Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Defense Threat Reduction Agency	Date: March 2023
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 1: *Basic Research*	**R-1 Program Element (Number/Name)** PE 0601000BR / *DTRA BASIC RESEARCH*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	401.058	11.519	16.584	14.761	-	14.761	15.311	15.897	16.498	17.128	Continuing	Continuing
RU: *BASIC RESEARCH FOR COUNTERING WMD*	401.058	11.519	16.584	14.761	-	14.761	15.311	15.897	16.498	17.128	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Basic Research for Countering WMD project, as the nation's primary basic research portfolio dedicated to countering weapons of mass destruction (CWMD), is a core strategic investor in future scientific and technological progress across the Defense Threat Reduction Agency's (DTRA) mission areas. This project concentrates on high-risk, high-payoff basic research, leveraging world-class expertise in academia, government, and industry, to increase the foundational body of scientific knowledge supporting DTRA's Applied Research and Advanced Technology Development projects.

This project aligns with DTRA's strategic objectives that support policy and planning guidance from the Executive Office of the President, the DoD, and the broader WMD threat reduction community. The portfolio addresses this guidance through capability enhancements, projects, and Science and Technology (S&T) investments that support CWMD. Specifically, they include: accelerating the development of standoff radiological/nuclear detection capabilities; securing vulnerable materials; defeating WMD agents; strategic radiation hardened microelectronics; and leveraging science, technology, and innovation through domestic partnerships and agreements.

This project solicits, coordinates, and conducts research to build a robust, forward-looking fundamental research portfolio targeting strategic, mission-focused, basic research with high potential impact for CWMD. The research projects are selected for scientific merit, technical quality, and the potential for innovation. Each research project offers opportunities to expand the knowledge base to help the warfighter, to bring to bear new science solutions with a fresh approach, or to leverage revolutionary approaches to technical surprise, building a foundation for future CWMD solutions. This research will enable new capabilities to control, defeat, disable, and/or dispose of WMD threats.

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B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	11.828	11.584	11.715	-	11.715
Current President's Budget	11.519	16.584	14.761	-	14.761
Total Adjustments	-0.309	5.000	3.046	-	3.046
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	5.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-0.309	0.000			
• Realignments	-	-	3.046	-	3.046

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: RU: *BASIC RESEARCH FOR COUNTERING WMD*		
Congressional Add: *Materials Science in Extreme Environments*	-	5.000
Congressional Add Subtotals for Project: RU	-	5.000
Congressional Add Totals for all Projects	-	5.000

Change Summary Explanation

The increase in FY 2024 from the previous President's Budget funds additional post-doctoral expertise while expanding basic research activities in the University Research Alliances (URAs). Additional resources fund enhancements for strategic competition to sustain global scientific enduring advantage in support of future warfighting. This will enable fundamental research in nuclear detonation plume modeling and radiological signature analysis to leverage novel Machine Learning techniques and automate discovery and manufacturing of new radiation-sensitive materials, reducing the cost of deployed radiation detectors by a factor of 10. This increase is funded predominately by decreased investment in Project RR: Countering WMD Test and Evaluation in PE 0602718BR.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Defense Threat Reduction Agency			Date: March 2023
Appropriation/Budget Activity 0400 / 1	R-1 Program Element (Number/Name) PE 0601000BR / *DTRA BASIC RESEARCH*	Project (Number/Name) RU / *BASIC RESEARCH FOR COUNTERING WMD*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
RU: *BASIC RESEARCH FOR COUNTERING WMD*	401.058	11.519	16.584	14.761	-	14.761	15.311	15.897	16.498	17.128	Continuing	Continuing

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Project RU: Basic Research for Countering WMD	11.519	11.584	14.761
Description: The Defense Threat Reduction Agency (DTRA) Basic Research Program conducts revolutionary countering-weapons of mass destruction (CWMD) scientific research with broad applicability across multiple mission areas. The research sets conditions for disruptive gains in the effectiveness of technology-enabled concepts of operation not possible through evolutionary excursions from the current state of practice. Basic research builds up U.S. research personnel, and institutional scientific capability and capacity to counter near peer competitors below the threshold of armed conflict.			
FY 2023 Plans: DTRA enters the third year of its URA program. The overarching goals of the two URAs remain unchanged.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Collectively the URAs are training more than 177 students in STEM fields critical to DTRA's mission. Importantly the URAs are providing critical exposure to DTRA-mission relevant research via internships to 87 cadets and midshipmen from the U.S. Service Academies and ROTC programs. The DTRA Basic Research funded Materials Science in Extreme Environments (MSEE) URA, led by Johns Hopkins University, includes a team of 18 universities that work collaboratively with DTRA personnel to advance the fundamental understanding of material properties and mechanisms in non-equilibrium high pressure, high temperature, and high photon number regimes. The MSEE URA will enable new methods to disrupt WMD attacks, enhance conventional nuclear integration, and improve enhanced consequence analysis. - Complete first principles calculations and experiments that will improve DoD models of nuclear fireball dynamics across various environments. - Add new diagnostics (i.e., a flash x-ray spectrometer) to the experimental facility Hypervelocity Facility for Impact Research Experiments (HyFIRE). - Conduct experiments to improve DoD models of penetration into quartzite and sandstone for Hard and Deeply Buried Target defeat. - Test alliance designed and fabricated material targets at the OMEGA Laser Facility to investigate the effect of pulse length on thermomechanical shock propagation. - Investigate the effect of reduced laser power and tamper materials to support additional tampered OMEGA shot. - Develop composite nanoparticles with a staged energy release. - Create staged energy release composites and additive manufacturing-derived structure-function relationships. The Interaction of Ionizing Radiation with Matter (IIRM) URA, led by Pennsylvania State University, includes a team of 14 partner institutions that work collaboratively with DTRA personnel to advance the fundamental understanding of the interaction of radiation with materials for detection and electronics, devices and integration, nuclear survival and response, modeling, and simulation. Ultimately, this investment will enable radiation sensing from multiple platforms; cost effective hardening and hardness testing of DoD systems; and safe and efficient military operations in a nuclear environment. - Study novel findings on semiconductors for radiation detection that competes with the state of the art without the need for refrigeration or mechanical cooling to low temperatures, providing the potential for significant reduction to size, weight, and power, and ease of field use of current radiation detection capabilities. - Synthesize and test functional fibers with embedded microchip readouts that could be woven into uniforms for wearable radiation sensing.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Conduct experiments at the Los Alamos Neutron Science Center for Systems on a Chip survivability in high neutron dose environments. - Determine appropriate gas concentrations to enable long range radiation detection, concentrate on experiments for laser based sensing methods to detect radiation plumes and contamination from long range. - Conduct additional testing on transconductance for alliance designed and fabricated Ferroelectric Field Effect Transistors (FeFETs); test for radiation effects to drive an improved device design for fabrication. - Verify and expand scintillation experiments with a focus toward potential integration with semiconductor materials for combined improvements in radiation detection. ***FY 2024 Plans:*** - Maintain two University Research Alliances (URA): Materials Science in Extreme Environments (MSEE): Develop and certify FY 2024-25 MSEE URA Biennial Program Plan and modify, adapt, and change 10 research thrust areas as required to meet new threats. Extend existing foundational research in three primary research areas supporting DTRA's mission in preparation for possible transition including: enhanced computational modeling for agent defeat scenarios, and quantification of uncertainty in nuclear blast simulation modeling. Interaction of Ionizing Radiation with Matter (IIRM): Develop and certify FY 2024-25 IIRM URA Biennial Program Plan and modify, adapt, and change 12 research thrust areas as required to meet new threats. Extend existing foundational research in three primary research areas supporting DTRA's mission in preparation for possible transition including: development and assessment of low-cost methods for assessing chip vulnerability, and implementation of AI-driven modeling techniques to develop novel semiconductor systems. - Provides four additional post-doctoral experts, two for each URA. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The increase from FY 2023 to FY 2024 is due to additional funding for post-doctoral expertise and expansion of basic research activities in the University Research Alliances (URAs). Additional resources fund enhancements for strategic competition to sustain global scientific enduring advantage in support of future warfighting. This will enable fundamental research in nuclear detonation plume modeling and radiological signature analysis to leverage novel Machine Learning techniques and automate discovery and manufacturing of new radiation-sensitive materials, reducing the cost of deployed radiation detectors by a factor of 10. This increase is funded predominately by decreased investment in Project RR: Countering WMD Test and Evaluation in PE 0602718BR.			
Accomplishments/Planned Programs Subtotals	11.519	11.584	14.761

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	FY 2022	FY 2023
Congressional Add: Materials Science in Extreme Environments	-	5.000
FY 2023 Plans: Investment will enable the Materials Science in Extreme Environments (MSEE) program to more effectively support DoD's response to emerging threats by providing critical understanding, research transitions, and a highly skilled future workforce. Investment will: - Modernize aging facilities at four Lead Research Area Organization (LRAO) universities to ensure state of the art equipment and facilities are available to the URAs. - Further support of the collaborative workforce development program, Extreme Science Internships. - Support early career investigators and collaborative opportunities across the URAs for students, postdocs, and PIs.		
Congressional Adds Subtotals	-	5.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Procurement methods include competitive selection awards through university partnerships, DTRA’s Broad Agency Announcement, and collaborative funding through other organizations.