentioned in PE/Project 0603004A/232; validate post launch propulsion methods for next generation extended range munitions and determines range extension gains achieved by post launch lifting surfaces.			
Title: Fuze and Power Technologies for Munitions	1.887	2.000	2.000
Description: This effort investigates and designs innovative fuze and power technologies for enhanced environment and target sensing/classification, warhead initiation schemes and advanced fuze setting to provide enhanced lethality combined effects on targets and advanced initiation schemes for the next generation munitions. ***FY 2015 Accomplishments:*** Identify candidate technologies that can be used to facilitate advanced high-g target sensing/classification that are miniaturized, integrated and packaged into existing fuze form factors which are currently not available for advanced munitions; new miniaturized safe and arm architectures that can enable the next generation of enhanced lethality; and advanced fuze setting for size and weight reduction through advanced electronic packaging schemes and efficient setting technologies; investigate viability of candidate technologies; develop initial concepts and determine feasibility to known technological gaps; and evaluate innovative miniaturized munitions power source candidate technologies. ***FY 2016 Plans:*** Explore robust airburst fuze technology concepts for increased accuracy in multi-purpose rounds; develop microscale sensor concepts and devices for enhanced environment sensing and for arming and warhead initiation in which all the energetic components are out-of-line; investigate alternative fuze setting methodologies to more efficiently transfer and store power and data to smart indirect fire projectiles; investigate multi-point initiation concepts applicable for Insensitive Munitions applications; investigate innovative munitions power source candidate technologies for medium and large caliber munitions. These technologies support the Joint Munitions Program Technical Coordinating Group (TCG – 5 and TCG-10) and the Joint Fuze Technology Program (JFTP). ***FY 2017 Plans:*** Will continue to design and develop robust airburst fuze technology concepts for increased accuracy in multi-purpose rounds; mature micro-scale sensor components and devices for enhanced environment sensing and for arming and warhead initiation in which all the energetic components are both in and out-of-line; validate alternative fuze setting methodologies to more			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
efficiently transfer and store power and data to smart indirect fire projectiles; mature multi-point initiation components applicable to Insensitive Munitions; validate innovative munitions power source technologies for medium and large caliber munitions. These technologies will continue to support the Joint Munitions Program Technical Coordinating Group (TCG – 5 and TCG-10) and the JFTP.			
Title: Cluster Munitions Replacement Acceleration ***Description:*** This effort will design and develop the critical components that will aid in the maturation of a materiel solution designed to replace 155mm dual purpose improved conventional munition (DPICM) artillery. The components will include the design, development and component testing of fuzing, warhead and stabilization technologies. ***FY 2017 Plans:*** Effort will investigate high reliability DPICM technologies, design and develop high reliability fuzing architectures in a small, self-contained form factor; assign component space allocation including investigation of fuze component level technologies, stabilizer design and development and mature warheads. Continue to develop advanced unitary warhead designs and to further design and establish warhead initiation requirements and compatibility with existing artillery fuze designs. Develop and mature critical components leveraging lessons learned from prior cluster munition replacement component testing.	-	-	6.000
Accomplishments/Planned Programs Subtotals	18.346	20.974	21.749

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 2017 Army			Date: February 2016
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / *Weapons and Munitions Technology*	Project (Number/Name) H19 / *Asymmetric & Counter Measure Technologies*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
H19: *Asymmetric & Counter Measure Technologies*	-	6.761	13.212	14.924	-	14.924	9.482	13.904	20.002	17.834	-	-

A. Mission Description and Budget Item Justification

This project designs and develops technologies to support asymmetric countermeasures such as radio frequency and ultra-short pulse directed energy and efforts to maintain the lethality and overmatch of US weapons against current and future threat systems. Work in this project is related to, and fully coordinated with, efforts in projects H18 and H28 (also in Program Element (PE) 0602624A), PE 0602618A (Ballistics Technology), and projects 232 and L94 in PE 0603004A (Weapons and Munitions Advanced Technology).

Efforts in this PE support the Army Science and Technology Lethality Portfolio.

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

This work is performed by the Armament Research, Development, and Engineering Center (ARDEC), at Picatinny Arsenal, NJ, and the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Novel Battlefield Effectors	1.490	1.753	2.359
Description: This effort investigates unique weapon and munitions enabling technologies to achieve tunable effects on targets and that are capable of providing a full range of effects from non-lethal to highly lethal via a single weapon or munition.			
FY 2015 Accomplishments: Developed the most promising effector technologies for transition to advanced development; investigated size, weight, power and cost benefits of those technologies; explored the use of non-traditional technologies in new applications.			
FY 2016 Plans: Continue to investigate the most promising effector technologies such as Hostile Fire Detection Mortar Blast Attenuation, and Counter-Counter Measure Technologies ready for transition to advanced development; investigate size, weight, power and cost benefits of those technologies in new applications; explore the use of disruptive technologies that can be applied to current and future precision guided direct and indirect fired munitions.			
FY 2017 Plans:			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Will investigate novel technologies capable of improving ammunition development and demilitarization throughout the life cycle; provide counter-countermeasure technologies for advanced development; explore the use of disruptive technologies that can be applied to current and future munitions and armament systems.			
Title: Counter-Countermeasure (CCM) Technologies for Weapons and Munitions ***Description:*** This effort investigates guidance signal reduction, inertial measurement unit, and antenna design technologies to enable continued effectiveness of US weapon systems against enemy countermeasures including Active Protection Systems (APS), Global Positioning System (GPS) jamming, and active seeker jamming. ***FY 2015 Accomplishments:*** Developed the most promising technologies to protect munitions and weapons technologies against emerging threat countermeasure technologies; explored disruptive directed energy as a means of providing CCM; investigated most promising CCM technologies for transition to advanced development. ***FY 2016 Plans:*** Conduct experimentation of CCM technologies for gun launched munition components in a relevant laboratory environment. ***FY 2017 Plans:*** Will validate high power antenna array concept designs that offer size, weight, and power (SWaP) reduction; investigate scalability of novel technologies for various potential applications such as vehicle stopping, counter electronics and counter Unmanned Aeriel Systems (UAS); continue to design and develop innovative technologies for compact solid state high power radio frequency sources.	1.265	1.445	1.463
Title: Enhanced Fire Control for Indirect Fires ***Description:*** This effort evaluates the applicability and integration of state-of-the-art acquisition and engagement technologies for data and image processing, weapon orientation sensors and methodologies to enhance fire control capability, and therefore weapon effectiveness, at various ranges and under battlefield conditions. Investigates components and architectures that will reduce size, weight, power and cost (SWaP-C), and increase commonality and operation across direct and indirect fire control systems. ***FY 2015 Accomplishments:*** Developed novel methods and algorithms for improved ballistics, for data and image processing, and for sensing battlefield, weapon and target environment; investigated small, accurate, survivable weapon orientation sensors, technologies and	2.011	2.000	2.000

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
compensation methodologies to improve the weapon pointing; refined concepts for hardware and software architectures for optimum physical and functional integration, increased commonality, lower weight, and faster engagement times. ***FY 2016 Plans:*** Evaluate and integrate acquisition and engagement technologies which support extended range indirect fire systems such as: extended range tracking and sizing capabilities, advanced sensors, hardware prototyping and firmware coding technologies for use in GPS-denied environments; navigation and pointing technologies/compensation techniques; conventional munition accuracy and reduced navigational burden for smart munitions technologies; communication techniques for in-flight interface/control with smart munitions; investigate miniaturized and multifunctional electronic components to reduce SWaP-C, and increase commonality of hardware, software and operation across indirect fire systems; perform architecture trade-off analyses that allow for efficient, real-time fusion of information and data. ***FY 2017 Plans:*** Will further mature extended range tracking and miniaturization of components for use in GPS-denied environments as well as further maturing navigation and pointing technologies/compensation components; validate improved conventional munition accuracy and communication techniques for in-flight interface/control with smart munitions.			
Title: High Powered Radio Frequency ***Description:*** The use of High Power Radio Frequency (RF) has been demonstrated to provide desired target effects against various targets; however such systems are still too large and consume too much power to make them tactically useful for Army applications. This effort will focus on addressing the SWaP - C of High Power RF systems and their components so as to allow tactically useful systems. ***FY 2015 Accomplishments:*** Focused on reducing antenna size for high power RF transmission; investigated high dielectric constant composites (nano-dielectrics) to produce 60-80% size reduction in antenna array elements; developed the antenna array elements to transmit known RF waveforms (frequency, pulse width, and amplitude) to cause a desired target effect of interest. ***FY 2016 Plans:*** Continue investigation of high dielectric constant composites (nano-dielectrics) to achieve the desired size reduction of the high power antenna array to include validation; design, fabricate and evaluate transistor technologies, such as laterally diffused metal oxide semiconductor (LDMOS) field-effect transistors, for highly efficient solid state transmitter applications. ***FY 2017 Plans:*** Will validate antenna array at high power and prove SWaP reduction; investigate scalability of nano-dielectric technology to alternate frequency ranges for various potential applications such as vehicle stopping, counter electronics, counter UAS, etc.;	1.995	2.007	2.002

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
continue design and development of innovative technologies for compact solid state high power radio frequency sources, leveraging advances in gallium nitride switches, nano-dielectrics, and/or efficient transistors.			
Title: Terrain Shaping Munition Technologies ***Description:*** This effort develops an improved munition capability, remote delivery, and man-in-the-loop control technologies that will allow the warfighter to maintain dominance in the battlefield by denying adversaries access to an area of operations. ***FY 2016 Plans:*** Investigate munition technologies including: large area coverage anti-personnel and dual mode warhead designs, directed energy vehicle defeat effects for low hazard protection of area denial munitions, and munition configurations; and investigate different designs of tamper deterrence and anti-tamper technologies such as obscuration and non-lethal technologies. ***FY 2017 Plans:*** Will investigate and develop new methods for generation of very high voltages via chemical, capacitive and explosive means, production of pulse / waveform against targets, and delivery of energies into targets by direct injection or remotely.	-	2.000	2.000
Title: Small Arms Fire Control ***Description:*** This effort focuses on providing the soldier a set of small arms capabilities to increase the accuracy at extended ranges, probability of hit, improve time of engagement, and enhance situational awareness. By achieving these objectives, the soldier will be able to improve their operational effectiveness in reduced time. ***FY 2016 Plans:*** Investigate advanced materials and technologies that optimize small arms fire control architecture at a reduced weight; develop and assess advanced small arms technologies for improved target handoff; evaluate technologies that detect and provide threat indicators and potential targets; investigate technologies that recognize/classify and identify targets, aid in accurately aiming the weapon for effective firing and allow the soldier to assess conditions after firing for potential reengagement. ***FY 2017 Plans:*** Will investigate technologies to increase probability of hit, including ballistic corrections for advanced sensor data including down-range wind sensing, target tracking and handoff at the individual-weapon platform, and moving target aim correction.	-	4.007	4.200
Title: Indirect Fire Aiming Techniques ***Description:*** This effort supports future integrated aiming technologies for indirect fires with enhanced capabilities and a simplified user interface while reducing size, weight and power. ***FY 2017 Plans:***	-	-	0.900

Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Will investigate various innovative technologies to provide high fidelity location and orientation coordinates for use in indirect-fire applications; analyze technologies that can both provide these capabilities and reduce size, weight and power consumption for the next generation of fire control systems.			
Accomplishments/Planned Programs Subtotals	6.761	13.212	14.924

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 2017 Army			Date: February 2016
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / *Weapons and Munitions Technology*	Project (Number/Name) H1A / *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
H1A: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE*	-	25.000	35.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Weapons and Munitions Technology applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016
Congressional Add: Program Increase	25.000	35.000
FY 2015 Accomplishments: Program increase for weapons and munitions technology research.		
FY 2016 Plans: Program increase for weapons and munitions technology research.		
Congressional Adds Subtotals	25.000	35.000

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 2017 Army			Date: February 2016
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602624A / *Weapons and Munitions Technology*	Project (Number/Name) H28 / *Warheads/ Energetics Technologies*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
H28: *Warheads/ Energetics Technologies*	-	12.024	14.154	16.908	-	16.908	17.060	19.698	17.942	18.305	-	-

A. Mission Description and Budget Item Justification

This project investigates and designs enabling warhead and energetic technologies such as novel warhead architectures, new propellant techniques, and high-density explosives to produce smaller, lighter, more effective, multi-role warheads, flare and pyrotechnic countermeasures, and novel approaches for ammunition demilitarization and combat in complex environments.

Efforts in this Program Element (PE) support the Army Science and Technology Lethality Portfolio.

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

This work is performed by the Army Armament Research, Development, and Engineering Center (ARDEC), at Picatinny Arsenal, NJ in collaboration with the Army Research Laboratory (ARL) at Aberdeen Proving Ground, MD; and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), Huntsville, AL.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Scalable Warhead Technology	4.294	6.193	5.931
Description: This effort designs scalable and adaptive explosives and reactive materials technology for either gun or missile-launched weapons and munitions that can deliver a broad spectrum of effects with reduced collateral damage. In addition, this effort will facilitate the design and development of improved area clearance technologies.			
FY 2015 Accomplishments: Matured designs and conducted experiments in the area of spin compensated shaped charges, enhanced fragmentation, directional lethality and multiple explosively formed penetrator (MEFP) warheads; validated scalable technologies as they relate to lethal to less than lethal effects.			
FY 2016 Plans: Design and develop multi-functional warheads for multi-role missions that include Counter-Rocket, Artillery, and Missile(C-RAM), Counter-Unmanned Aircraft Systems(C-UAS) and anti-vehicle/personnel. Design and test brass board designs for shaped charge, explosively formed penetrator (EFP) and blast fragmentation with targeted lethality; determine, through modeling and simulation, the applicability of tunable/tailorable effects for adaptable warheads for future artillery, mortars and medium caliber munitions.			
FY 2017 Plans:			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Will design and test brass board designs for shaped charge, EFP and blast fragmentation with targeted lethality; determine tunable/tailorable effects for adaptable warheads through modeling and simulation. After successful testing at the component level, designs will be applied to warhead subsystem for validation. In addition, will investigate novel concepts of area clearance capabilities with focus on the advancement of new warheads, line charge materials and fills while reducing collateral damage and maintaining or increasing effectiveness on target.			
Title: Explosives Research ***Description:*** This effort develops high energy/high performance, multi-purpose insensitive munitions (IM) explosives. ***FY 2015 Accomplishments:*** Formulated and processed combined effects and high efficiency explosives; validated affordable new energetic binders for enhanced blast formulations; investigated new synthetic processes to enable low-cost, high energy solid crystal explosive ingredients; matured processing techniques for nano-enhanced organic energetics formulations; conducted experiments on electrically-induced tailored energy release for proof of chemistry-based variable warhead fragmentation and the possibility of an on/off energetic capability. This effort was conducted in collaboration with ARL through both the integrated project team and technical working groups. ***FY 2016 Plans:*** Continue to investigate single step nano-enhanced explosive munitions with greatly reduced shock sensitivities; validate lethality and fragmentation concepts; investigate scale up high pressure synthesis chemistry of disruptive energetic materials; validate high efficiency explosive concepts in munition systems. This effort is being conducted in collaboration with ARL through both the integrated project team and technical working groups. ***FY 2017 Plans:*** Will investigate synthesis and formulation of advanced energetic materials for low sensitivity and higher performance applications; advance and develop the use of meso-scale reactive flow models to further understand energetics performance as well as energetics sensitivity as it relates to initiation behavior to unplanned stimuli; research materials and processes to enable energetic inks and energetic powder deposition for application to additive three-dimensional (3D) printed energetic parts and devices; investigate the advancement of developing novel nano-energetic formulations to provide substantially less shock sensitivity than current formulations; research synthesis and processing of new materials using novel techniques such as Advanced Flow Reactors (AFR) technology for processing energetic materials in a timely, safe and efficient manner; further research and validate tailored energy release technology for demonstration of electrical on/off energetic capabilities and chemistry-based variable warhead fragmentation; investigate unique disruptive and scalable technologies in collaboration with ARL.	3.968	4.861	7.877
Title: Material Development for Water Purification	0.248	-	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Description: This effort originated from a material development for armament systems and was found to have a dual use application. The effort (also known as Adaptive Armament Reactive Interface Domains/AARID) is intended to provide a capability to enhance contingency basing water efficiency via recycling with secondary contributions to reduction of waste and power. Other advantages are on improved sustainment, greater logistics flexibility, and reduced Warfighter threat from supply convoys. ***FY 2015 Accomplishments:*** Designed and developed a method to collect real time data to determine flow rates and validate water purity values; conducted experiments to compare coated filters to uncoated filters to determine the benefits of the coating in purifying water.			
Title: Explosives Safety for Automated Base Camp Planning ***Description:*** This effort determines data interoperability requirements between explosive safety and base camp planning software tools; designs an integrated tool that increases explosive safety for base camps by managing the risk due to interaction between changes in Net Explosive Weight, geography, facilities and force structure. ***FY 2015 Accomplishments:*** Developed and evaluated ammunition explosives safety planning and management modules within the base camp planner design architecture. This task is fully coordinated with the effort of the same name in PE/Project 0603001A/543.	0.497	-	-
Title: Tunable Pyrotechnics ***Description:*** This effort develops smoke and flare countermeasure for passive protection for ground and air combat platforms, and hand held signals for illumination and signaling. These capabilities will increase warfighter and aircraft survivability. ***FY 2015 Accomplishments:*** Assessed formulations and functional concepts for dazzler, cloud and seeker countermeasures; conducted experiments on dazzler flares and prepare for flight tests; conducted experiments on cloud countermeasures; analyzed dazzler and cloud countermeasure performance using experiment and simulation results for application to multiple aircraft and aspect angles; identified threats and developed concepts for seeker countermeasure. ***FY 2016 Plans:*** Refine dazzler countermeasure (CM) formulations along with additional flight testing. Refine dazzler model and simulation (M&S) algorithms as well; cloud countermeasure undergoing final prototype formulation in full up system level demonstrations on aircraft; update M&S algorithms for cloud countermeasure; test advanced countermeasure initial formulations and flare concepts against hardware in the loop threat seekers; develop digital M&S algorithms. ***FY 2017 Plans:***	3.017	3.100	3.100

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Will finalize formulation and prototype design for dazzler CM for night time solution; perform M & S studies to evaluate if requirements can be met; produce scaled-up quantities for cloud countermeasure for two different flare formulations; conduct flight tests and evaluate effectiveness; transition cloud CM to Engineering Manufacturing Development (EMD) phase; down select from initial formulations of advanced seeker counter-measures (ASCM) and design prototypes for further maturation and demonstration.			
Accomplishments/Planned Programs Subtotals	12.024	14.154	16.908

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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