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Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Office of the Secretary Of Defense **Date:** April 2022

Appropriation/Budget Activity 0400: <i>Research, Development, Test & Evaluation, Defense-Wide I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602251D8Z I <i>Applied Research for the Advancement of S&T Priorities</i>
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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	-	51.675	58.982	67.666	-	67.666	68.042	68.159	69.613	71.005	Continuing	Continuing
227: <i>Applied Research for the Advancement of S&T Priorities</i>	-	51.675	58.982	67.666	-	67.666	68.042	68.159	69.613	71.005	Continuing	Continuing

Note

New Start (Y/N): No

A. Mission Description and Budget Item Justification

This program supports the Department's initiatives to Build Sustainable Advantage, Build a Resilient Joint Force and Defense Ecosystem, and Taking Care of People.

The Applied Research for the Advancement of Science and Technology (S&T) Priorities (ARAP) program builds a strong Department of Defense future workforce and infrastructure in critical emerging technology areas within the Under Secretary of Defense for Research and Engineering (USD(R&E)) Technology Vision for an Era of Competition to enable future leap-ahead capabilities that outpace our competitors. This program funds tri-Service applied researchers to work with university and industry partners, accelerating DoD learning and technology development for new capabilities. Programs continually have follow-on activities funded by the individual Services and Agencies, which reflects the overall value of the investment. Specific projects support the design, development, and improvement of immature technologies and new concepts to achieve general mission requirements and to translate promising research into solutions for military needs. In addition, the program enables concept exploration efforts and studies of alternative concepts. The research projects are aligned with the DoD S&T priorities and designated focus areas that include non-system specific technology efforts and feasibility assessments and are formulated and managed by teams of subject matter experts drawn from the Office of the Secretary of Defense, the Military Services, and the Defense Agencies. The program also provides support to the S&T Communities of Interest (Cols) multi-agency collaboration and coordination. The S&T Cols produce Joint S&T Roadmaps to contribute to the USD(R&E) Modernization Priority Roadmaps.

B. Program Change Summary (\$ in Millions)

	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023 Base</u>	<u>FY 2023 OCO</u>	<u>FY 2023 Total</u>
Previous President's Budget	53.359	65.015	0.000	0.000	0.000
Current President's Budget	51.675	58.982	67.666	0.000	67.666
Total Adjustments	-1.684	-6.033	67.666	0.000	67.666
• Congressional General Reductions	-	-5.828			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.674	-			
• Other Reprogramming	-0.010	-	-	-	-

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Appropriation/Budget Activity	R-1 Program Element (Number/Name)
0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> / BA 2: <i>Applied Research</i>	PE 0602251D8Z / <i>Applied Research for the Advancement of S&T Priorities</i>

• FFRDC	-	-0.205	-	-	-
• Adjustments to Budget Year	-	-	65.332	-	65.332
• Economic Assumption	-	-	2.334	-	2.334

Change Summary Explanation

In FY 2022, program reduced by \$5.828 million for unjustified growth.

FY 2023 funding increase reflects the fact that the FY 2022 President's Budget request did not include out-year funding.

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Exhibit R-2A, RDT&E Project Justification: PB 2023 Office of the Secretary Of Defense										Date: April 2022		
Appropriation/Budget Activity 0400 / 2					R-1 Program Element (Number/Name) PE 0602251D8Z / <i>Applied Research for the Advancement of S&T Priorities</i>				Project (Number/Name) 227 / <i>Applied Research for the Advancement of S&T Priorities</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
<i>227: Applied Research for the Advancement of S&T Priorities</i>	-	51.675	58.982	67.666	-	67.666	68.042	68.159	69.613	71.005	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Applied Research for the Advancement of Science and Technology (S&T) Priorities program was established to implement Department-wide technology development portfolios and foster tri-Service research areas of common interest within cross-cutting S&T efforts. The program has three investment areas: (1) large, three-year applied research programs selected by the S&T Executives; (2) smaller, two-year technology ‘seedling’ programs nominated by the S&T Communities of Interest (Cols) to address technology gaps or opportunities; and (3) support to the Cols. The execution of the program by the Office of the Secretary of Defense and the support it provides to the Cols assures joint strategic S&T oversight and multi-Service, multi-agency collaboration and coordination.

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

	FY 2021	FY 2022	FY 2023
Title: Applied Research for the Advancement of S&T Priorities (ARAP)	48.559	53.182	57.666
Description: The program focuses on cross-cutting S&T efforts that foster tri-service research areas of common interest that give the joint warfighter a technological advantage. It focuses on emerging areas of science, building expertise within the DoD laboratories, including investment in laboratory infrastructure and people, and on research areas that are a foundation for further investments by the Services following the completion of the projects.			
Cross-cutting efforts are aligned with S&T Priorities, such as Electronic Warfare, Human Systems, Autonomy, Space, Kinetic Weapons, Directed Energy and Non-Lethal Weapons, Cyber, Sensors and Processing, Command, Control, Communications, Computers and Intelligence, Air Platforms, and Ground and Sea Platforms, as well other focus areas, such as Materials and Manufacturing Processes, Advanced Electronics, Energy and Power Technologies, Biotechnology, and Armed Services Biomedical Research Evaluation and Management.			
FY 2022 Plans:			
Complete Enhanced Energetic Effects (EEE): Transition new high energy propellant formulations to cost-competitive production lines.			
Complete Topologically-Enabled Devices (TEDs) (Year 3 of 3): Continue development of high-speed ultra-low-power electronics and photodetectors with new spin-polarized topological electronics and magnetic materials.			
Continue A Combined Development Pipeline for Novel Neuromorphic Hardware (NeuroPipe) (Year 2 of 3): Design and fabricate first neuromorphic processor in a foundry using Complementary Metal-Oxide Semiconductor (CMOS) “neurons” as a key component for artificial intelligence dominance.			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>Initiate Surface Morphing and Adaptive Structures for Hypersonics (SMASH) (Year 1 of 3): Begin developing methods to extend the speed and range of hypersonics by addressing five technical areas to increase the lift/drag ratio: surface morphing, materials and material processing, actuation and maneuverability, trajectory simulation, and electromagnetic analysis.</p> <p>FY 2023 Plans: Complete A Combined Development Pipeline for Novel Neuromorphic Hardware (NeuroPipe) (Year 3 of 3): Demonstrate on-chip dynamic learning software (i.e. learning after training) with a low-power radiation-hard neuromorphic processor. Transition viable materials to commercial on-shore fabrication prototypes.</p> <p>Continue Surface Morphing and Adaptive Structures for Hypersonics (SMASH) (Year 2 of 3): Conduct wind tunnel testing that demonstrates initial concepts to significantly extend the speed, range, and maneuverability of hypersonics.</p> <p>Initiate new ARAP project to be selected in third quarter FY 2022.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Changes reflect increase in execution after COVID-related delays.</p>				
<p>Title: S&T Communities of Interest (Cols)</p> <p>Description: The S&T Cols facilitate coordination and collaboration across Components to reduce duplication and optimize the development of critical S&T efforts across the DoD enterprise. Their efforts include the development of joint S&T roadmaps and the planning of technology integration. The Cols assess and address capability gaps and their multi-domain operational impact.</p> <p>FY 2022 Plans: Continue to provide support to the Cols, i.e., Advanced Electronics; Air Platforms; Autonomy; Armed Services Biomedical Research Evaluation and Management. Biotechnology; Command, Control, Communications, Computers, and Intelligence (C4I); Cyber; Directed Energy - Non-Lethal Weapons; Electronic Warfare; Energy and Power; Ground and Sea Platforms; Human Systems; Kinetic Weapons; Materials and Manufacturing Processes; Sensors and Processing; and Space.</p> <p>FY 2023 Plans: Continue to provide support to the Cols, i.e., Advanced Electronics; Air Platforms; Autonomy; Armed Services Biomedical Research Evaluation and Management. Biotechnology; Command, Control, Communications, Computers, and Intelligence (C4I); Cyber; Directed Energy - Non-Lethal Weapons; Electronic Warfare; Energy and Power; Ground and Sea Platforms; Human Systems; Kinetic Weapons; Materials and Manufacturing Processes; Sensors and Processing; and Space.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement:</p>		3.116	4.800	5.000

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
There is no significant change between FY 2022 and FY 2023.				
<p>Title: Power Thermal Management</p> <p>Description: The program focuses on cross-cutting power and thermal Applied Research efforts that enable integration of high-power and high-energy mission systems on platforms. Unlike conventional kinetic weapons, large heat loads generated from large electrical currents will limit high-power laser and microwave performance on future envisioned DoD platforms. The program pursues solutions to challenges or gaps in power and thermal technologies, research areas and DoD laboratory expertise, including investment in laboratory infrastructure and people, that are a foundation for platform-integrated and fielded capability.</p> <p>Cross-cutting efforts include power and thermal technologies and subcomponents that support more than one domain (air, sea, land, or space) or address power and thermal technologies required for standardization to broadly realize capability across multiple platforms.</p> <p>FY 2022 Plans: Investigate and mature technologies that enable cross-domain solutions for large-scale energy storage on platforms in a manner that is safe and scalable and delivers power and energy densities appropriate for advanced mission systems. Support cross-domain modeling of power and thermal architecture necessary to assess challenges and advance emerging thermal technologies that enable advanced mission systems.</p> <p>FY 2023 Plans: Start multiple seedlings for non-kinetic effects. Conduct applied research to operate wideband sensors on DoD platforms at the intersection of cyber space, electronic warfare, radar, and communications using the speed of artificial intelligence to provide non-escalatory engagement options.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Increase supports development of non-kinetic effects that OUSD(R&E) has identified as a critical technology area.</p>		-	1.000	5.000
Accomplishments/Planned Programs Subtotals		51.675	58.982	67.666
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				