Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Office of the Secretary Of Defense	Date: May 2017
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
Total Program Element	76.183	18.993	17.745	19.111	-	19.111	19.307	19.472	19.787	20.203	Continuing	Continuing
P000: *Insensitive Munitions*	52.967	12.828	11.993	12.910	-	12.910	13.049	13.156	13.367	13.658	Continuing	Continuing
P204: *Enabling Fuze Technology*	23.216	6.165	5.752	6.201	-	6.201	6.258	6.316	6.420	6.545	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program addresses applied research associated with improving the lethality, reliability, safety, and survivability of munitions and weapon systems. The goal is to develop and demonstrate joint enabling technologies that can be used by the Program Executive Officers (PEOs) as they develop their specific weapon programs. The program invests in and demonstrates technologies from a Joint Service perspective, thus maximizing efficiencies, ensuring the development of technology with the broadest applicability while avoiding duplication of efforts.

Munition Area Technology Groups (MATGs) and Fuze Area Technology Groups (FATGs) have been established for each munition and capability area and are tasked with: 1) coordinating, establishing, and maintaining 2018 and 2023 year technology development plans and roadmaps, 2) coordinating biannual meetings to review technical and programmatic details of each funded and proposed effort, 3) developing and submitting Technology Transition Agreements in coordination with appropriate PEOs for insertion in their Insensitive Munitions (IM) Strategic Plans / Fuze Technology Development Plan, and 4) interfacing with other MATGs / FATGs and IM / fuze science and technology projects as appropriate. The Joint Insensitive Munitions Technology Program (JIMTP) and Joint Fuze Technology Program (JFTP) will utilize a Technical Advisory Committee (TAC) (consisting of senior Department of Defense (DoD) and Department of Energy (DOE) laboratory representatives, and senior Munitions PEO representatives) to provide program oversight, policy, direction, and priorities during its annual meeting.

The IM effort will demonstrate enabling technologies needed to develop weapons in compliance with requirements established in United States Code, Title 10, Chapter 141, Section 2389 and DoD Instruction 5000.1. This effort will take promising technologies demonstrated at the laboratory scale and transition them into demonstration programs utilizing generic hardware based on priority munitions identified in the PEO IM Strategic Plans. Mature demonstrated IM technology can be transitioned, thereby decreasing their program costs and schedule risk and facilitating spin-offs to other non-compliant munitions within their portfolios.

The JIMTP investments focus on five Munition Areas: 1) High Performance Rocket Propulsion (HPP), 2) Minimum Signature Rocket Propulsion (MSP), 3) Blast and Fragmentation Warheads (BFW), 4) Anti-Armor Warheads (AAW), and 5) Gun Propulsion (GP). MATGs, under tri-service leadership, have developed technology roadmaps for each Munition Area that are used to guide investments based on goals consistent with the DoD IM Strategic Plan. These IM technologies, alone or in combination, will be developed and tested at the small-scale, and for eventual incorporation in hardware, simulating real-world munitions, to demonstrate their utility and feasibility.

The Enabling Fuze Technology effort will also demonstrate fuze enabling technologies needed to develop weapons that address priority capability areas identified in the Guidance for Development of the Force (GDF), the Secretary of Defense Memorandum, DoD Policy on Cluster Munitions and Unintended Harm to Civilians, and shortfalls in current weapon systems. This effort will develop fuzing technologies and mature them for transition into advanced technology (Budget Activity (BA)

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Office of the Secretary Of Defense	Date: May 2017
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*

6.3) programs and/or design tools and protocols for weapon fuzing. In this way, the Service and Industrial base weapon and fuze communities will be able to heavily leverage and apply these emerging and promising technologies in fuzing modeling and simulation tools, multi-point initiation, high reliability fuze architectures, survivable components, modular fuze packaging, and fuze sensor.

The Joint Fuze Technology Program investments focus on four specific capability areas that have been identified by Department's strategic guidance and current shortfalls in weapon systems and will be validated by the PEOs and the Heads of the Service Science and Technology (S&T) communities. The capability areas are: 1) Hard Target Survivable Fuzing, 2) Tailorable Effects Weapon Fuzing, 3) High Reliability Fuzing, and 4) Enabling Fuze Technologies and Common Architecture.

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	19.314	17.745	19.128	-	19.128
Current President's Budget	18.993	17.745	19.111	-	19.111
Total Adjustments	-0.321	0.000	-0.017	-	-0.017
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.321	-			
• Other Adjustments	-	-	-0.017	-	-0.017

Change Summary Explanation

FY 2018 adjustments are a result of internal realignment which reflects funding for higher Departmental priorities and requirements.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Office of the Secretary Of Defense			Date: May 2017
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602000D8Z / *Joint Munitions Technology*	Project (Number/Name) P000 / *Insensitive Munitions*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
P000: *Insensitive Munitions*	52.967	12.828	11.993	12.910	-	12.910	13.049	13.156	13.367	13.658	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Joint Insensitive Munitions (IM) Technology Program (JIMTP) aims to develop the enabling technologies needed to build weapons in compliance with statutory requirements (United States Code, Title 10, Chapter 141, Section 2389) and regulation (DoDI 5000.1 and 5000.02, and CJCSI 3170.01F). This effort will take promising technologies developed at the laboratory scale and mature them for transition into advanced technology (Budget Activity (BA) 6.3) programs based on the priority munitions identified in the DoD IM Strategic Plans. Mature and demonstrated IM technology can be transitioned to the Program Executive Officers (PEOs), thereby decreasing the program costs and schedule risk. This will additionally promote spin-offs to other non-compliant munitions within the DoD portfolio. Without new technology, future variants of current weapon systems will have the same, or worse, response to IM stimuli. New weapon developments will face similar challenges. This is especially true with increased performance requirements for improved and new systems.

The JIMTP investments focus on five Munition Areas: 1) High Performance Rocket Propulsion, 2) Minimum Signature Rocket Propulsion, 3) Blast and Fragmentation Warheads, 4) Anti-Armor Warheads, and 5) Gun Propulsion. Munition Area Technology Groups (MATGs), under tri-service leadership, have developed technology roadmaps for each Munition Area that are used to guide investments based on goals consistent with the DoD IM Strategic Plans. The program is structured around these five areas with clear cross-cutting tasks.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: High Performance Rocket Propulsion (HPP)	3.505	3.349	3.537
Description: HPP focuses on the development of technologies to improve the IM response of HPP systems, rocket motors with Ammonium Perchlorate and with or without a metal fuel, for rockets and missiles launched from air, ground, and sea platforms. These technologies, when applied to rocket motors, improve to one or more threats, while not degrading the response to other IM threats and, at minimum, maintaining munition performance. Technologies include, but are not limited to, rocket propellant ingredients, including synthesis, characterization and scale-up; reduced smoke or smoky propellants, including formulation, characterization and scale-up; rocket motor case design; materials for active and passive thermal mitigation; shock mitigation materials and techniques; passive and active coatings; active and passive venting techniques for motor cases or containers; ignition systems; sensors; and thrust mitigation techniques. Operating conditions may be controlled or widely varying in both temperature and vibration. The 2018 and 2023 year goals of the HPP MATG are concentrated on solving the IM response of missile propulsion systems due to Fragment Impacts and Slow Cook Off for the majority of HPP rocket motors, and solving the Fast Cook Off response of very large HPP motors.			
FY 2016 Accomplishments: - Formulated and conducted characterization, aging, and small scale performance testing on rocket propellant formulation composed of less reactive ingredients.			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Office of the Secretary Of Defense		Date: May 2017
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** P000 / *Insensitive Munitions*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
- Optimized novel mitigation device design and conducted small scale tests. - Produced 25 gram batches and completed characterization data on new slow cook-off propellant formulation. - Conducted critical temperature and auto ignition tests on formulations and down selected best performing modifications for year 2 formulation effort using a new sub-scale test to predict full-scale reactions in cook-off and impact testing. - Conducted preliminary testing on remote sensing device and interface sensing unit with venting device. - Established a baseline thermal history model to optimize current code to create a baseline model to correctly simulate the heat transfer and propellant decomposition chemistry. ***FY 2017 Plans:*** - Demonstrate acceptable small scale slow cook-off properties and demonstrate acceptable safety, tensile, and ballistic properties at the pint scale for new slow cook-off propellant formulation. - Demonstrate the concept and feasibility of a plateau burning propellant that will not maintain a reaction at elevated pressure - Integrate di-electric sensors into subscale motor test article. - Collect thermally damaged propellant burning rates to measure burning rate as a function of thermal exposure. ***FY 2018 Plans:*** - Solving the IM response of missile propulsion systems due to Fragment Impacts and Slow Cook Off for the majority of HPP rocket motors - Solving the Fast Cook Off response of very large HPP motors.			
Title: Minimum Signature Rocket Propulsion (MSP)	2.421	2.254	2.442
Description: MSP focuses on the development and demonstration of technologies to improve the IM response of MSP systems. The development and demonstration of minimum signature (MS) rocket technologies, when applied to munition systems, will improve munition IM response to one or more threats, while not degrading the response to other IM threats and, at minimum, maintaining munition performance. Technologies include, but are not limited to, MS rocket propellant formulations, ingredients for MS propellant formulations (including synthesis, characterization and scale-up), case and packaging design, active and passive venting techniques, rocket motor case design, ignition systems, and thrust mitigation techniques. Of particular interest are technologies that provide a higher burning rate minimum signature propellant with state-of-the-art energy and reduced shock sensitivity. The 2018 and 2023 year goals of the MSP MATG are concentrated on solving the IM response of missile propulsion systems due to Fragment Impact, Slow Cook Off, and Shaped Charge Jet (SCJ) threats. ***FY 2016 Accomplishments:*** - Conducted impact testing on baseline and novel MS propellants in representative cylindrical container to investigate propellant reactions relative to Army Burn-to-Violent Reaction (ABVR) test result predictions. - Fabricated and tested composite materials to validate modeling and analysis. Optimized materials and design for future testing.			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Office of the Secretary Of Defense		Date: May 2017
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** P000 / *Insensitive Munitions*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
- Synthesized and scaled up newly selected propellant ingredient to one kilogram batch for initial characterization studies. - Analyzed and fabricated composite material launch tube and perform fragment impact testing to gain data on material and fragment response. Optimized design based upon results. - Conducted cylindrical configuration propellant response testing to validate testing conducted on flat samples. - Scaled up to one pint mix new minimum signature propellant formulations and conducted safety testing. - Produced 250 gram batches of novel material for propellant formulation. ***FY 2017 Plans:*** - Fabricate baseline and optimized configurations with inert energetic and embedded sensors and conduct fragment impact testing of baseline and optimized configurations. - Validation of modeling will be conducted using a full scale propellant subjected to fragment impact testing. Comparison of data to predicted results will determine success of model. - Formulate extruded double base (NC/NG) types of energy levels without the use of nitro glycerin (NG) making the propellant much safer and resistant to shock - Develop predictive test tools for evaluation of novel propellant materials based on web thickness and bore size. ***FY 2018 Plans:*** - Solving the IM response of missile propulsion systems due to Fragment Impact, Slow Cook Off, and Shaped Charge Jet (SCJ) threats.			
Title: Blast and Fragmentation Warheads (BFW)	2.582	2.415	2.601
Description: BFW focuses on the development of technologies to improve the IM response of Blast/Fragmentation munitions. These technologies, when applied to munitions, improve IM response to one or more threats, while not degrading the response to other IM threats and, at minimum, maintain munition performance. Munition operating conditions may be controlled or have widely varying environmental conditions, such as temperature and vibration, and other factors such as cost, availability and reliability may be critically important depending on the intended munition application. Technologies include, but are not limited to, new ingredient synthesis and characterization, initial formulation development, scale-up, warhead/charge configuration, venting techniques for both munitions and their containers, protection or packaging materials and systems, shock mitigation liners, initiation devices, techniques, and technologies. Applications vary but include high performance warhead fills, booster explosives, bulk demolition charges, and bulk fills for blast and/or fragmentation charges. The 2018 and 2023 year goals of the BFW MATG are concentrated on solving the IM response of blast fragment warheads to the Sympathetic Detonation, Fast Cook Off, and SCJ threats. ***FY 2016 Accomplishments:***			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Office of the Secretary Of Defense		Date: May 2017
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** P000 / *Insensitive Munitions*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
- Conducted large scale gap experiment, as well as bullet and fragment impact testing on unique explosive formulation for large warheads. - Continued to mature explosive initiation device design and conducted small-scale performance testing. Down-selected design and began design refinement. - Utilized novel coating process and scaled up formulations of high energy explosive. Prepared samples and conducted screening tests. - Refined fuze booster design, conducted M&S to develop companion auxiliary booster to complete the explosive train, and include implications to future cost and manufacturing process. - Investigated unique initiation method in environmental operating range while meeting IM criteria. - Conducted small scale experiments to investigate impact on performance and sensitivity of novel lining material for air to air warhead. - Conducted baseline testing with known explosive materials to validate new model. ***FY 2017 Plans:*** - Conduct verification tests on fuze booster design in preparation for transition to Budget Activity (BA3) demonstration. - Develop replacement explosives for higher power Artillery and mortar systems such as the M1130 and MAPAM. - Develop and scale up novel meltable materials to improve munitions responses to slow cook off. - Conduct fragment impact tests on materials after unique initiation method exposure. - Demonstrate the possibility of fully insensitive materials (off) that can be “activated” (on) before being used to improve the safety and logistics burden. - Validate the predicted results with experimental results from two explosive materials, at two different sizes. Compare to existing data. ***FY 2018 Plans:*** - Solving the IM response of blast fragment warheads to the Sympathetic Detonation, Fast Cook Off, and SCJ threats.			
Title: Anti-Armor Warheads (AAW) ***Description:*** AAW focuses on the development of explosive ingredients, explosives, and warhead and fuze technologies for improving IM of AAW munitions. The development of explosive ingredients, explosives, and warhead and fuze technologies, when applied to munitions, improve IM response to one or more threats, while not degrading the response to other IM threats and, at minimum, maintain munition performance. Technologies include, but are not limited to, new ingredient synthesis and characterization, initial formulation development, scale-up, warhead/charge configuration, venting techniques for both munitions and their containers, protection/packaging materials and systems, shock mitigation liners, and initiation devices, techniques, and technologies. Applications vary but include high performance warhead fills, booster explosives, and all other technology to mitigate the violent response of AAW munitions to IM threats. Munition operating conditions may be controlled or have widely	2.352	2.185	2.371

Exhibit R-2A, RDT&E Project Justification: FY 2018 Office of the Secretary Of Defense		Date: May 2017
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** P000 / *Insensitive Munitions*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
varying environmental conditions, such as temperature and vibration, and other factors such as cost, availability, and reliability may be critically important depending on the intended munition application. The 2018 and 2023 year goals of the AAW MATG are concentrated on solving the IM response of anti-armor warheads to the Fragment Impact, Sympathetic Reaction, and Shaped Charge Jet threats for larger munitions and the Fragment Impact, Slow Cook-off, and Sympathetic Reaction / Shaped Charge Jet threats for Medium Caliber Munitions. ***FY 2016 Accomplishments:*** - Conducted tests using surrogate munition and shaped charge jet impact initiation testing configurations to validate models utility for weapon design. - Completed design of experiments, manufactured down-selected formulations, and conducted characterization study of newly identified explosive ingredient with high performance and low sensitivity potential. - Investigated initiation response of explosive due to SCJ stimuli using the model. - Matured formulation and process ability using new production technique. - Produced 100 pounds of a unique material and conducted formulation studies using a design of experiments to optimize the IM response. - Conducted small-scale mixtures to assist design of experiments for formulation of plastic explosive. ***FY 2017 Plans:*** - Complete in-situ mixing and casting of warheads in preparation for component testing using RAM technology. - Prepare and demonstrate an IM shock improvement by creation of nano explosive composites. - Demonstrate a ground to air weapon with improved shock sensitivity to the current Javelin system. ***FY 2018 Plans:*** - Solving the IM response of anti-armor warheads to the Fragment Impact, Sympathetic Reaction, and Shaped Charge Jet threats for larger munitions and the Fragment Impact, Slow Cook-off, and Sympathetic Reaction / Shaped Charge Jet threats for Medium Caliber Munitions.			
Title: Gun Propulsion (GP) ***Description:*** GP focuses on the development and demonstration of technologies in the area of GP systems. The development and demonstration of gun propulsion technologies, when applied to munition systems, will improve munition IM response to one or more threats, while not degrading the response to other IM threats and, at minimum, maintaining munition performance. Technologies include, but are not limited to, gun propellant formulations, ingredients for gun propellant formulations, including synthesis, characterization and scale-up, cartridge case and packaging design, active and passive venting techniques, reduced sensitivity primer propellant and primer systems, and robust primers for insensitive propellants. Applications vary, but include both large and medium caliber munitions, as well as propelling charges for mortars and shoulder launched munitions. Operating	1.968	1.790	1.959

Exhibit R-2A, RDT&E Project Justification: FY 2018 Office of the Secretary Of Defense		Date: May 2017
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** P000 / *Insensitive Munitions*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
requirements vary, and other factors such as barrel life and operation over varying environmental conditions may be critically important depending on the intended munition application. The 2018 and 2023 year goals of the GP MATG are concentrated on solving the IM response of gun propulsion munitions to Fragment Impact and Slow Cook Off threats. ***FY 2016 Accomplishments:*** - Matured unique process ingredient propellant formulation, conducted gun testing and prepared for large scale manufacturing of propellant to prepare for slow cook-off testing. - Conducted impact performance testing of propellant and primer for new projectile. - Compiled ballistic performance data on coated propellant for modelers. - Scaled up two candidate materials for manufacturing and conducted characterization studies for new propellant. - Prepared propellant formulations using three different methods, to compare product sensitivity and processing characteristics. - Developed two new large caliber propellant production techniques and used modeling and simulation to down select the formulations that will produce the least sensitive materials. ***FY 2017 Plans:*** - Integrate primer and conduct full scale gun testing on new propellant for fragment impact and slow cook-off response. - Prepare advanced coating materials and mixing methods to improve sensitivity to shock. - Conduct characterization studies on new large caliber propellant formulations, down select and conduct sub-scale IM testing. - Demonstrate a new gun propellant and cook off system for the 120mm rifled mortar system that can also improve the response of the High Explosive Guided Mortar (HEGM) system. ***FY 2018 Plans:*** - Solving the IM response of gun propulsion munitions to Fragment Impact and Slow Cook Off threats.			
Accomplishments/Planned Programs Subtotals	12.828	11.993	12.910

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
• 0603000D8Z P002: *BA 3 Insensitive Munitions Advanced Technology*	18.867	17.756	19.039	-	19.039	19.152	19.323	19.640	20.028	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Office of the Secretary Of Defense		Date: May 2017
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** P000 / *Insensitive Munitions*

E. Performance Metrics

1) Transition of technologies developed by the Program are tracked and documented by technology maturity.
2) Munition Area Technology Group (MATG) Technology Roadmaps are prepared, evaluated, and analyzed by Joint Insensitive Munitions Technology Program management and technical staff.
3) Chairman's Annual Assessments for each MATG are critically reviewed by the Technical Advisory Committee to determine progress, transition plans, and relevance of each project.
4) Project progress toward goals and milestones is assessed at each MATG meeting.
5) Annual technical reports and papers are tracked and documented for the Program.
6) External Peer Review of Projects conducted as part of Joint Army/Navy/NASA/Air Force meetings.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Office of the Secretary Of Defense			Date: May 2017
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602000D8Z / *Joint Munitions Technology*	Project (Number/Name) P204 / *Enabling Fuze Technology*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
P204: *Enabling Fuze Technology*	23.216	6.165	5.752	6.201	-	6.201	6.258	6.316	6.420	6.545	Continuing	Continuing

A. Mission Description and Budget Item Justification

This RDT&E effort will demonstrate fuze enabling technologies needed to develop weapons that address priority capability areas identified in the Guidance for Development of the Force (GDF), the Secretary of Defense Memorandum, DoD Policy on Cluster Munitions and Unintended Harm to Civilians, and shortfalls in current weapon systems. This effort will develop enabling technologies at the laboratory scale and transition them into Budget Activity (BA) 6.3 demonstration programs for weapons where priority capabilities and technology needs have been identified and validated by the Program Executive Officers (PEOs) and the Heads of the Service Science and Technology (S&T) communities. Mature BA 6.2 fuze technologies will be transitioned, thereby decreasing their program costs and schedule risk and facilitating spin-offs to other munitions within their portfolios.

Under the Joint Fuze Technology Program (JFTP), investments are focused on specific capability areas that have been identified by the Department's strategic guidance and current shortfalls in weapon systems and validated by the PEOs and Heads of the Service S&T communities. The four capability areas are: 1) Hard Target Survivable Fuzing, 2) Tailorable Effects (TE) Weapon Fuzing, 3) High Reliability Fuzing, and 4) Enabling Fuze Technologies and Common Architecture.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Hard Target Fuzing	1.590	1.504	1.617
Description: The Hard Target Fuzing challenges are grouped into three Technology Areas. First, improved modeling and simulation (M&S) capabilities provide the validated computational tools necessary for hard target applications. Second, basic phenomenology and understanding of the Fuze Environment is the science-based endeavor of providing the test equipment, instrumentation, and analysis techniques for experimentation and data gathering necessary for next generation fuzing. Third, hard target survivable fuze components are developed to increase the effectiveness of facility denial munitions by improving the prediction tools and testing methodologies to evaluate the survivability and functionality of legacy and future fuzes. Development of these technologies will enable next generation boosted and hypersonic penetrators to execute missions against hardened and deeply buried targets.			
FY 2016 Accomplishments: - Developed high shock survivable low-cost target layer detection fuze sensor to measure post impact environments in hardened target weapons. - Developed modeling & simulation code that enables simulation of fuze response at high frequency regimes in the hard target environment.			
FY 2017 Plans:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Office of the Secretary Of Defense		Date: May 2017
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** P204 / *Enabling Fuze Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
- Develop and demonstrate 3-D printed fuze electronic components and packaging technologies for survivability and reliability in DoD hypersonic penetrating weapons. - Develop fuze energetic and firing components to reliably function in boosted and hypersonic penetrators munitions. ***FY 2018 Plans:*** - Release modeling and simulation tools to improve the prediction of the dynamic response of embedded fuze systems for a specific shock environment. - Conduct characterization testing for establishing design guidelines of ruggedizing fuzes in high shock environment.			
Title: Tailorable Effects Fuzing ***Description:*** Develop fuzing for tailorable effects weapons that encompasses the ability to selectively vary the output of the weapon (Dial-a-Yield) and/or the ability to generate selectable effects (directed blast, fragmentation). Develop initiation and multi-point technologies; electronic safe and arm based multi-point initiators for tunable output – scalable yield warheads; MicroElectro-Mechanical Systems (MEMS) based multi-point initiators for tunable output/scalable yield warheads; and smart fuzing for tailorable effects weapons. These technologies will enable weapons that can effectively defeat a variety of targets while minimizing unintentional collateral effects. ***FY 2016 Accomplishments:*** - Development of multi-point inline firing system in simultaneous and/or post-impact delay into Double Reinforced Concrete (DRC) / Brick over Block (BOB) or equivalent target in accordance with Redstone Test Center (RTC) standards. ***FY 2017 Plans:*** - Develop wirelessly powering and functioning distributed detonating output nodes in a multi-output safe, arm, and fire system for distributed weapon fuzing and initiation systems, eliminating the need for complex cable assemblies and adding flexibility for easily customizing. - Demonstrate and transition into Budget Activity (BA) 6.3 advanced technology development of Hardened Selectable Multipoint Fireset technologies that provides reliable, selectable detonation of tailorable effects warheads. ***FY 2018 Plans:*** - Develop government owned detonator formulation for weapons with inline fuzing architectures conventional or high-g applications. - Demonstrate wirelessly powering and functioning distributed detonating output technology in a multi-output safe, arm, and fire system.	1.486	1.303	1.415
Title: High Reliability Fuzing	1.569	1.475	1.587

Exhibit R-2A, RDT&E Project Justification: FY 2018 Office of the Secretary Of Defense		Date: May 2017
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** P204 / *Enabling Fuze Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Description: Develop high reliability fuzing architectures, fuzing components, and Unexploded Ordnance (UXO) reduction features. These technologies will enable the next generation of cluster munitions to achieve the required greater than 99 percent reliability goal. Evolving DoD emphasis on increased weapon system reliability is driving the need to consider new and novel approaches for achieving increased fuze reliability while maintaining or enhancing fuze design safety. DoD policy, higher weapon reliability expectations and harsher weapon system operational requirements are dictating the need for higher fuze reliability than available using current technologies. ***FY 2016 Accomplishments:*** - Completed testing and characterization of MEMS safety and arming (S&A) micro scale materials and energetics to transition into high reliability low cost munitions technology applications. - Developed experimental techniques and applied M&S tools to analyze and evaluate fuze components and explosive trains to increase margin of reliability in fuze design. ***FY 2017 Plans:*** - Develop and demonstrate energy harvesting and free fall sensor technologies to power an electronic safe-arm fuze resulting in an increased margin of reliability in general purpose bomb fuzes. - Investigate reactive growth process at ideal and marginal conditions to guide the quantification of fuze explosive train margin and performance. Applications include: Air Force penetrator weapon demo programs and Army M935 and Precision Guidance Kit (PGK) fuzes. ***FY 2018 Plans:*** - Develop liquid reserve lithium oxyhalide battery technology with fast rise time and maintain low temperature performance in weapon applications. - Develop MEMS scale stab detonator and micro-scale firetrain technologies for miniature fuzing applications.			
Title: Enabling Fuze Technologies ***Description:*** Develop common/modular fuze architecture; innovative fuze component technologies; sensors; next generation fuze setting capability, tools and modeling; and fuzing power sources. These fuzing technologies will provide smaller, more cost effective solutions while meeting or exceeding the performance of existing technologies. Development of these technologies will enable future weapon applications to be more mission adaptive and smaller along with improved target detection capabilities. ***FY 2016 Accomplishments:*** - Developed and demonstrated low cost, small energy harvesting and event detection sensors for application in cannon fire projectile fuzing that improves safety.	1.520	1.470	1.582

Exhibit R-2A, RDT&E Project Justification: FY 2018 Office of the Secretary Of Defense		Date: May 2017
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** P204 / *Enabling Fuze Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
- Continued development of prototype wireless technology system so as to provide power and data transfer to aerial rockets and small guided munitions for use on US Army rotary aircraft. ***FY 2017 Plans:*** - Develop fast radar signature simulation tool for application in fuzing sensor algorithms that will enables rapid detection and processing of complex targets during weapon end-game. - Develop a reliable, low cost (reduce by 40%) pulse discharge switch for application in electronic safe/arm fuzes (ESAFs). ***FY 2018 Plans:*** - Develop conformal antennas with wideband operation to provide fuze sensor waveforms for target detection. - Develop miniature thermal battery technology to yield fast rise time and high power density required for small munitions.			
Accomplishments/Planned Programs Subtotals	6.165	5.752	6.201

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
• 0603000D8Z P301: *BA 3 Enabling Fuze Advanced Technology*	6.585	6.146	6.588	-	6.588	6.627	6.678	6.781	6.949	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

1) Transition of technologies developed by the Program are tracked and documented by technology maturity.
2) Fuze Area Technology Group (FATG) Technology Roadmaps are prepared, evaluated, and analyzed by Joint Fuze Technology Program management and technical staff.
3) Chairman's Annual Assessments for each FATG are critically reviewed by the Technology Advisory Committee to determine progress, transition plans, and relevance of each project.
4) Project progress toward goals and milestones is assessed at each FATG meeting.
5) Annual technical reports and papers are tracked and documented for the Program.
6) Technology Transition Agreements in place with Munitions programs.