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 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602890D8Z / *High Energy Laser Research*

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	44.212	47.624	48.804	48.640	-	48.640	48.742	48.979	49.443	49.343	Continuing	Continuing
890: *High Energy Laser Development*	44.212	47.624	48.804	48.640	-	48.640	48.742	48.979	49.443	49.343	Continuing	Continuing

Note

New Start (Y/N): No

A. Mission Description and Budget Item Justification

This program supports the Department's initiatives to defend the homeland, deter aggression and prevail in conflict, and build sustainable and long-term advantage.

This program funds applied research in directed energy through the Joint Directed Energy Transition Office, including studies, investigations, and component and subsystem design and development to further the knowledge base of directed-energy technologies and enable future defense capabilities to be realized by the Services as part of an overall Department of Defense directed energy science and technology program. The program is broken up into the following areas: (1) directed energy sources; (2) beam control and propagation; and (3) lethality and vulnerability to reflect the OSD science and technology priorities for directed energy. Directed energy weapons systems have many potential advantages, including speed-of-light time-to-target, high precision, low incremental cost per kill, and a magazine that is recharged through on-board, fuel-based power and thermal management systems that reduce logistics requirements in contrast to stocks of munitions or warheads. Directed energy weapon systems have the potential to perform a wide variety of military missions, including high value asset and base protection, precision strike and platform self-protection versus a wide variety of missile, rocket, artillery, mortar, and air platforms. Efforts under this program are generally chosen for their potential to have an impact on multiple directed energy weapon systems and multiple military missions while complementing specific Service needs. A broad range of technologies are addressed in key areas, such as laser sources, microwave sources, beam-control optics, antennas, waveguides, modeling and simulation, and lethality mechanisms. This program provides the enabling technologies necessary to demonstrate advanced concepts for mission areas not considered to date. The lethality, hardware and software, and modeling and simulation advances provided by this program are essential to expand and build upon current architectures. Efforts in this program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

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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	48.587	48.804	50.673	-	50.673
Current President's Budget	47.624	48.804	48.640	-	48.640
Total Adjustments	-0.963	0.000	-2.033	-	-2.033
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.005	-			
• SBIR/STTR Transfer	-0.958	-			
• Program Adjustment	-	-	-1.625	-	-1.625
• Internal Realignment	-	-	-0.507	-	-0.507
• Economics Assumption	-	-	0.099	-	0.099

Change Summary Explanation

The FY 2025 decrease of $2.033 million is the result of an internal realignment to Program Element 0604924D8Z: High Energy Laser Tech Maturation (1.625 million) to support directed energy advanced component development and prototypes.

In addition to the internal realignment, a reduction of -$0.507 million was applied to meet DoD overall funding reductions, which were spread to mitigate impact.

Increase (.099) due to "economic assumptions”.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Office of the Secretary Of Defense			Date: March 2024
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602890D8Z / *High Energy Laser Research*	Project (Number/Name) 890 / *High Energy Laser Development*	

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
890: *High Energy Laser Development*	44.212	47.624	48.804	48.640	-	48.640	48.742	48.979	49.443	49.343	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program is broken up into the following areas: (1) directed energy sources; (2) beam control and propagation; and (3) lethality and vulnerability to reflect the OSD science and technology priorities for directed energy. Efforts under this program are executed through the Joint Directed Energy Transition Office, including studies, investigations, and component and subsystem design and development to further the knowledge base of directed-energy technologies and enable future defense capabilities to be realized by the Services as part of an overall Department of Defense directed energy science and technology program. Directed energy weapons systems have many potential advantages, including speed-of-light time-to-target, high precision, low incremental cost per kill, and a magazine that is recharged through on-board, fuel-based power and thermal management systems that reduce logistics requirements in contrast to stocks of munitions or warheads.

Efforts under this program are generally chosen for their potential to have an impact on multiple mission areas. Directed energy weapon systems have the potential to perform a wide variety of military missions, including high value asset and base protection, precision strike and platform self-protection versus a wide variety of missile, rocket, artillery, mortar, and air platforms. As a result, this program supports a broad range of technologies in key areas, such as laser sources, microwave sources, beam-control optics, antennas, waveguides, modeling and simulation, and lethality mechanisms. This program provides the enabling technologies necessary to demonstrate advanced concepts for mission areas not considered to date. Advancements provided by this program are essential to expand and build upon current system architectures. Efforts in this program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Directed Energy Applied Research	47.624	48.804	48.640
Description: Mature technologies that improve component-level performance and enable fieldable directed energy weapon systems. Develop technologies that support improving beam control and beam propagation for directed energy weapon systems. Conduct directed energy vulnerability experiments on materials, components, and targets. Develop lethality databases and integrate technologies into system-level architectures.			
FY 2024 Plans: Conduct analyses and trades studies to determine the most effective laser and microwave source parameters. Collaborate with the national and international directed energy community on progress in the development and application of high energy laser and high power microwave technologies for military missions.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Explore advanced concepts for technologies that will improve efficiency and decrease size and weight for future laser sources. Evaluate materials for high energy laser applications. Improve understanding of laser technologies to include material interaction and propagation. Scale electrically driven lasers to higher kilowatt-class power levels. - Develop beam control technologies for high energy laser weapon use across all domains of the Department. Develop technologies to improve the beam director throughput efficiency, optimize size and weight, and improve/automate tracking and compensation through the atmosphere. Invest in atmospheric sensor innovation, field test evaluations, and next-generation models. - Characterize and understand the physics of high energy laser atmospheric propagation in adverse environmental conditions such as fog, rain, smoke and dust. Improve cameras and track illuminators to enable target engagement at longer ranges and enable improvements to shorten engagement timelines. Evaluate effectiveness of digital holography for wavefront compensation with improved deformable mirrors for high energy laser propagation through severe turbulence. - Collaborate with the national and international directed energy community on progress in the development and application of high energy laser ***FY 2025 Plans:*** - Modernize antenna designs with an emphasis on bandwidth agility throughput. Transition government-laboratory research efforts in pulsed power to industry. Decrease the size, weight, and power requirements for future high power microwave weapon systems and increase the vendor base for these critical technologies. -Conduct trade studies to determine the most effective directed energy weapon system parameters. Collaborate with the national and international directed-energy community on progress in the development and FY 2024 Plans: -Conduct analyses and trades studies to determine the most effective laser and microwave source parameters. Collaborate with the national and international directed energy community on progress in the development and application of high energy laser and high power microwave technologies for military missions. - Explore advanced concepts for technologies that will improve efficiency and decrease size and weight for future laser sources. Evaluate materials for high energy laser applications. Improve understanding of laser technologies to include material interaction and propagation. Scale electrically driven lasers to higher kilowatt-class power levels. - Develop beam control technologies for high energy laser weapon use across all domains of the Department. Develop technologies to improve the beam director throughput efficiency, optimize size and weight, and improve/automate tracking and			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
compensation through the atmosphere. Invest in atmospheric sensor innovation, field test evaluations, and next-generation models. - Characterize and understand the physics of high energy laser atmospheric propagation in adverse environmental conditions such as fog, rain, smoke and dust. Improve cameras and track illuminators to enable target engagement at longer ranges and enable improvements to shorten engagement timelines. Evaluate effectiveness of digital holography for wavefront compensation with improved deformable mirrors for high energy laser propagation through severe turbulence. - Collaborate with the national and international directed energy community on progress in the development and application of high energy laser technologies for military missions. Validate predictive models through analysis of atmospheric propagation data and measurements. - Provide maintenance, verification, validation, and accreditation for updated system level atmospheric propagation and high energy laser system models. Collaborate with Service-sponsored field-test planning to correlate model predictions with measured data for surface, maritime, and aerospace environments. Incorporate atmospheric data into theater models to support performance characterization tables. Continue the development of a predictive avoidance fire control system for use on multiple platforms. - Develop theoretical physical models describing the propagation of a high power microwave pulse through the atmosphere to understand the reflection characteristics of the high power microwave propagation. Study and understand the dynamic behavior of the propagation of high power microwave pulses and the effects on the intensity, frequency, and width of the pulse and the physical processes occurring during the interaction of the pulse with the air. - Characterize and understand the physics of high power microwave propagation in adverse environmental conditions. Collaborate with the national and international directed energy community on progress in the development and application of high power directed energy weapon technologies for military missions. - Integrate lethality and target imagery data into campaign-level high energy laser system models. FY 2025 Plans: - Modernize antenna designs with an emphasis on bandwidth agility throughput. Transition government-laboratory research efforts in pulsed power to industry. Decrease the size, weight, and power requirements for future high power microwave weapon systems and increase the vendor base for these critical technologies.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
-Conduct trade studies to determine the most effective directed energy weapon system parameters. Collaborate with the national and international directed-energy community on progress in the development and application of high energy laser and high power microwave technologies for military missions. - Explore advanced concepts for technologies that will improve efficiency and decrease the size and weight for future directed energy weapons. Evaluate materials for high energy laser and high power microwave sources. Improve understanding to include material interaction and propagation. Scale electrically driven directed energy sources to higher power levels. - Develop beam control technologies for use across all domains of the Department. Develop component technologies that improve the high energy laser beam director throughput efficiency, optimize size and weight, and improve/automate tracking and compensation through the atmosphere. Invest in atmospheric characterization innovation, field test evaluations, and next-generation models. - Characterize and understand the physics of atmospheric propagation in adverse environmental conditions such as fog, rain, smoke, and dust. Improve prototype cameras and illuminators to enable target engagement at longer ranges and shorter engagement timelines. Evaluate the effectiveness of advanced sensing techniques like 3D imaging for propagation through turbulence. - Collaborate with the national and international directed energy community on progress in the development and application of high energy laser and high power microwave technologies for military missions. Jointly validate predictive models through analysis of laboratory data and field measurements. - Provide maintenance, verification, validation, and accreditation for updated system-level models. Collaborate with Service-sponsored field-test planning to correlate model predictions with measured data for surface, maritime, and aerospace environments. Incorporate atmospheric data into fast-running models to support wargaming events. Continue the development of a predictive avoidance fire control system for use on multiple platforms. Integrate previously collected lethality and target imagery data into accessible databases for use with system-level models. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The decrease of $0.263 million between FY 2024 and FY 2025 reflects an internal realignment to Program Element 0604924D8Z: High Energy Laser Tech Maturation to support directed energy advanced component development, as well as a reduction to meet DoD overall funding reductions, which were spread to mitigate impact.			
Accomplishments/Planned Programs Subtotals	47.624	48.804	48.640

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C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

N/A

D. Acquisition Strategy

N/A