

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Defense Threat Reduction Agency **Date:** April 2022

Appropriation/Budget Activity 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> / BA 1: <i>Basic Research</i>	R-1 Program Element (Number/Name) PE 0601000BR / <i>DTRA Basic Research</i>
---	---

COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
Total Program Element	386.814	14.244	11.828	11.584	0.000	11.584	11.715	11.945	12.184	12.427	-	-
RU: <i>Basic Research for Countering WMD</i>	386.814	14.244	11.828	11.584	0.000	11.584	11.715	11.945	12.184	12.427	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.

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Defense Threat Reduction Agency	Date: April 2022
--	-------------------------

Appropriation/Budget Activity 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> / BA 1: <i>Basic Research</i>	R-1 Program Element (Number/Name) PE 0601000BR / <i>DTRA Basic Research</i>
---	---

B. Program Change Summary (\$ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	14.617	11.828	0.000	0.000	0.000
Current President's Budget	14.244	11.828	11.584	0.000	11.584
Total Adjustments	-0.373	0.000	11.584	0.000	11.584
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.373	-			
• Adjustments to Budget Year	-	-	11.584	0.000	11.584

Change Summary Explanation

FY 2023 funds increase because the FY 2022 President's Budget request did not include out-year funding.

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Defense Threat Reduction Agency										Date: April 2022		
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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
RU: <i>Basic Research for Countering WMD</i>	386.814	14.244	11.828	11.584	0.000	11.584	11.715	11.945	12.184	12.427	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.

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

	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Title: Project RU: Basic Research for Countering WMD	14.244	11.828	11.584	0.000	11.584
Description: Project RU funds the exploration and discovery of fundamental scientific knowledge related to DTRA’s CWMD mission by research partnerships with academia, government, and industry. DTRA’s Basic Research University Research Alliance (URA) program conducts revolutionary CWMD scientific research with broad applicability across multiple mission areas. DTRA’s basic research sets conditions for disruptive gains in the future effectiveness of technology-enabled concepts of operation not possible through evolutionary research. In FY 2021, DTRA established two URAs; Materials Science in Extreme Environments (MSEE) and Interaction of Ionizing Radiation with Matter (IIRM).					
FY 2022 Plans:					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Defense Threat Reduction Agency	Date: April 2022
---	-------------------------

Appropriation/Budget Activity 0400 / 1	R-1 Program Element (Number/Name) PE 0601000BR / <i>DTRA Basic Research</i>	Project (Number/Name) RU / <i>Basic Research for Countering WMD</i>
--	---	---

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

	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<p>- Enable new methods to disrupt WMD attacks, enhance conventional nuclear integration, and improve enhanced consequence analysis. This Materials Science in Extreme Environments (MSEE) is a URA of 18 institutions from across the nation led by Johns Hopkins University.</p> <p>- Enhance capabilities to counter nuclear threat networks, enhance WMD survivability, and improve understanding the WMD environment. Interaction of Ionizing Radiation with Matter (IIRM) is a URA of 15 institutions nationwide led by Pennsylvania State University.</p> <p>FY 2023 Base Plans: DTRA enters the third year of its URA program. The overarching goals of the two URAs remain unchanged.</p> <p>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 US Service Academies and ROTC programs. The URAs published 42 peer reviewed journal articles during the first year of operation.</p> <p>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.</p> <p>- Complete first principles calculations and experiments that will improve DoD models of nuclear fireball dynamics across various environments.</p> <p>- 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.</p> <p>- Test alliance designed and fabricated material targets at the OMEGA Laser Facility to investigate the effect of pulse length on thermomechanical shock propagation.</p> <p>- Investigate the effect of reduced laser power and tamper materials to support additional tampered OMEGA shot.</p> <p>- Develop composite nanoparticles with a staged energy release.</p> <p>- Create staged energy release composites and additive manufacturing-derived structure-function relationships.</p>					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Defense Threat Reduction Agency	Date: April 2022
---	-------------------------

Appropriation/Budget Activity 0400 / 1	R-1 Program Element (Number/Name) PE 0601000BR / <i>DTRA Basic Research</i>	Project (Number/Name) RU / <i>Basic Research for Countering WMD</i>
--	---	---

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
<p>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.</p> <ul style="list-style-type: none"> - 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. - 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. <p>FY 2023 OCO Plans: N/A</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: The decrease from FY 2022 to FY 2023 is due to the residual impact of prior portfolio rebalancing to fund higher priority RDT&E programs.</p>					
Accomplishments/Planned Programs Subtotals	14.244	11.828	11.584	0.000	11.584

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

Remarks

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2023 Defense Threat Reduction Agency **Date:** April 2022

Appropriation/Budget Activity 0400 / 1	R-1 Program Element (Number/Name) PE 0601000BR / <i>DTRA Basic Research</i>	Project (Number/Name) RU / <i>Basic Research for Countering WMD</i>
--	---	---

D. Acquisition Strategy

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