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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 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603225D8Z I Joint DOD/DOE Munitions Technology Development
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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	-	18.681	18.861	19.063	-	19.063	-	-	-	-	-	-
225: Joint DOD/DOE Munitions	-	18.681	18.861	19.063	-	19.063	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The Department of Defense (DoD)/Department of Energy (DOE) Joint Munitions Technology Development Program (JMP) enables military superiority by setting and driving the critical path for cutting-edge capability-driven munitions science and technology (S&T) to equip the Joint Force for the future fight. The JMP portfolio comprises essential cross-cutting and foundational S&T investments that enable Future Force operational capabilities in the near, mid, and far term. In setting the technical direction for the DoD, the Joint DoD/DOE Munitions Program performs S&T to advance the state of the art for non-nuclear munitions technology in the focus areas of decision tools, delivery, munition controls, lethal effects, and readiness.

A Memorandum of Understanding signed in 1985 by the DoD and DOE provides the basis for the cooperative effort. Through this interdepartmental cooperation and joint investment (DOE matches the DoD's investment at 1:1), DoD leverages the DOE's substantial investments in intellectual capital and highly specialized skills, advanced scientific equipment and facilities, and computational tools not available within the DoD, bolstering good stewardship of taxpayer dollars. The portfolio is monitored by a panel of Tri-Service Senior Executive Service-nominated subject matter experts who conduct rigorous technical and programmatic review to prioritize essential investments. The technology, resources, and capabilities return for DoD in this program is estimated at two to three times its investment.

B. Program Change Summary (\$ in Millions)

	<u>FY 2020</u>	<u>FY 2021</u>	<u>FY 2022 Base</u>	<u>FY 2022 OCO</u>	<u>FY 2022 Total</u>
Previous President's Budget	18.773	18.873	19.285	-	19.285
Current President's Budget	18.681	18.861	19.063	-	19.063
Total Adjustments	-0.092	-0.012	-0.222	-	-0.222
• Congressional General Reductions	-	-0.012			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.089	-			
• Program Adjustment	-	-	-0.222	-	-0.222
• Cancelled Amount	-0.003	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Office of the Secretary Of Defense **Date:** May 2021

Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603225D8Z / Joint DOD/DOE Munitions Technology Development	Project (Number/Name) 225 / Joint DOD/DOE Munitions
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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
225: Joint DOD/DOE Munitions	-	18.681	18.861	19.063	-	19.063	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

Projects within the JMP portfolio enable capability advancements in: higher speed and hypersonic delivery, counter unmanned aerial systems, microelectronics, longer range precision effects, networked and collaborative systems of systems, agility at the engagement level, logistics in contested environments, increased capacity/affordable mass, survivability during deployment and target engagement, rapid technology refreshes/adaptation to changing threats, post-launch re-programming, open systems architectures, and weapon cyber-resiliency. JMP investments may be leverageable for nuclear deterrence, space, quantum science, and 5G, but the portfolio does not specifically focus on these capability areas.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2020	FY 2021	FY 2022
Title: Joint DoD/DOE Munitions Technology Development	18.681	18.861	19.063
<p>Description: DoD/DOE Munitions Technology Development focuses on the following key areas: (1) the development of in silico decision tools for munition design and in-theater function; (2) innovation of munitions delivery technology to include weapon bodies, propulsion systems, propellants, and environment/target hardening; (3) development of state-of-the-art munition controls for fuzing, microelectronics, power, sensors, kill chains, and survivable components; (4) design of lethal effects through explosive, formulation, warhead, and target damage innovations; and (5) development and transition of decisive readiness technology for munitions through the full munitions lifecycle (design through end-of-life). The JMP organized accordingly with five Technical Coordinating Groups (TCGs), Decision Tools, Delivery, Munition Controls, Lethal Effects, and Readiness.</p> <p>FY 2021 Plans: In FY 2021 the portfolio will be completely aligned with the TCG structure with a new Statement of Need process to identify and prioritize DoD S&T gaps and leverage DOE investment. This process is fully coordinated with OUSD(R&E) Hypersonics efforts and will be utilized to develop technology solutions for hypersonic weapons developments and existing and future conventional weapons systems.</p> <ul style="list-style-type: none"> • TCG 1 – Decision Tools will employ machine learning code development to support lethality assessments, develop multi-physics modeling code development and updates (ALE3D, CTH), and corresponding experimental verification and validation to inform hypersonics warhead design. • TCG 2 – Delivery will develop processing techniques for high performance and robust materials to inform high speed and hypersonic system development efforts. 			

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B. Accomplishments/Planned Programs (\$ in Millions)

- TCG 3 – Munition Controls will advance thin film thermal battery development and performance modeling for reduced munition footprint and stability in hypersonics environments, develop new initiation systems and characterization tools to reduce SWaP with increased thermal stability, mechanical survivability, and intelligent fuzing/firing response time, and develop new sensors (GPS-denied environments, proximity sensors) for extreme environments.
- TCG 4 – Lethal Effects will develop new high performance, low sensitivity energetic ingredients and new formulations, and characterization techniques to develop materials capable of withstanding demanding hypersonic environments (high temperatures, shock, vibration) while coupling these efforts with approaches for advanced warhead architectures and processing methods (additive manufacturing) to support hypersonic warhead design. Focus will also be put toward penetrator impact event modeling (terminal ballistics) and high strength concrete modeling code development to inform target effects.
- TCG 5 – Readiness will evaluate and quantify COTS device reliability studies to inform in-use and storage readiness for hypersonic components

FY 2022 Plans:

In FY 2022, the portfolio will address priority DoD S&T capability advancements and leverages DOE investment.

- The Decision Tools focus area will a) employ machine learning code development to support lethality assessments/ weaponizing models, b) accelerate decision tool codes with faster processing, c) demonstrate improved munitions and subsystems modeling and simulation in complex shock environments, and d) deliver improved material model packages for hard and deeply buried targets.
- The Delivery focus area will: a) deliver integrated warhead cases for high speed perforation/penetration into buildings, light bunkers, and maritime targets, and b) fabricate and test materials for hypersonics.
- Munition Controls will a) demonstrate design improvement for a novel supercapacitor, b) optimize explosive-train design in the presence of competing system requirements, c) deliver a transformer component in a relevant form factor, d) demonstrate survivability of a capacitor for miniaturized fuzing, e) demonstrate development of a component for hardened electronic, verify a GPS-denied navigation solution, and f) advance and transition sensor technology battery innovations.
- Lethal Effects will a) demonstrate explosive volume reduction using additive manufacturing, b) demonstrate increase in kinetic energy for an additively manufactured subsystem, c) deliver a characterization dataset for novel energetics, d) predict effects of gun launch on energetics, e) validate materials and diagnostics for improved energetics, f) deliver a database for warhead materials, g) improve energetic systems performance, h) deliver a model to predict temperature effects on lethal systems, i) validate an arena-test alternative, and j) produce a dataset for enhanced target damage.
- Readiness will: a) baseline additively manufactured parts for qualification standards, b) deliver test method for a power system failure mode analysis, and c) identify mechanism for adhesive failures in components.

FY 2021 to FY 2022 Increase/Decrease Statement:

FY 2020	FY 2021	FY 2022

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021	FY 2022
Changes reflect minor budget fluctuation.			
Accomplishments/Planned Programs Subtotals	18.681	18.861	19.063

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A