Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Defense Threat Reduction Agency	Date: May 2017
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 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	216.027	38.288	35.436	37.201	-	37.201	37.340	37.563	38.609	39.644	Continuing	Continuing
RU: ***Basic Research for Countering WMD*	216.027	38.288	35.436	37.201	-	37.201	37.340	37.563	38.609	39.644	Continuing	Continuing

Note

*Program Element 0601000BR name changes from DTRA Basic Research Initiative to DTRA Basic Research beginning in FY 2018.
**Project RU title changes from Fundamental Research for Combating WMD to Basic Research for Countering WMD beginning in FY 2017.

A. Mission Description and Budget Item Justification

Defense Threat Reduction Agency (DTRA) Basic Research funds research across physical, material, engineering, computational, and life sciences directed toward greater knowledge and understanding of the fundamental aspects of observable phenomena associated with weapons of mass destruction (WMD).

DTRA's Basic Research is the Nation’s only basic research program solely dedicated to countering weapons of mass destruction (CWMD). It provides for the discovery and development of basic knowledge by research performers comprised from academia and world-class research institutions in government and industry. This investment helps motivate the scientific community to conduct research benefiting WMD-related defense missions, advancing the body of CWMD knowledge, and improving knowledge of research efforts that benefit nonproliferation, counter proliferation, and consequence management efforts. These efforts are closely coordinated with DTRA’s Chemical and Biological Technologies Department, which executes a basic research program under DoD’s Chemical and Biological Defense Program.

Each year, program and technical managers conduct formal assessments of the portfolio, leveraging deep Science and Technology (S&T) expertise within DTRA, as well as from the Defense Basic Research Advisory Group, independent external panel reviews, and other CWMD-focused stakeholders. This coordination facilitates unique, CWMD-relevant basic research while eliminating unintended duplication of effort in the broader defense S&T community.

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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*

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	38.436	35.436	38.408	-	38.408
Current President's Budget	38.288	35.436	37.201	-	37.201
Total Adjustments	-0.148	0.000	-1.207	-	-1.207
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.075	-			
• SBIR/STTR Transfer	-0.073	-			
• Realignments	-	-	-1.207	-	-1.207

Change Summary Explanation

The decrease in FY 2018 from the previous President's Budget submission is due to a shift in investment priorities to fund Special Test Bed capability requirements for missile defeat in Program Element 0603160BR.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Defense Threat Reduction Agency										Date: May 2017		
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 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
RU: **Basic Research for Countering WMD*	216.027	38.288	35.436	37.201	-	37.201	37.340	37.563	38.609	39.644	Continuing	Continuing

Note

*Project RU title changes from Fundamental Research for Combating WMD to Basic Research for Countering WMD beginning in FY 2017.

A. Mission Description and Budget Item Justification

The Basic Research for Countering WMD project, as the nation's only basic research solely dedicated to countering weapons of mass destruction (CWMD), is a core strategic investor in future scientific and technological progress across the full spectrum of Defense Threat Reduction Agency's (DTRA's) CWMD 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 Initiative aligns with DTRA's strategic objectives that directly support policy and planning guidance from the Office of the President, the Department of Defense (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 and reduce global nuclear dangers. Specifically, they include: Accelerating the development of standoff radiological/nuclear detection capabilities; researching countermeasures and defenses to non-traditional agents; enhancing nuclear forensics; securing vulnerable materials; developing new verification technologies; developing an in-depth understanding of the capabilities, values, intent, and decision making of potential adversaries, whether they are states, networks, or individuals; defeating WMD agents; researching biologically-based and inspired materials for DoD applications; and leveraging science, technology, and innovation through domestic and international partnerships and agreements. This project solicits, coordinates, and conducts basic research aligned to five Thrust Areas. Each Thrust Area Manager coordinates an independently reviewed portfolio of research projects selected for scientific merit, technical quality, and the potential for innovation.

Thrust Area 1: Science of WMD Sensing and Recognition. This thrust area explores novel methodologies to investigate physical properties of sensitive materials as they interact with phenomena associated with WMD, such as ionizing radiation. This research provides the basis for developing capabilities to discover the presence, identity, and quantity of material or energy in the environment that may be significant, in turn providing the means to develop advanced forensic applications that enable detection, characterization, and attribution, particularly in post-detonation radiative environments.

Thrust Area 2: Network Sciences. This thrust area explores analytical, numerical, computational, and other mathematical approaches to model and simulate the behavior of layered, interdependent physical networks affected by WMD. This interdisciplinary, theoretical research provides the basis for developing advanced algorithms and analytical frameworks that accurately predict and depict WMD environments by characterizing impacts and vulnerabilities, representing root causes of cascading failures, and assessing robustness, resilience, restoration, and recovery in varying degrees of disruption.

Thrust Area 3: Science for Protection. This thrust area employs experimental, computational, and theoretical approaches to explore and understand the causal mechanisms and deleterious characteristics of ionizing radiation and the tolerance, response, and resistance characteristics of affected sensitive electronic systems and microorganisms. This research provides the basis for engineering resilient systems and technologies, offering radical improvements to the survivability and performance of mission-critical electronic equipment and personnel in hostile radiative environments.

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Thrust Area 4: Science to Defeat WMD. Through experimentation and computational modeling and simulation, this thrust area investigates phenomena associated with penetration physics, shock propagation and turbulence dynamics, and researches novel energetic and reactive materials for defeat of targets containing WMD. This research provides the scientific foundation necessary to develop advanced solutions for: (1) Accessing WMD in hardened and deeply buried infrastructure, (2) defeating (non-nuclear) targets with minimal unintended collateral effects, and (3) predicting post-detonation (non-nuclear) weapon effects.

Thrust Area 5: Science to Secure WMD. This thrust area leverages a wide range of scientific and mathematical disciplines to explore phenomena related to physical, biological, and chemical interactions with radioactive particles and waveforms. This research provides the technical basis for development of innovative, unconventional applications to improve security oversight and control of WMD materials and facilities and to improve monitoring and surveillance systems related to arms control and nonproliferation.

The decrease from FY 2016 to FY 2017 balances near term operational needs with future technical developments and capabilities. The increase from FY 2017 to FY 2018 is due to the relative impact of the decrease in FY 2017.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Project RU: Basic Research for Countering WMD	38.288	35.436	37.201
Description: Project RU funds the exploration and discovery of fundamental scientific knowledge related to DTRA's CWMD mission by research performers from academia, government, and industry. ***FY 2016 Accomplishments:*** - Managed over 150 active basic research awards on a three to five year cycle. The Agency's Basic Research portfolio directly addresses the DoD CWMD S&T priority and supports the specific priorities on Autonomy, Data to Decisions, Electronic Protection, and Engineered Resilient Systems. - Supported the development of the future Science, Technology, Engineering, and Mathematics workforce by supporting world-class talent in WMD research at universities and laboratories. - Conducted an annual technical review of each grant to assess the scientific advancements and progress in meeting the award's technical objectives and to foster collaboration and build relationships within the scientific community. - Conducted an annual external panel review of the basic research program that is open to DoD research stakeholders. The review will assess the focus and scope of the program concerning CWMD challenges and assess the coordination of CWMD basic research across the DoD mission space and the broader basic research community to avoid duplication and ensure successful partnerships. - Researchers discovered that cognitive impairment from radiation exposure occurs at much lower levels, and on later timelines than previously thought. New data rewrites the exposure/protection guidelines in consideration of after-battlefield effects. - Researchers developed a new model to characterize and assess power grid responses to WMD events on a country-wide scale. The Defense Advanced Research Projects Agency, the National Science Foundation, and Advanced Research Projects Agency-Energy have awarded research grants based on these results.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
- Researchers found the use of micro-vesicles harvested from normal adult stem cells could reverse the effects of radiation-induced cognitive impairment. The finding has potential to lead to a new class of therapeutics to counteract battlefield radiation exposure. - Researchers developed a novel spectroscopic technique to differentiate isotopic signatures in molecules. The findings suggest shortened timelines for developing capabilities to perform rapid in-field isotopic analysis of nuclear debris, critical for nuclear forensics. - Researchers developed a new method to reduce noise 100x below the classical limit for atom interferometric sensors; published in Nature. The findings show the potential to greatly improve gravimetric sensors for radiological/nuclear search and tunnel detection. - Researchers developed new low-noise contacts for solid-state radiation detectors by taking advantage of a photon-exchange effect. This research has the potential to eliminate the need for cooling, leading to the development of field ready, high-resolution radiological/nuclear detectors. This research has transitioned to Iljin Radiation Engineering for further development. - A DTRA-funded researcher was chosen as a DoD National Security Science and Engineering Faculty Fellow and another researcher was awarded the Presidential Early Career Award for Scientists and Engineers. These prestigious DoD and Presidential awards showcase the quality of DTRA-funded principal investigators working within the CWMD science and technology mission space.			
FY 2017 Plans: - Manage over 150 active basic research awards on a three to five year cycle. The Agency's Basic Research portfolio directly addresses the DoD priority on CWMD S&T and supports specific priorities on Autonomy, Data to Decisions, Electronic Protection, and Engineered Resilient Systems. - Support the development of the future Science, Technology, Engineering, and Mathematics workforce by supporting world-class talent in WMD research at universities and laboratories. - Conduct an annual technical review of each grant to assess the scientific advancements and progress in meeting the award's technical objectives and to foster collaboration and build relationships within the scientific community. - Conduct an annual external panel review of the basic research program that is open to DoD research stakeholders. The panel will assess the focus and scope of the program related to CWMD challenges and will assess the coordination of CWMD basic research across the DoD mission space and the broader basic research community to avoid duplication and ensure successful partnerships.			
FY 2018 Plans: - Shape and oversee the CWMD Basic Research portfolio, comprised of approximately 150 active basic research awards on a three to five year cycle. This portfolio continues to address the DoD priority on CWMD science and technology, and supports specific priorities on Autonomy, Data-driven Decisions, Electronic Protection, System Resiliency and other emerging areas of interest.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
- Support world-class talent in WMD research at universities and laboratories to bolster the development of the future Science, Technology, Engineering, and Mathematics workforce by supporting. - Assess entire CWMD Basic Research portfolio on an annual basis. - Assure progress toward technical objectives and support collaborative relationships within the scientific community through an annual technical review of each grant to assess scientific advancement. - Assess the focus and scope of the program related to CWMD challenges and assess the coordination of CWMD basic research across the DoD mission space and the broader basic research community to avoid duplication and ensure successful partnerships via an External Panel Review.			
Accomplishments/Planned Programs Subtotals	38.288	35.436	37.201

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

*Prior year funds are related to this project in program element 0602718BR.

D. Acquisition Strategy

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

E. Performance Metrics

Project performance is measured via a combination of statistics including the number of publications generated, number of students trained in sciences and engineering supporting DoD educational goals, number of participating research organizations, and percentage of awards transitioned to other programs for further development.