Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Office of the Secretary Of Defense	Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	-	19.092	24.397	19.591	-	19.591	-	-	-	-	-	-
000: *Insensitive Munitions*	-	12.924	0.000	0.000	-	0.000	-	-	-	-	-	-
204: *Enabling Fuze Technology*	-	6.168	6.288	0.000	-	0.000	-	-	-	-	-	-
076: *Enhanced Munitions*	-	0.000	18.109	19.591	-	19.591	-	-	-	-	-	-

Note

This Program Element (PE) aligns with PE 0603000D8Z, Joint Munitions Advanced Technology. The two project codes within each PE form the 6.2 applied research and 6.3 technology demonstration components of the Joint Enhanced Munitions Technology Program (JEMTP) and the Joint Fuze Technology Program (JFTP). The JEMTP funds applied research efforts from PE 0602000D8Z Project code (P) 076 Enhanced Munitions and technology demonstration efforts from PE 0603000D8Z P077.

The JFTP funds applied research efforts from PE 0602000D8Z P204 Enabling Fuze Technology and technology demonstration efforts from PE 0603000D8Z P301. In FY 2022 the JFTP and JEMTP will merge and the program scope will expand to exploit technology developments and accelerate their application to enable next generation kinetic weapons capabilities in the areas of energetic materials, propulsion, warhead effects, fuzing, power sources, guidance, navigation & control, communications and munitions airframe applied technologies.

With the JFTP and JEMTP merge in FY 2022, the P204: Enabling Fuze Technology line and budget will combine into P076 Enhanced Munitions.

A. Mission Description and Budget Item Justification

This program conducts cross-cutting, foundational research improving the lethality, range, reliability, safety, survivability, and effectiveness of kinetic weapon systems to rapidly advance U.S. capabilities necessary for the Joint Fight. The program technology objectives include: high-speed weapon delivery, longer range precision effects, networked and collaborative systems of systems, agility at the engagement level, increased capacity / affordable munitions, survivability during delivery and target engagement, and open systems architecture. The program develops enabling technologies specific to kinetic weapon munitions (warheads, propulsion, advanced lethality mechanisms, state of the art fuzing technologies, and pioneering targeting technologies) from a Joint Service, multi-domain perspective, thus maximizing efficiencies and ensuring the development of technologies with the broadest applicability to ensure good stewardship of taxpayer dollars.

U.S. power projection capabilities are comparable to near peer adversaries, and there is an urgent need to provide U.S. warfighters with augmented or new capabilities to ensure technical superiority. The program follows a threat/opportunity analysis to develop kinetic capabilities that enable scenario-based effects from a Joint Fight perspective by exploring technological advances that are beyond Service investment risk acceptance and target asymmetric advantage. The goal is to enable military dominance to ensure effective deterrence of adversary aggression.

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Office of the Secretary Of Defense	Date: May 2021
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602000D8Z *I Joint Munitions Technology*

The program will invest in technologies that will enable U.S. warfighters to regain the operational and battlefield advantages that technologies can provide through increased performance, range, and lethality to improve the Joint Force military advantages and build a more lethal force across all contested domains – air, land, sea, and space. This program's investment portfolio has been aligned to complement, and utilize, the Department's priority technology areas.

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	19.306	19.409	19.833	-	19.833
Current President's Budget	19.092	24.397	19.591	-	19.591
Total Adjustments	-0.214	4.988	-0.242	-	-0.242
• Congressional General Reductions	-	-0.012			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	5.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.211	-			
• Program Adjustments	-	-	-0.242	-	-0.242
• Cancelled Account	-0.003	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: 076: *Enhanced Munitions*		
Congressional Add: *Advanced Energetics Long Range Munitions*	-	5.000
Congressional Add Subtotals for Project: 076	-	5.000
Congressional Add Totals for all Projects	-	5.000

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602000D8Z / *Joint Munitions Technology*	Project (Number/Name) 000 / *Insensitive Munitions*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
000: *Insensitive Munitions*	-	12.924	0.000	0.000	-	0.000	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The enhanced munitions effort will explore and develop advanced energetics concepts and explosive and propellant materials with the potential to improve the performance, range, and lethality of weapons. Technologies and concepts developed will have the potential to impact multiple munitions technologies with wide applicability to improve the performance, lethality, and range of weapons to ensure the U.S. is not outgunned and outranged on the battlefield of the future.

The Joint Enhanced Munitions Technology Program (JEMTP) investments focus on five Munition Areas: 1) High Performance Rocket Propulsion; 2) Minimum Signature Rocket Propulsion; 3) Area Effects Warheads; 4) Hard Target Effects Warheads; and 5) Gun Propulsion. Munition Area Technology Groups (MATG), under tri-service leadership, have developed technology roadmaps for each Munition Area, which are used to guide investments based on goals consistent with the DoD priorities. These technologies, alone or in combination, will be incorporated in hardware, simulating real-world munitions, to demonstrate their utility and feasibility as part of Technology Transition Agreements with Program Executive Offices (PEOs).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Enhanced Munitions (previously Insensitive Muntions)	12.924	-	-
Description: Enhanced Munitions focuses on the following key areas: - High Performance Propulsion – Develops technologies to improve weapon range and speed, rocket motors with Ammonium Perchlorate, with or without a metal fuel, for rockets and missiles launched from air, ground, and sea platforms as well as advanced air breathing systems. - Minimum Signature Rocket Propulsion (MSP) - focuses on the development and demonstration of technologies to improve range and speed of minimum signature propellant missiles. - Area Effects Warheads (AEW) - focuses on the development of technologies to enhance the lethality of blast/ fragmentation munitions. - Hard Target Effects Warheads (HTEW) - focuses on the development of explosive ingredients, explosives, and warhead technologies for improving performance of Anti-armor warhead munitions. - Gun Propulsion (GP) - focuses on the development and demonstration of propellant, case, and igniter technologies for improved gun propulsion. FY 2020 Accomplishments: - Evaluated novel ingredients to increase conventional propellant burn rate for extended range across a suite of munitions. Completed the initial testing of a new large diameter, tactical engine for future extended range systems. Demonstrated the			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** 000 / *Insensitive Munitions*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
printing of a new rocket propellant for use in boost motors for high speed weapons. Demonstrated binder system for advanced boost motors with increased service life. - Evaluated proven binder materials for a missile propellant that can be used in multiple minimum signature applications. Down-selected modified high sensitivity formulations to six candidates to compare against baseline propellant and conduct performance testing. Formulated propellant using novel ingredients and advanced processing to reduce risk. - Completed initial designs on additively manufactured fragmenting warheads to tailor fragment size and increase fragment velocity. Performed modelling and simulation effort to investigate small scale detonations for improved pressure and lethality. Began evaluation of new ingredients in novel explosives for high energy warheads. - Produced precursor materials for new novel explosive material and produced 10 kg of new material, for studies to ensure viability and optimized material. Evaluated very fine grain novel material for use with multiple binder systems for increased performance and penetration. - Investigated a pressed cured explosive utilizing a unique binder system to be formulated with multiple nitramines. Completed development of a dual explosive shaped charge jet for improved performance. - Investigated novel solvent-less processing for improved thermal properties and tailored energy release. Developed a continuous process to produce a novel energetic plasticizer that is more energetic than current materials. Acquired and began formulation work with a new form of nitrocellulose (NC) that will potentially increase gun propellant energy and simplify gun propellant production for small and medium caliber gun propulsion systems.			
Accomplishments/Planned Programs Subtotals	12.924	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602000D8Z / *Joint Munitions Technology*	Project (Number/Name) 204 / *Enabling Fuze Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
204: *Enabling Fuze Technology*	-	6.168	6.288	0.000	-	0.000	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This RDT&E effort strategically develops fuze-enabling technologies needed to develop weapons that address Joint fight capability areas including ones highlighted by the Office of the Under Secretary of Defense for Research and Engineering (OUSD(R&E)) Munitions Science and Technology (S&T) Joint strategy and Technology-Focused Modernization such as High Speed Weapons, Networked Munitions, Air Defense and Scalable Lethality. This effort identifies and matures fuze enabling technologies at the laboratory scale and transitions them into Budget Activity (BA) 6.3 technology maturation and demonstration programs.

The Joint Fuze Technology Program (JFTP) investments are focused on four fuze capability areas that reflect U.S. fuzing capability gaps: 1) Extreme Environment Survivable Fuzing, 2) Tailorable Effects Fuzing and Warhead Initiation, 3) High Reliability Safe and Arm Technology, and 4) Target Detection and Burst Point Control.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Enabling Fuze Technology	6.168	6.288	0.000

Description: Enabling fuze technology focuses on the following areas:
- Extreme Environmental Survivable Fuzing - challenges are addressed with improved modeling and simulation (M&S) capabilities to provide the computational tools necessary understand extreme weapon environments, test equipment, instrumentation, and analysis techniques that provide basic phenomenology and understanding of the fuze environment, and survivable fuze components are developed to increase the effectiveness of hypersonic munitions by improving the prediction tools and testing methodologies to evaluate the survivability and functionality of future fuzes. Development of these technologies will enable next generation of hypersonic weapon fuzes to survive and function.
- Tailorable Effects Fuzing and Warhead Initiation - develops technologies for tailorable effects weapons that encompasses the ability to selectively vary the output of the weapon and the ability to generate selectable effects, initiation and multi-point technologies; electronic safe and arm based multi-point initiators, and embedded fuzing for high speed/penetrating weapons.
- High Reliability Safe and Arm Technology - develops high reliability common fuzing architectures, miniature/high efficiency munitions power sources, and Unexploded Ordnance (UXO) reduction features.
- Target Detection and Burst Point Control - develops sensing and algorithm foundational technologies for precision target detection while meeting or exceeding the performance of existing technologies in order to operate in contested and high speed weapon environments.

FY 2020 Accomplishments:
- Completed research that establish foundational knowledge and feasibility of application of Doppler Synthetic Aperture Radar (SAR) for very high speed weapons applications.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** 204 / *Enabling Fuze Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Developed highly efficient proximity fuze RADAR signal processing algorithms and associated hardware architectures to create minimally sized affordable tracking proximity sensors. - Developed foundational knowledge of using acoustic wireless power transfer to enable embedding fuzing in the warhead explosive fill to replace complex weapon cabling. ***FY 2021 Plans:*** - Conduct High G characterization testing for establishing design guidelines of ruggedizing fuzes in high shock environment. - Demonstrate highly reliable and robust safe and arm sensors for High Speed and Counter Unmanned Aerial System (UAS) weapons. - Demonstrate non-RF detection and advanced algorithm technologies for fuzing applications for Air Defense and Counter-Unmanned Aerial System (c-UAS) weapons. ***FY 2022 Plans:*** Enabling fuze technology work and resourcing planned for FY 2022 will be transferred to Project Code 076 Enhanced Munitions as a technical area under the Joint Enhanced Munitions Program. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding re-aligned to Project Code 076 to merge the JFTP and JEMTP efforts.			
Accomplishments/Planned Programs Subtotals	6.168	6.288	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense			Date: May 2021
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602000D8Z / *Joint Munitions Technology*	Project (Number/Name) 076 / *Enhanced Munitions*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
076: *Enhanced Munitions*	-	0.000	18.109	19.591	-	19.591	-	-	-	-	-	-

Note

New project code beginning in FY 2021. Funding was realigned from P000 Insensitive Munitions.

A. Mission Description and Budget Item Justification

The enhanced munitions effort investigates and develops advanced energetics concepts and explosive and propellant materials with the potential to improve the performance, range, speed, and lethality of weapons. Technologies and concepts developed will have the potential to impact multiple munitions types with wide applicability to improve the performance, lethality, speed, and range of weapons to ensure the U.S. is not outgunned and outranged on the battlefield of the future.

Through FY 2021, the Joint Enhanced Munitions Technology Program (JEMTP) investments focus on five Munition Areas: 1) High Performance Rocket Propulsion, 2) Minimum Signature Rocket Propulsion, 3) Area Effects Warheads, 4) Hard Target Effects Warheads, and 5) Gun Propulsion. Munition Area Technology Groups (MATG), under tri-service leadership, have developed technology roadmaps for each Munition Area which is used to guide investments based on goals consistent with the DoD National Defense Strategy. The improved performance technologies developed, alone or in combination, will be incorporated in hardware, simulating real-world munitions, to demonstrate their utility and feasibility as part of Technology Transition Agreements with Program Executive Offices (PEOs).

In FY 2022, the Joint Fuze Technology Program (JFTP) and JEMTP will merge and the program scope will expand to exploit technology developments such as (hypersonics, machine learning, artificial intelligence, quantum computing, etc.) and accelerate their application to enable next generation kinetic weapons capabilities in the areas of energetic materials (EM), advanced propulsion (AP), warhead effects (WE), enabling fuze technologies (FT), and pioneering targeting technologies (TT) with a specific focus on enhancing kinetic weapons lethality, range and resultant effects. The program will retain tri-service leadership to inform technology investments accelerating development across the Department. Investments will be informed by a threat-opportunity based analysis that focuses on developing weapons systems that exploit technology dominance to ensure military objectives in Joint Force campaign scenarios. New technology roadmaps for munition technical areas will guide investments consistent with the DoD National Defense Strategy and inform Service technology investments.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Enhanced Munitions	-	13.109	19.591
Description: Enhanced Munitions focuses on the following key areas: - High Performance Propulsion – Develops technologies to improve weapon range and speed, rocket motors with Ammonium Perchlorate, with or without a metal fuel, for rockets and missiles launched from air, ground, and sea platforms as well as advanced air breathing systems. - Minimum Signature Rocket Propulsion (MSP) - focuses on the development and demonstration of technologies to improve the range and speed of minimum signature propellant missiles launched from air, ground, and sea platforms.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** 076 / *Enhanced Munitions*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Area Effects Warheads (AEW) - focuses on the development of technologies to improve the lethal effectiveness and reduce the size and weight of Area Effects munitions. - Hard Target Effects Warheads (HTEW) - focuses on the development of explosive ingredients, explosives, and warhead technologies to improve the performance of penetrator munitions. - Gun Propulsion (GP) focuses on the development of technologies in the area of GP systems to improve the range and/or time to target of all gun launched munitions to include tank/mortar and medium/large caliber propulsion systems, as well as shoulder launched weapon systems. ***FY 2021 Plans:*** - Complete small-scale safety testing and larger scale characterization testing of novel propellant material. Scale-up and test the feasibility of a dual use propellant that can be used as an explosive to create fragments. Investigate novel materials that can be used to reduce weight by replacing the rocket motor casing. Complete sub-scale and start full scale testing on novel propulsion system - Conduct small-scale safety testing and scale up to 50 gram batches novel reduced smoke propellant. Integrate novel mixing methods to create formulations using proven binder materials for eventual demonstration in future air-to-ground missile systems. - Complete modeling and simulation, as well as small-scale testing on novel explosive initiation technique. Conduct hydrocode modeling of unique large projectile warhead design with improved lethality. - Complete 50 gram scale-up batches of explosive formulations for testing and down-selection to two formulations. - Complete formulation, interior ballistics modelling, and small-scale tests of coextruded propellant. Complete lab-scale evaluation of advanced coatings for improved performance at cold temperature and scale up to 40 pound batches of materials. ***FY 2022 Plans:*** In FY 2022, the JFTP will merge with the JEMTP, and the program scope will expand to holistically address S&T that will enable next generation kinetic weapons capabilities, specifically, energetic materials, advanced propulsion, warhead lethal effects, enabling fuze technologies, and advanced targeting. Existing projects will be realigned to the new program structure and re-competed against potential new efforts program-wide. - Fabricate test motors with novel propellant material and validate improved performance. Complete full scale testing on novel propulsion system, to prepare for demonstration transition. - Prepare full-scale demonstration and complete testing on novel explosive initiation technique. - Complete structural modeling, fabrication, loading, and testing of first series improved lethality warhead. - Scale-up explosive formulations to complete cylinder expansion and set-back testing. - Develop critical fuze component and munitions technologies for embedded, smart fuzes to enable networked weapons effects and precision warhead detonation.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense		Date: May 2021
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602000D8Z / *Joint Munitions Technology*	**Project (Number/Name)** 076 / *Enhanced Munitions*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Develop additively manufactured fuzing radome technology to enhance target detection performance and resistance to jamming in contested environments. - Develop new multi-mode ultrafast targeting algorithms exploiting advancements in microelectronics and materials. - Develop technologies to enable collaborate weapons communication and networking facilitating improved guidance, target detection, and weapons effectiveness. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding re-aligned from Project Code 204 to merge JFTP and JEMTP efforts in Project Code 076.			
Accomplishments/Planned Programs Subtotals	-	13.109	19.591

	FY 2020	FY 2021
Congressional Add: Advanced Energetics Long Range Munitions	-	5.000
FY 2021 Plans: - Explore advanced energetics concepts and accelerate development of new explosive and propellant materials to drive improvements to the performance, range, and lethality of weapons. - Application of machine learning tools and techniques for advanced energetics discovery and applied research of energetics suitable for long range/high speed munitions propellant applications.		
Congressional Adds Subtotals	-	5.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A