Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Office of the Secretary Of Defense	Date: March 2024
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603330D8Z / *Quantum Application*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	75.000	69.290	-	69.290	69.410	69.450	69.732	73.035	Continuing	Continuing
441: *Quantum Industrial Base Acceleration*	0.000	-	-	5.521	-	5.521	5.646	5.690	5.971	8.281	Continuing	Continuing
444: *Quantum Transition Acceleration*	0.000	-	75.000	63.769	-	63.769	63.764	63.760	63.761	64.754	Continuing	Continuing

Note

New Start (Y/N): No

A. Mission Description and Budget Item Justification

This program supports the Department's initiative to Build Sustainable and Long-Term Advantage.

Quantum Technology is approaching a tipping point that will determine how quickly it can make an impact. If the United States can stay on pace, many important outcomes for the Department of Defense (DoD) can be realized including robust position, navigation and timing for DoD freedom of operations with precision strike even with contests in spectrum, space, or cyber operations. Also, greatly enhanced capabilities in the spectrum giving the DoD significant advantages for Electronic Warfare (EW), Command, Control, and Communications (C3) and Intelligence, Surveillance, and Reconnaissance (ISR). Finally, quantum computation allowing rapid advances in materials and chemistry for advanced energetics, propulsion, and platform coatings, possibly optimization for material properties, logistics, and machine learning.

Without deliberately addressing these challenges, we risk slowdown of technological maturity. Two barriers to implementation are: 1) component and supply chain maturity of bleeding edge capability in photonics, including lasers, active light manipulation, light delivery, and packaging; and 2) the relative cost and workforce barrier for one Service or Agency to alone transition this complex and emerging technology for one particular mission while the missions enabled by quantum technology and the workforce are distributed among multiple Defense organizations.

This effort’s funding will improve quantum supply chain maturity and accelerate DoD priority quantum technology by overcoming these barriers.

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B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	0.000	75.000	100.000	-	100.000
Current President's Budget	0.000	75.000	69.290	-	69.290
Total Adjustments	0.000	0.000	-30.710	-	-30.710
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	-	-	-30.850	-	-30.850
• Economic Assumptions	-	-	0.140	-	0.140

Change Summary Explanation

Program adjustments of -$30.710 million in FY 2025 consists of the following:
-$4.850 million realignment to PE 0603379D8Z Advanced Technical Integration
-$26.000 million was applied to meet DoD overall funding reductions, which were spread to mitigate impact.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Office of the Secretary Of Defense			Date: March 2024
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603330D8Z / *Quantum Application*	Project (Number/Name) 441 / *Quantum Industrial Base Acceleration*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
441: *Quantum Industrial Base Acceleration*	0.000	-	-	5.521	-	5.521	5.646	5.690	5.971	8.281	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Department of Defense's (DoD) research and development of quantum technologies is critical to maintaining the Nation's technological superiority. But the transition of laboratory innovations to manufacturable products is hampered by immature quantum component technology and the need for specialized fabrication, integration and packaging processes to manufacture quantum devices.

This funding will identify detailed component requirements and promising technology solutions then develop those critical components. This effort will be coordinated with non-defense US Government agencies. The resulting component supply chain will enable defense applications of quantum technology as well as dual-use applications. This funding will leverage existing resources in academic institutions, national laboratories and private industries as well as other Defense programs such as Manufacturing Innovation Institutes and the Microelectronics Commons.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Quantum Supply Chain	0.000	-	5.521
Description: This effort focuses on identifying, developing and maturing critical components supporting technology for atomic clocks, quantum sensors, and quantum computers. Supports aligning and leveraging multiple organizations for DoD needs across academic institutions, national laboratories, non-profits, and private industry. This effort will accelerate the transition of laboratory-scale systems to manufacturable commercial products. This effort will fund various studies that will identify various components required to shorten the supply chain gaps within industry and academia. The specific critical component efforts funded by this project include: - Transitioning low noise Near Infrared (NIR) lasers for quantum sensors. - Multi-Project Wafer (MPW) service runs at AIM-Photonics for novel quantum-specific component devices. ***FY 2025 Plans:*** - Continued collaboration begun under P-code 444 with component activities within DoD (e.g. the Microelectronics Commons and the DoD Manufacturing Innovation Institutes). - Initiate prototyping of two different NIR laser components identified within P-code 444: Quantum Transition Acceleration. -Establish process with US Govt. Agencies and US companies to identify, coordinate and prioritize critical component needs. ***FY 2024 to FY 2025 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Office of the Secretary Of Defense		Date: March 2024
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603330D8Z / *Quantum Application*	**Project (Number/Name)** 441 / *Quantum Industrial Base Acceleration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
The increase of $5.650 between FY 2024 and FY 2025 was to create a separate P-code that focused on the supply chain tasks previously occurring in P444.			
Accomplishments/Planned Programs Subtotals	0.000	-	5.521

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Office of the Secretary Of Defense			Date: March 2024
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603330D8Z / *Quantum Application*	Project (Number/Name) 444 / *Quantum Transition Acceleration*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
444: *Quantum Transition Acceleration*	0.000	-	75.000	63.769	-	63.769	63.764	63.760	63.761	64.754	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Department of Defense (DoD) has pioneered and advanced classical sensor technology for decades. Over the past years, quantum sensing technology has shown the ability to meet program level metrics throughout DoD R&D programs. In order to sustain technological superiority, the Department must continue to work to transition sensor research and development for United States Air Force, Army and Navy applications.

This funding will allow OUSD(R&E) oversight of a multi-service program designed to develop quantum sensing technology capable of integration into multiple DoD applications in each of the Army, Navy, and Air Force. As structured, the program will be able to maximize the utilization of the military department's distributed technical expertise and capabilities. OUSD(R&E) will contribute connections to program of record and the joint force strategic goals, connectivity and integration between organizations, risk reductions to individual project through coordinated work on technology challenges, and connectivity to other R&E capabilities including the other critical technology areas, basic science office, manufacturing innovation, and the microelectronics commons. OUSD(R&E) will confirm all developed quantum technology meets specified requirements ensuring a more diverse use case for all developed technology with an industry base that can sustain DoD needs. Projects will include testing and evaluation, device integration, and application analysis to aid in future acquisition and sustainment of innovative technologies developed in DoD research programs.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Quantum Sensors	-	75.000	63.769
Description: The Department of Defense's (DoD) research and development of quantum technologies is critical to maintaining the Nation's technological superiority. This effort will focus on maturing, demonstrating, and transitioning quantum inertial sensors, gravity sensors, atomic clocks, and quantum electro-magnetic sensors. The specific quantum technologies efforts are: - Joint (USAF/USN) Magnetic Navigation program led by the USAF using quantum magnetic sensors and magnetic maps to navigate aerial platforms without GPS. - Joint (USAF/USN) Inertial Sensing program utilizing accelerometer and gyroscopes to track position, orientation and velocity of a moving object in a non-jammable mode of operations: important for strategic platforms in multiple domains. - Joint (USN/USA) Magnetometer program led by ONR to enable a new generation of unmanned vehicles to create magnetic anomaly detection capabilities for both land and sea. - Quantum accelerometer program led by ONR to calibrate guidance accelerometers at sea without having to come back to port. - Joint (USA/USN) Atomic Clock program led by ARL providing the next generation of strategic atomic clocks.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Office of the Secretary Of Defense		Date: March 2024
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603330D8Z / *Quantum Application*	**Project (Number/Name)** 444 / *Quantum Transition Acceleration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Start Modeling and Simulation (M&S) of quantum technology in operational scenarios while comparing to commercial alternatives if available. - Measure quantum sensor environmental capabilities in various operationally relevant situations. - Initiate size, weight and power (SwaP) redesign of quantum sensors, ensuring the future quantum sensors are compatible with current/future military applications. - Conduct initial systems requirement review (SRR) with industry contractors outlining integration plan for quantum sensors into specified applications. - Initiate documentation of military-grade technical data package outlining the specifications for quantum sensors. - Initialize critical technology identification and assessment procedure with stake-holders across government and industry. - Initialize early projects that can leverage existing activities within DoD (e.g. the Microelectronics Commons and the DoD Manufacturing Institutes) - Initiate projects identified as supporting improved manufacturability or performance of the quantum sensors funded through this Program Element. - Establish information mechanism to more easily integrate quantum specific components through Process Design Kit (PDK) and/or Assembly Design Kits (ADK). This PDK and/or ADK will combine multiple information libraries from multiple fabrication sources (e.g. national laboratories, manufacturing institutes, and private fabrication facilities). - Establish National Laboratory testbed to identify the hardest integration problems associated with quantum technology and develop technology solutions for those problems. ***FY 2025 Plans:*** - Utilizing technology developed within this effort, initiate planning for future Joint AUKUS PNT demonstrations. - Execute atomic clock demonstrations, showcasing current Australia, United Kingdom and United States technology. - Finalize SwaP redesign of quantum sensors (magnetometers, accelerometers and gravimeters), ensuring the transitioning quantum sensors are compatible with current/future military applications. - Conduct preliminary design reviews (PDR) with industry contractors validating the redesign and system requirements meet military application specifications. - Initiate planning for OUSD led quantum sensing demonstration. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The decrease of $11.360 million between FY 2024 to FY 2025 is due to P-code 441 absorbing all Supply Chain plans and DoD overall funding reductions which were spread to mitigate impact.			
Accomplishments/Planned Programs Subtotals	-	75.000	63.769

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Office of the Secretary Of Defense		Date: March 2024
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603330D8Z / *Quantum Application*	**Project (Number/Name)** 444 / *Quantum Transition Acceleration*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A