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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*

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	256.567	194.019	171.668	167.279	-	167.279	168.756	175.969	178.844	182.205	Continuing	Continuing
455: *OECIF*	141.112	102.415	171.668	51.130	-	51.130	51.575	53.771	54.644	55.670	Continuing	Continuing
456: *ES and Tactical Micro-Grids*	48.748	28.703	0.000	40.025	-	40.025	40.381	42.110	42.800	43.605	Continuing	Continuing
457: *Power Beaming and Space Solar*	28.222	26.561	0.000	46.186	-	46.186	46.596	48.591	49.388	50.316	Continuing	Continuing
458: *Nuclear*	38.485	36.340	0.000	29.938	-	29.938	30.204	31.497	32.012	32.614	Continuing	Continuing

Note

New Start (Y/N): No

Beginning in FY 2024, Program Element (PE) funding was realigned under four new project codes to correctly align PE funding in support of the Department's strategic priorities. The new project codes are: (1) P455 OECIF; (2) P456 ES and Tactical Micro-Grids; (3) P457 Power Beaming and Space Solar; and (4) P458 Nuclear. The prior year funding project codes did not continue after FY 2023 though the overarching goals of the program element are the same. The four new project codes refocus the PE and provide traceability to the Department's Operational Energy Strategy ensuring that Joint Forces have the energy needed to fight and win in contested environments.

A. Mission Description and Budget Item Justification

Operational Energy underpins the future force requirements for increased mobility, extended range, greater integration across services and coalition partners, and increased resiliency to fight and win in contested environments. OECI's mission is to increase the effectiveness of Joint, DOD-wide, operational energy programs, avoid duplication, identify and close technology gaps, and maximize success in research efforts. OECI leads the community to common, interoperable technology advances that support warfighting overmatch through extended reach, extended range, deliberate implementation of silent operations, silent watch, signature management (thermal and acoustic), power and thermal management innovations to enable next generation weapons advances (directed energy weapons), and reduced exposure to warfighter attacks in contested logistics.

The Operational Energy Capability Improvement (OECI) program is the Department's dedicated investment in Operational Energy Advanced Technology Development addressing joint operational energy requirements. The OECI program matures and demonstrates first-of-its-kind advanced operational energy technologies across warfighting platforms and domains. Technology innovations are focused on four key areas: (1) OECIF; (2) ES and Tactical Micro-Grids; (3) Power Beaming and Space Solar; and (4) Nuclear. The OECI's execution approach of competitive selection to Defense Department laboratories strengthens technical depth within the DoD and fosters broad industry engagement, allowing for implementation of other transaction authorities where appropriate for expediting technology development of warfighter solutions.

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*

Operational Energy technology is a critical enabler for next generation weapon systems, platforms, and the agile and integrated operations required for all four 2022 National Defense Strategy (NDS) priorities. In addition, this PE directly supports the NDS priority of building a resilient Joint Force and defense ecosystem through modernization of key capabilities for operational reach in contested environments providing a sustainable and long-term advantage against adversaries.

This Program Element supports the Office of the Under Secretary of Defense for Acquisition and Sustainment's (OUSD(A&S)) Operational Energy Strategy. The four lines of effort defined in Department's OE Strategy include: Energy Demand Reduction; Energy Substitution and Diversification; Supply Chain Resilience; and Enterprise-wide Energy Visibility. The OECI Program matures first-of-its-kind technology that will ensure that Joint Forces have the energy needed to fight and win in contested environments.

Per the 2021 NDAA section 324, this PE activity is being led by the Under Secretary of Defense for Acquisition and Sustainment.

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	199.142	171.668	176.399	-	176.399
Current President's Budget	194.019	171.668	167.279	-	167.279
Total Adjustments	-5.123	0.000	-9.120	-	-9.120
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-5.123	-			
• Defense-Wide Topline Adjustment	-	-	-9.120	-	-9.120

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Project: 455: *OECIF*		
Congressional Add: *Adaptive Aerodynamic Surfaces Technology*	5.000	0.000
Congressional Add Subtotals for Project: 455	5.000	0.000
Project: 456: *ES and Tactical Micro-Grids*		
Congressional Add: *Power & Thermal Management Subsystem Technologies for High Energy Laser Activities*	7.000	-
Congressional Add Subtotals for Project: 456	7.000	-
Project: 457: *Power Beaming and Space Solar*		

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 I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0604055D8Z *I Operational Energy Capability Improvement (OECI)*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Congressional Add: *Laser Wireless Power Transfer*	5.000	0.000
Congressional Add Subtotals for Project: 457	5.000	0.000
Project: 458: *Nuclear*		
Congressional Add: *TRISO*	10.000	-
Congressional Add: *Distributed Maritime Energy Research*	2.000	0.000
Congressional Add Subtotals for Project: 458	12.000	0.000
Congressional Add Totals for all Projects	29.000	0.000

Change Summary Explanation

The OECI program received an $18 million reduction for excessive growth. As a result, OECI was not able to advance innovations related to: Hydrogen technology for maritime lift and tactical vehicle fuel cells; additional technical pathways associated with waste-to-energy conversion; or study the radioisotope supply chain in depth.

Congressional additions to the program included: (1) $8 million program increase which enabled investment in contested logistics capabilities for arctic operations, and additional projects in nuclear fuels; $2 million addition for distributed maritime energy research to project 455; $5 million addition for laser wireless power transfer to project 457; and $10 million addition for TRISO advanced fuels to project 458. OECI appreciates congressional trust for execution of unplanned targeted funds, and would appreciate congressional patience for financial performance as we seek to execute congressional direction.

The program received two congressionally requested reprogrammings: (1) $7 million Power and thermal management subsystem technologies for high energy laser activities (to Navy – in process); and (2) $5 million Adaptive aerodynamic surfaces technology (to USAF - complete). FY 2023 resulted in a total increase of $7 million across the OECI projects.

FY 2024 planned program decrease reflects maturation of TRISO advanced fuel production. OECI remains supportive and is positioned to execute targeted investments from congress.

FY 2025 program increase enables rapid response to emerging operational energy technology insights derived from ongoing operations and keep pace with adversary advancements . Additional investments will focus on operational energy computing capabilities to the tactical edge, power and thermal management advancements to enable next generation high power weapon systems, space qualifications of low-cost high efficiencies solar array diversified energy sources, and support rapid spaceflight demonstrations of Stirling energy conversion systems.

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*	Project (Number/Name) 455 / *OECIF*	

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
455: *OECIF*	141.112	102.415	171.668	51.130	-	51.130	51.575	53.771	54.644	55.670	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The mission of the OECI is to fund operational energy innovation that will improve DOD operational effectiveness via targeted S&T investments. This project focuses those investments on technologies that enable operations in contested environments and bring energy awareness into the DOD command and control architectures. S&T efforts harness energy data and information to improve decision making as part of Joint All-Domain Command and Control (JADC2). S&T investments in this project: 1) Improve mission-planning tools and analytics; 2) Increase operational control and decision making for power and energy at all warfighting echelons; 3) Provide state of the art metering and monitoring of platform / system capabilities; 4) Develop operational energy modeling and simulation tools that quantify operational and climate impacts; 5) Bring power and energy-innovation knowledge and analytics to warfighters and senior leaders to inform future acquisition, sustainment, and budget decision making; and 6) Deliver foundational training and education on power and energy-innovation across the military and S&T communities. All six technology areas within this project support the Department's OE Strategy Enterprise-wide Energy Visibility line of effort.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Contested Logistics and Battlespace Awareness	97.415	171.668	51.130
Description: In FY 2023, OECI: addressed key operational energy gaps for battlespace awareness; enabled cyber secured operational energy data and information in and around the battlespace; conducted analysis of emerging operational energy technologies that impact dismounted warfare; optimized energy storage solutions for arctic operations; provided a framework for OE technology investments transparency and accountability; and evaluated energy impacts of joint logistics resilience and sustainability in ongoing operations.			
FY 2024 Plans: There are 15 projects/studies continuing from FY 2023 and prior years. In FY 2024, OECI is awarding approximately 13 new start projects to advance Joint capabilities and improve battlespace awareness for the warfighter in contested environments. New technology maturation projects are focusing on advancements to energy metering and monitoring, sensing, capturing end-to-end tactical fuel data, and optimizing UXV planning and energy consumption.			
FY 2025 Plans: In FY 2025, OECI aims to deliver: 1) improved operational energy command and control of UXVs – automating logistics resupply systems; 2) Improved precision for energy efficient, long range delivery systems; 3) Secure communications using private blockchain networks; 4) Real time command and control of electrical power systems 5) Power monitoring with anomaly detection and analysis tools; 6) Improved war gaming focused on real time energy consumption and 7) Low-cost, attritable, energy distribution vehicles for a contested battlefield.			

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*	**Project (Number/Name)** 455 / *OECIF*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
In FY 2025, OECI will continue development of: 1) Technology maturation projects focusing on advancements to energy metering and monitoring, sensing, real-time energy data analytics, mission planning tools, and cyber integration for OE data integrity at all echelons; 2) New analytical studies focusing on innovative energy solutions, energy cyber security needs, and using AI/ML tools to incorporate operational energy into the JADC2 network; 3) New modeling and simulation projects focusing on improving user interface and user experience (UI/UX) with energy management software delivering predictive consumption and resupply for the warfighter. In FY 2025, OECI will award projects to advance disruptive technologies in contested logistics and battlespace awareness. Current operational energy lessons learned highlights the need for investment in low energy demand autonomous systems, such as drones and wearable AI-based microelectronics and software. Project investments will focus on the new generation of sensors to monitor, identify, and alert on “digital threats” to energy and power generation, transport, storage, and infrastructure. Technology maturation of AI/ML tools will improve the ability of US forces and Combatant Commands to integrate critical OE considerations into planning tools. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Programmatic increase is required for Operational Energy innovations to increase energy awareness by extending computing capabilities to the tactical edge. Historical demand for project investments have exceeded 7:1 (proposals submitted vs funded). With additional funding, CLBA would focus on: improving model and simulation tools, data, and scenarios to enhance war fighters and senior leader decision making across the operational energy trade-space.			
Accomplishments/Planned Programs Subtotals	97.415	171.668	51.130

	FY 2023	FY 2024
Congressional Add: Adaptive Aerodynamic Surfaces Technology	5.000	0.000
FY 2023 Accomplishments: OECI patterned with DIU and Airforce for state of the art industry Adaptive Aerodynamic Surfaces Technology. Contracting action with DIU complete October 2023. ***FY 2024 Plans:*** The department is prepared to run a competition to down select to a single vendor in FY 2024.		
Congressional Adds Subtotals	5.000	0.000

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*	**Project (Number/Name)** 455 / *OECIF*

C. Other Program Funding Summary ($ in Millions)

Remarks

N/A

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*	Project (Number/Name) 456 / *ES and Tactical Micro-Grids*	

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
456: *ES and Tactical Micro-Grids*	48.748	28.703	0.000	40.025	-	40.025	40.381	42.110	42.800	43.605	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project drives innovations improving operational energy resilience – a critical enabler for operational flexibility, freedom of maneuver, and mission assurance. Technical areas of this project include energy diversification, standardization, interoperability, and energy components enabling next generation warfighting capabilities. Energy diversification investments focus on hybrid and electrification technologies, hydrogen and PEM fuel cell technologies, expanding energy sources through innovative production, and providing power, fuel, and heat from waste. Standardization and interoperability investments focus on tactical micro-gridding, electrical and communication standards, and energy component commonality for multiplatform applications. Next generation energy component capability investments are focusing on high power weapons enablers, advanced energy storage devices, power and thermal management technologies, and energy innovations optimized for Arctic operations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Operational Energy Resilience	21.703	0.000	40.025
Description: In FY 2023 OECI successfully completed operational energy resilience projects delivering innovative next generation warfighting capabilities emphasizing agile energy management solutions and extending range while minimizing generator dependency by advancing microgrid technologies.; FY 2023 projects advanced hydrogen and synthetic/alternative fuel production; increased access to improved battery technologies, enhanced visibility of DoD battery demand requirements, and increased operating temperature ranges (storage and power) for Arctic environments Additionally, these innovations are positively addressing supply-chain competition concerns. OECI competitively awarded 22 new projects in FY 2023 improving resiliency of tactical operations. The projects focused on battlefield recharging for hybrid/electric platforms, evaluation of commercial EV batteries for DE weapons, advanced batteries and hybrid architectures extending range and silent watch capabilities for tactical vehicles, grid resiliency improvements involving tactical vehicle-enabled microgrids for ground power and weapon system payloads. Project 456 included 29 active projects and studies in FY 2023.			
FY 2024 Plans: In FY 2024 OECI is developing resilient production, storage, delivery, and use of fuels and energy storage technologies at/near the tactical edge including: 1) Cold-weather solutions for the Arctic and reduced-cost logistical transportation solutions; 2) First-of-a-kind H2 powered high-altitude balloons enabling over-the-horizon communication, increasing autonomous underwater vehicle (AUV) vigilance using an H2/O2 battery-recharging system, and hybrid airships supporting INDOPACOM operational energy gaps;			

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*	**Project (Number/Name)** 456 / *ES and Tactical Micro-Grids*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
3) Completion of synthetic fuel aircraft engine qualification; and 4) Additional innovation to reduce operational energy demand providing power, fuel, and heat from waste. Additionally, OECI is developing DOD's operational resilience through tactical vehicle hybridization and electrification – providing the warfighter with essential battlefield capability. OECI technology innovations are: 1) Providing Services' ground forces and special operations forces the ability to leverage tactical silent watch/silent running, tactical sprint, improved signature management (thermal and acoustic), and reducing reliance on costly and dangerous fuel supply convoys; 2) Boosting resilience, by enabling exportable power from manned-unmanned teaming, and 3) Enabling energy use optimization through vehicle-to-grid and vehicle-to-vehicle technologies providing ground power and payload (DE weapons) power. ***FY 2025 Plans:*** In FY 2025, OECI's vision is to continue maturing energy interoperability creating energy redundancies and building an energy architecture across the spectrum (hydrogen, batteries, renewables, energy harvesting) to include all austere operational environments. Projects will focus on developing improved energy resilience and endurance across land, air and sub-sea with continued emphasis on maturing fuel cells, developing all-electric hybrid airships, and increasing warfighter range and agility through fuel diversity. Project emphasis will be on disruptive technologies that improve resiliency by reducing logistical support and increasing operational persistence supporting warfighters in contested environments. Technical focus on hybrid architectures, diversified energy sources (advanced energy storage, hydrogen, etc.), and energy distribution advancements will also enable next generation weapon capabilities such as directed energy weapons. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Programmatic increase is required for Operational Energy innovations in power and thermal management advancements enabling directed energy weapons. Historical demand for project investments have exceeded 7:1 (proposals submitted vs funded). With additional funding, OECI would combine waste-to-energy investments with synthetic fuel and Hydrogen production – creating the ability to produce in-situ fuel at-the-edge.			
Accomplishments/Planned Programs Subtotals	21.703	0.000	40.025

	FY 2023	FY 2024
Congressional Add: Power & Thermal Management Subsystem Technologies for High Energy Laser Activities	7.000	-

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*	**Project (Number/Name)** 456 / *ES and Tactical Micro-Grids*

	FY 2023	FY 2024
FY 2023 Accomplishments: Per the request of Senator Patty Murray, Washington State, OECI completed a topline transfer from PE 0604055D8Z to the Office of Naval Research PE 0603801N. OECI is not executing this congressional add.		
Congressional Adds Subtotals	7.000	-

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*	Project (Number/Name) 457 / *Power Beaming and Space Solar*	

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
457: *Power Beaming and Space Solar*	28.222	26.561	0.000	46.186	-	46.186	46.596	48.591	49.388	50.316	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project drives innovations that reduce operational energy demand, increase efficiencies for aviation and space domains, and reduce risks by providing next-generation power and clean energy delivery options (power beaming) for military effectiveness in contested environments. Aviation efficiency investments focus on innovations to gain efficiency and lower energy consumption through advances in aviation powerplants (e.g., electrification, hybridization, etc.), flight software planning tools, inflight algorithms, composite airframe structures, proton exchange membranes (PEM), hydrogen fuel cells (H2), and sustainable aviation fuels (SAF), among other emerging technologies. Space efficiencies include power and energy (generation, transmission, and storage) for space-access (platform launch and orbital transfer), platform maneuver and station keeping/resupply, platform operation capabilities that improve energy efficiency, lower energy consumption, and/or mitigate environmental impact, and innovations that dramatically reduce the cost of production and/or launch-weight of critical space components.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Operational Energy Demand Reduction	21.561	0.000	46.186
Description: In FY 2023, OECI successfully completed operational energy efficiency projects that delivered innovative next generation warfighting capabilities including: demonstration of the first in-space laser power beaming experiment – a critical and essential component to multi-domain energy delivery capabilities; world record-setting evolution of space-based photovoltaics; multi-domain power beaming/wireless power transfer that increased efficiencies over longer distances at greater power levels; completion of supply chain studies into materials, battery technology, graphene and novel innovation pathways for alternative fuels, and adaptive aerodynamic surfaces that drive efficiencies in aviation platforms. OECI competitively awarded 28 new projects in FY 2023 to increase aviation efficiencies and space efficiencies and reduce demand of fossil fuels in contested environments. ***FY 2024 Plans:*** Project 457 will remain focused on aviation efficiencies, next generation power delivery, and space efficiencies. Technical operational energy innovations will concentrate on: aircraft development to dramatically decrease aerodynamic drag (reduce fuel demand) with the added benefit of reduced radar observability; extending aircraft range including secondary benefits in silent loiter/reconnaissance capabilities; energy diversification away from fossil fuels for aviation and support equipment; hydrogen fuel cells and hydrogen powered technology to improve resiliency with positive climate impacts; increase power beaming/wireless			

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*	**Project (Number/Name)** 457 / *Power Beaming and Space Solar*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
energy capabilities with continued testing of next-generation photovoltaics (perovskites); improving efficiencies of wireless power transfer; and reducing weight and driving affordability of photovoltaic development for space applications. ***FY 2025 Plans:*** In FY 2025, OECI will deliver: 1) Increases to distance and power efficiencies for power beaming (laser/microwave/mmWave); 2) UAV advances in micro-generation and propulsion driving down energy consumption; 3) Innovative wing designs that create significant increases in energy efficiencies of aviation platforms – reducing operational and mission risk by decreasing logistics demand; 4) Substrate reuse and epitaxial liftoff techniques commercialization for high demand space and terrestrial PV cell production – driving down cost; and 5) The first ever perovskite photovoltaic panel with 10-year stability in space environments with greater than 20% AM0 efficiency and at less than $1/W. In FY 2025, OECI will continue to: 1) Advance aviation platforms towards greater automation at scale, and electrification and hybridization of aerial platforms; 2) Explore alternative fuel engines (hydrogen) and energy storage (batteries and fuel cells) at greater energy density to increase on-station time for aerial applications; 3) Make incremental improvements in aviation efficiencies by harvesting electricity from wing vortices, decreasing wire/cable weight through intelligent switching, light-weighting structural aerodynamic materials, and advancing efficient oil-less turbines; 4) Advance energy sensing capabilities for terrestrial and space applications; 5) Enable zero-volt energy storage capability for long term storage and operations; and 6) Develop configurable energy receivers and transmitters for energy sharing between UAV swarms in the near-field and beyond line of sight. In FY 2025, OECI will award new projects focused on disruptive technologies for autonomous space and aviation applications for driving down both energy demand and costs. Opportunities will include providing continuous and efficient on-demand electrical power, increasing capabilities to sense power usage, and energy harvesting of free-space power across the battlespace. Experimenting with practical applications of advanced aviation structure designs and materials. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Programmatic increase is required for space qualification of low-cost high efficiency solar arrays. If additional programmatic increase is made, it will be directed towards hydrogen propulsion systems (hydrogen turbines, and hydrogen internal combustion engines) for aviation platforms, lunar and cislunar power systems, and in space refueling technologies.			
Accomplishments/Planned Programs Subtotals	21.561	0.000	46.186

	FY 2023	FY 2024
Congressional Add: Laser Wireless Power Transfer	5.000	0.000

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*	**Project (Number/Name)** 457 / *Power Beaming and Space Solar*

	FY 2023	FY 2024
FY 2023 Accomplishments: The $5 million add for Laser Power Beaming has enabled novel thermal management for wireless power beaming, photovoltaic cell & array design improvements, and rapid prototyping of key components increasing power, distance, and efficiency. ***FY 2024 Plans:*** In FY 2024 efforts will focus on improving the efficiency of the beam receiver through development of multi-junction photovoltaic cells matched to the wave length of the laser transmitter.		
Congressional Adds Subtotals	5.000	0.000

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*	Project (Number/Name) 458 / *Nuclear*	

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
458: *Nuclear*	38.485	36.340	0.000	29.938	-	29.938	30.204	31.497	32.012	32.614	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project leads DOD innovations enabling nuclear power across the battlespace. Energy diversification such as nuclear power will greatly reduce the need for moving energy over long distances and will help counter adversary capabilities to track and target our logistics forces.

Technical areas of this project include nuclear fuel fabrication processes, energy conversion methods, novel power generation and energy storage technologies, and analytical study and strategy development. Nuclear fuel investments include establishing new and novel fission fuel production (e.g. TRISO), fission fuel moderators, repurposing waste-fuel radioisotopes, and prioritizing efficient use-of and access-to national stockpiles of radioisotopes. Energy conversion investments include steady state energy conversion methods such as thermoelectric and betavoltaic systems; and dynamic methods such as turbine-alternator-compressors, and Stirling engines. Analytical and regulatory study investments focus on shaping policy and strategy for viable nuclear technologies for terrestrial, spaceflight, and maritime applications.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Nuclear Power	24.340	0.000	29.938
Description: In FY 2023, this project successfully established and optimized the first and only US commercial TRISO fabrication line which is foundational to the demonstration of the first advanced reactor funded by DOD - Pele. The successful demonstration of an advanced nuclear reactor for defense applications positions US military forces in a globally advantageous position over adversaries by providing safe, reliable, and transportable power to any location on earth. This project also finalized necessary agreements between performers and the Department of Energy (DOE) for procurement of national isotope stockpiles for technology development of new spaceflight and terrestrial nuclear defense platforms. P458 completed preliminary experimental methods of isotope production for aerospace propulsion applications, and also completed a space nuclear strategy study to better-inform near-term adoption of nuclear power in the theater of earth-orbit and cis-lunar space. OECI competitively awarded 4 new projects in FY 2023 to develop nuclear technologies in future capabilities for radioisotope power systems (RPS) for subsea power generation and transmission, RPS-powered spaceflight power beaming capabilities, spaceflight sensing devices, innovative moderator materials for fission reactors, and super-critical CO2 energy conversion technologies. ***FY 2024 Plans:*** In FY 2024, this project is accomplishing multiple nuclear technology milestones such as novel isotopic heat and power source utilization in austere environments, improved thermal energy conversion technologies such as Stirling engines, enhancing nuclear			

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 0604055D8Z / *Operational Energy Capability Improvement (OECI)*	**Project (Number/Name)** 458 / *Nuclear*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
coated particle fuels, first-of-a-kind innovative mobile nuclear systems for multiple national defense initiatives. FY 2024 projects are delivering terrestrial experimentation of an RPS platform in a simulated spaceflight environment (e.g., vacuum chamber), a separate RPS in a simulated subsea environment, an electrically heated demonstration of an airbreathing nuclear propulsion system, and fabrication and testing of novel moderator materials for coated particle fuel reactors. Multiple regulatory and licensing studies are completing and laying the foundation for near-term adoption and use of nuclear power for defense applications in direct support of DOD installation priorities along with far-term opportunities for innovative nuclear regulations for molten salt reactors. New projects are continuing to invest in innovative and competitive technology development, and DOD policy / regulatory roadmaps, along with first-of-a-kind nuclear technologies for warfighters across all domains (space, air, ground, marine).			
FY 2025 Plans: In FY 2025, OECI will deliver the first spaceflight test of a DOD RPS platform (launch availability permitting) since the ~1960s, complete development of improved super critical carbon dioxide (sCO2) turbomachinery applicable to advanced nuclear power generation, and demonstrate alternative RPS isotopes for power solutions in low-power ISR instrumentation suites for spaceflight assets that leverage a diversified and robust domestic inventory of radioisotope fuels independent of foreign supply chains. In FY 2025, OECI will continue developing advanced nuclear technology in viable devices and methods ensuring and stabilizing DOD's nuclear technologies, fuels, and material supply chains such as isotopic inventories and nuclear fuel production methods. Ongoing investments are focusing on energy conversion methods that better utilize the thermal energy generated by nuclear fuels (i.e., sCO2 turbine-alternators, Stirling engines, and betavoltaics), nuclear power system optimization (i.e., fuels, shielding, materials), and regulatory/infrastructure studies. In FY 2025, OECI will award disruptive nuclear technology innovations that will ensure continuity of safe operations for the warfighter in or around compromised nuclear facilities (i.e., Ukraine) by investing in rapid response capabilities, early detection methods, and nuclear proliferation countermeasures. Additionally, novel and resilient nuclear solutions to power demands for spaceflight platforms providing critical ISR capabilities for contested ground operations will be supported by OECI nuclear investments along with innovations allowing consideration of mobile nuclear systems for ground, sea, and air applications.			
FY 2024 to FY 2025 Increase/Decrease Statement: Programmatic increase is required for Operational Energy innovations to keep pace with adversarial developments, and to innovate at competitive levels enabling realistic adoption of nuclear technologies on realistic timelines. OECI's increase to support rapid spaceflight demonstrations of Stirling energy conversion systems are critical for surpassing China's aggressive investments in improved energy generation capabilities in space. With additional funds OECI will focus innovations to reduce size, volume, and risk of all nuclear systems (e.g., radioisotope or fission) in operational scenarios. This investment could be paramount for overmatch in the battlefield of the near-future in space, terrestrial, and maritime domains. Adversarial investments in nuclear technologies are evident by multiple, recent, successful, and fielded adversarial demonstrations. OECI is poised to lead DOD			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Office of the Secretary Of Defense		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
in nuclear technology innovations, but significant programmatic increase is needed to ensure meaningful change in competitive timeframes. Nuclear innovations are expensive, but the comparative energy potential that can be realized from these investments is unrivaled by any energy source and should be considered a time-sensitive, and critical matter for the battlefield of tomorrow.			
Accomplishments/Planned Programs Subtotals	24.340	0.000	29.938

	FY 2023	FY 2024
Congressional Add: TRISO ***FY 2023 Accomplishments:*** The TRISO congressional add in addition to the $13 million baseline successfully established and optimized the first and only US commercial TRISO fabrication line which is foundational to the demonstration of the first advanced reactor funded by DOD - Pele.	10.000	-
Congressional Add: Distributed Maritime Energy Research ***FY 2023 Accomplishments:*** FY 2023 congressional add contract action awarded in September 2023. ***FY 2024 Plans:*** The project will begin executing in FY 2024 to deliver continuous power in maritime environments.	2.000	0.000
Congressional Adds Subtotals	12.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A