Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602150A *I Air and Missile Defense Technology*							
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	-	94.972	33.301	39.188	-	39.188	42.813	51.931	52.026	55.179	0.000	369.410
AE2: *Unconventional Countermeasures-Survivability Tech*	-	3.896	3.384	2.772	-	2.772	2.719	3.779	3.370	3.093	0.000	23.013
BN6: *Advanced Weapons Components (CA)*	-	68.752	-	-	-	-	-	-	-	-	0.000	68.752
CV7: *High Energy Laser Direct Diode Apl Tech*	-	2.796	1.495	3.224	-	3.224	3.036	7.425	8.988	9.079	0.000	36.043
CV8: *Vulnerability Modules for Multi-Domain Operations*	-	7.788	8.987	7.750	-	7.750	7.467	6.704	2.791	4.483	0.000	45.970
DA9: *Radar Survivability through Dis Sensing Tech*	-	5.591	4.703	4.084	-	4.084	2.271	-	-	-	0.000	16.649
DC1: *Next Generation DE Concept Development & Analysis*	-	6.149	6.446	8.303	-	8.303	8.329	8.356	10.505	12.704	0.000	60.792
DE3: *Adv Beam Control Component Development for C-CM*	-	-	8.286	5.361	-	5.361	5.752	11.739	10.921	10.921	0.000	52.980
HP1: *High Power Microwave Technology**	-	-	-	-	-	-	0.501	2.004	4.008	2.004	0.000	8.517
SU1: *Counter Small Unmanned Aircraft Sys (C-sUAS) Tech*	-	-	-	7.694	-	7.694	12.738	11.924	11.443	12.895	0.000	56.694

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2025

Note

SU1 / Counter Small Unmanned Aircraft Sys(C-sUAS) Tech -(Extended Range C-sUAS (XRC) Tech) in Fiscal Year (FY) 2025 is a New Start.

This is an Army priority effort for Counter-small Unmanned Aircraft System (C-sUAS) capability.

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army	Date: March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*

A. Mission Description and Budget Item Justification

This Program Element (PE) line is directly aligned with the Air & Missile Defense (AMD) Army Modernization Priority. Work in this PE investigates and develops AMD technologies to enable defense of ground forces and selected geopolitical assets from aerial attack, missile attack, and surveillance. Major focus areas for AMD Science and Technology include: Missiles, Directed Energy, Gun-Based Air Defense Technologies, and Battlefield Sensors and Supporting AMD Technologies. Missiles Applied Research investigates and develops a broad range of Missile technologies to enhance Army integrated AMD capabilities at extended range. Directed Energy Applied Research investigates and develops critical High Energy Laser (HEL) technologies to explore performance against Air Defense threats and for other Directed Energy applications across Army Modernization Priorities. Gun-Based Air Defense Technologies Applied Research investigates and develops Combined Arms for Air Defense (CAFAD) technologies and components in a laboratory environment. Sensors and Supporting AMD Technologies Applied Research investigates and develops Battlefield Sensor and radar technologies required for detection, acquisition and tracking of air defense targets as well as supporting technologies that enhance AMD.

Work in this PE complements PE 0603466A (Air and Missile Defense Advanced Technology).

The cited research is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Research is performed by U.S. Army Aviation and Missiles Center (AvMC).

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	88.768	33.301	31.432	-	31.432
Current President's Budget	94.972	33.301	39.188	-	39.188
Total Adjustments	6.204	0.000	7.756	-	7.756
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	7.000	-			
• SBIR/STTR Transfer	-0.796	-			
• Adjustments to Budget Years	-	-	7.756	-	7.756

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Project: BN6: *Advanced Weapons Components (CA)*		
Congressional Add: *Program Increase - BEAM CONTROL SYSTEMS AND INDUSTRY GRADE OPTICAL FIBER FABRICATION FOR ENERGY LASER*	9.000	-
Congressional Add: *Program Increase - COUNTER UAS CENTER FOR EXCELLENCE*	5.000	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army	Date: March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Congressional Add: *Program Increase: HIGH ENERGY LASER AND OPTICAL TECHNOLOGY*	10.000	-
Congressional Add: *Program Increase - ARMY MISSILE RISK-BASED MISSION ASSURANCE*	5.000	-
Congressional Add: *Program Increase - Precision Long Range Integrated Strike (PLRIS)*	6.752	-
Congressional Add: *Program Increase - SMALL UAS TRACKING AND TARGETING DEVICES*	14.000	-
Congressional Add: *Program Increase - CYBER ELECTROMAGNETIC ACTIVITIES MISSILE DEFENDER*	2.000	-
Congressional Add: *Program Increase - MISSILE RISK-BASED MISSION ASSURANCE*	10.000	-
Congressional Add: *Program Increase - Missile Soldier Touch Point Center*	7.000	-
Congressional Add Subtotals for Project: BN6	68.752	-
Congressional Add Totals for all Projects	68.752	-

Change Summary Explanation

Increase in FY25 funding, due to realignment from Program Element (PE) 0603025A (Army Agile Innovation and Demonstration) / Project CK8 (Advanced Technology Development and Convergence), PE 0603041A (All Domain convergence Advanced Technology) / Project CM8 (Convergence Battlefield Integration), PE 0602145 Next Generation Combat Vehicle, and PE 0603464A (Long Range Precision Fires Advanced Technology) / Project CE9 (Armaments Advanced Technology) to support investigation of critical component technology to address small form factor C-sUAS missile systems.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602150A / *Air and Missile Defense Technology*	Project (Number/Name) AE2 / *Unconventional Countermeasures-Survivability Tech*	

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
AE2: *Unconventional Countermeasures-Survivability Tech*	-	3.896	3.384	2.772	-	2.772	2.719	3.779	3.370	3.093	0.000	23.013

A. Mission Description and Budget Item Justification

This Project designs and develops technologies to deter tactical surveillance and targeting by adversarial area denial systems and munitions. The Project investigates methods to increase survivability of critical assets against precision-guided near-peer advanced weapons threats, investigates and develops tonedown methods for signature management, and computationally develops novel countermeasures. This Project also develops a suite of high-fidelity, physics-based modeling and simulation tools for the design and development of unconventional countermeasures and survivability enhancers applicable to a wide range of operating environments.

Work in this Project complements Program Element (PE) 0603466A (Air and Missile Defense Advanced Technology) / Project AE3 (Unconventional Countermeasures-Survivability ATech).

The work cited is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the United States Army Engineer Research and Development Center Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Model-Based Assessment of Sensors and Countermeasures ***Description:*** This effort develops a suite of high-fidelity, physics-based modeling and simulation tools for the design and development of unconventional countermeasures for a wide range of operating environments; develops tools for the evaluation of threat detection and object identification.	1.853	-	-
Title: Advanced Integrated Unconventional Countermeasures Applications ***Description:*** This effort develops methods and materials to defeat peer advanced reconnaissance, surveillance, targeting methods through advancements in material science and computational prototyping to reduce targetable signatures and confuse targeting systems. ***FY 2024 Plans:***	2.043	1.651	1.036

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602150A / *Air and Missile Defense Technology*	**Project (Number/Name)** AE2 / *Unconventional Countermeasures-Survivability Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will develop computational tools and validate material science solutions to aid in the optimization of signature management by coupling material science and computational simulations within a closed-loop computational architecture for targeted countermeasure applications. ***FY 2025 Plans:*** Will develop and optimize physical prototype survivability enhancement kits for FIRES assets. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects the transition of technologies for maturation and demonstration.			
Title: Virtual Unconventional Countermeasure Environment ***Description:*** This effort develops physics-based modeling and simulation tools for rapid prototyping of novel unconventional countermeasures across multiple relevant operational environments and sensing modalities on an assortment of platforms. ***FY 2024 Plans:*** Will conduct studies to investigate effects on countermeasure development and effectiveness assessment under rapidly developed physics-based geo-typical scenes. ***FY 2025 Plans:*** Will validate and incorporate new physics algorithms for heavily vegetated regions into high fidelity modeling capabilities to increase precision in comparison to environmental data. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects planned milestones and accomplishments.	-	1.733	1.736
Accomplishments/Planned Programs Subtotals	3.896	3.384	2.772

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602150A / *Air and Missile Defense Technology*	Project (Number/Name) BN6 / *Advanced Weapons Components (CA)*	

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
BN6: *Advanced Weapons Components (CA)*	-	68.752	-	-	-	-	-	-	-	-	0.000	68.752

Note

Congressional Interest Item funding provided for Advanced Weapons Components.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Advanced Weapon Components.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
Congressional Add: Program Increase - BEAM CONTROL SYSTEMS AND INDUSTRY GRADE OPTICAL FIBER FABRICATION FOR ENERGY LASER	9.000	-
FY 2023 Accomplishments: Work in FY 2023 was a continuation of, and furthered, efforts executed under FY 2022. This effort continued to characterize and optimize a diverse set of fiber laser systems, optics, and photonics to support development, maturation, and suitability assessments for technology insertion for High Energy Laser (HEL) weapon systems. Additionally, this effort continued development and mature the next generation direct diode laser systems. Finally, this effort researched crystalline fiber lasers and techniques for high energy pulsed power applications for next generation High Energy Laser systems. Work was performed in Huntsville, Alabama by the United States Army Space and Missile Defense Command (USASMDC), with the Rapid Capabilities and Critical Technologies Office (RCCTO) oversight. Congressional Program Increase for BEAM CONTROL SYSTEMS AND INDUSTRY GRADE OPTICAL FIBER FABRICATION FOR ENERGY LASER.		
Congressional Add: Program Increase - COUNTER UAS CENTER FOR EXCELLENCE	5.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602150A / *Air and Missile Defense Technology*	**Project (Number/Name)** BN6 / *Advanced Weapons Components (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Program Increase for COUNTER UA CENTER FOR EXCELLENCE.		
Congressional Add: Program Increase: HIGH ENERGY LASER AND OPTICAL TECHNOLOGY ***FY 2023 Accomplishments:*** Work in FY 2023 was a continuation of, and furthered, efforts executed under FY 2022. This effort continued to develop and mature improvements in tracking, targeting, cueing, and battle damage assessment. Leveraged previous development efforts to integrate and demonstrate an integrated laser ranger/ illuminator with time gated camera that provides improved targeting and engagement in complex and cluttered environments. Work was performed in Huntsville, Alabama by the United States Army Space and Missile Defense Command (USASMDC), with the Rapid Capabilities and Critical Technologies Office (RCCTO) oversight. Congressional Program Increase for HIGH ENERGY LASER AND OPTICAL TECHNOLOGY.	10.000	-
Congressional Add: Program Increase - ARMY MISSILE RISK-BASED MISSION ASSURANCE ***FY 2023 Accomplishments:*** Congressional Program Increase for ARMY MISSILE RISK-BASED MISSION ASSURANCE	5.000	-
Congressional Add: Program Increase - Precision Long Range Integrated Strike (PLRIS) ***FY 2023 Accomplishments:*** Congressional Program Increase for PRECISION LONG RANGE INTEGRATED STRIKE (PLRIS)	6.752	-
Congressional Add: Program Increase - SMALL UAS TRACKING AND TARGETING DEVICES ***FY 2023 Accomplishments:*** This effort developed, built and demonstrated a small agile gimbal prototype incorporating enhanced lasers and servos for greater targeting range. The demonstration gimbal for High Energy Laser (HEL) beam direction was based on requirements and designs for next generation lightweight HEL systems. Project expands U.S. manufactured compact stabilized tracking and targeting devices for Class I, II and III small Unmanned Air Systems (sUAS).	14.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602150A / *Air and Missile Defense Technology*	**Project (Number/Name)** BN6 / *Advanced Weapons Components (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
Work was performed in Huntsville, Alabama by the United States Army Space and Missile Defense Command (USASMDC), with the Rapid Capabilities and Critical Technologies Office (RCCTO) oversight. Congressional Program Increase for SMALL UAS TRACKING AND TARGETING DEVICES.		
Congressional Add: Program Increase - CYBER ELECTROMAGNETIC ACTIVITIES MISSILE DEFENDER ***FY 2023 Accomplishments:*** Congressional Program Increase for CYBER ELECTROMAGNETIC ACTIVITIES MISSILE DEFENDER.	2.000	-
Congressional Add: Program Increase - MISSILE RISK-BASED MISSION ASSURANCE ***FY 2023 Accomplishments:*** Congressional Program Increase for MISSILE RISK-BASED MISSION ASSURANCE.	10.000	-
Congressional Add: Program Increase - Missile Soldier Touch Point Center ***FY 2023 Accomplishments:*** Congressional Program Increase for Missile Soldier Touch Point Center	7.000	-
Congressional Adds Subtotals	68.752	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602150A / *Air and Missile Defense Technology*				Project (Number/Name) CV7 / *High Energy Laser Direct Diode Apl Tech*			
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**
CV7: *High Energy Laser Direct Diode Apl Tech*	-	2.796	1.495	3.224	-	3.224	3.036	7.425	8.988	9.079	0.000	36.043

A. Mission Description and Budget Item Justification

This Project designs and develops single mode diode emitters to increase output power to 100 Watts with >60% electrical-to-optical efficiency and packaging for an array of emitters. This Project will also develop and validate a 100 kW-class laser subsystem with 58% electrical-to-optical efficiency and 80% fractional power in bucket (PIB) in a lab setting. This Project will leverage industry and National Labs research to overcome gain limitations in the semi-conductor gain region. This Project also funds research necessary to make significant improvements to the size, weight, and power (SWaP) of laser subsystems.
Research in this Project complements other Army Directed Energy efforts conducted under (PE) 0602150A (Air and Missile Defense Technology)/Project DC1 (Next Generation Directed Energy Concept Development and Analysis) and PE 0603466A (Air and Missile Defense Advanced Technology)/Project CV6 (Optimized High Energy Laser Source Advanced Technology).

The cited research is consistent with the Army's modernization programs, the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and supports the Army's future capability opportunities for leap-ahead technology for Directed Energy.
Research is performed by the United States Army Space and Missile Defense Command - Technical Center (USASMDC-TC) in coordination with RCCTO.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: High Energy Laser Direct Diode Applied Technology	2.796	1.495	3.224
Description: This effort designs and develops single mode diode emitters to increase output power to 100 Watts with >60% electrical-to-optical efficiency and develop packaging for an array of emitters. This effort will also design and develop a 100 kW-class laser subsystem with 58% Electric to Optical efficiency and 80% fractional Power in the Bucket; validated in a lab setting. This effort will leverage industry and National Labs research to overcome gain limitations in the semi-conductor gain region.			
FY 2024 Plans: Complete development of single mode diode array and packaging. Evaluate spectral locking of array beam quality. Complete development of higher power and efficiency single mode diodes. Evaluate performance and optimize single mode diode designs based on findings.			
FY 2025 Plans: Design and develop technology to passively phase lock many single mode emitters. Research will focus on design concepts that include emitter architectures, packaging, and combining techniques that will get to kilowatt class modules with good beam quality. Initiate proof of concept combining experiments.			
FY 2024 to FY 2025 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602150A / *Air and Missile Defense Technology*	**Project (Number/Name)** CV7 / *High Energy Laser Direct Diode Apl Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Funding increase reflects a planned increase of design, development and experimentation activities.			
Accomplishments/Planned Programs Subtotals	2.796	1.495	3.224

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602150A / *Air and Missile Defense Technology*	Project (Number/Name) CV8 / *Vulnerability Modules for Multi-Domain Operations*	

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
CV8: *Vulnerability Modules for Multi-Domain Operations*	-	7.788	8.987	7.750	-	7.750	7.467	6.704	2.791	4.483	0.000	45.970

A. Mission Description and Budget Item Justification

This Project will design and develop High Energy Laser (HEL) Vulnerability Modules (VM), engagement tactics data and kill signatures for targeting Unmanned Aerial Systems, Cruise Missiles, and Rotary Wing threats for future HEL weapon systems. Developed smart VMs will enable real time threat feature detection and targeting, increasing the lethality of the HEL weapon systems through optimizing aimpoint selection. The Development of smart VMs will enable optimized targeting across a large range of current and future threat targets due to detection capabilities applied against threat features and not specific threats.

Research in this Project complements other Army Directed Energy efforts conducted under (PE) 0602150A (Air and Missile Defense Technology)/Project DC1 (Next Generation Directed Energy Concept Development and Analysis.

The cited research is consistent with the Army's modernization programs, the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and supports the Army's future capability opportunities for leap-ahead technology for Directed Energy.

Research is performed by the United States Army Space and Missile Defense Command - Technical Center (USASMDC-TC) in coordination with RCCTO and PEO Missiles and Space/PM Shield.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Vulnerability Modules for Multi Domain Operations	7.788	8.987	7.750
Description: This effort will design and develop Vulnerability Modules for Multi Domain Operations against current and emerging high priority threats. Investigates and conducts experiments on High Energy Laser Lethality against Unmanned Aerial Systems, Cruise Missiles and Rotary Wing aircraft. The effort will fund research and conduct experiments to optimize aimpoints for rapid and effective High Energy Laser weapon systems fire control solutions. This effort's subtasks are: o Smart Vulnerability Modules o Aimpoint-specific Fire Control Algorithms o Target System Response o HEL engagement Performance Scoring (Army Mobile Performance Scoring Sensor)			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602150A / *Air and Missile Defense Technology*	**Project (Number/Name)** CV8 / *Vulnerability Modules for Multi-Domain Operations*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Each task is in support of the design and development of Multi-Domain Operations Vulnerability Modules against current and emerging priority threats - primarily Unmanned Aerial Systems, Cruise Missiles and Rotary Wing aircraft. The effort will fund research and conduct experiments to understand target High Energy Laser vulnerabilities and create smart methods to optimize aimpoints for effective High Energy Laser weapon systems fire control solutions. The evaluation of Target System Response's will further improve fire control systems by providing potential kill signatures to the operator. A key component to the generated Vulnerability Modules products is validation of prototypes using the Vulnerability Modules. The Army's Mobile Performance Scoring System is specifically designed to collect data to validate Vulnerability Modules. The Army Mobile Performance Scoring Sensor is two pieces - a hardware piece that tracks and collects data; and a software piece that estimates the total energy applied to the aimpoint to compare against the Vulnerability Modules values. The software will be designed to work with multiple collection telescopes such that Army Mobile Performance Scoring Sensor is a family of products. ***FY 2024 Plans:*** This effort will advance Vulnerability Modules (VMs) on Group 2&3 Unmanned Aerial Systems (UASs), Rotary Wing (R-W), and Subsonic and Supersonic Cruise Missiles (CMs) through vulnerability analysis and experiments. Conduct Part Two of UAS and R-W initial coupon/material and specific aimpoint experiments utilizing data gained in Smart VM development to further increase VM Readiness Levels (RLs). Conduct Subsonic CM complete set of components and full-scale experiments. Conduct studies of Supersonic CM analytical/existing data, intel, and SME operations combined with DoD simulations. ***FY 2025 Plans:*** This effort will mature Vulnerability Modules for Group 2-3 Unmanned Aerial Systems, Rotary Wing, and subsonic cruise missiles to a Vulnerability Modules Readiness Level 5; Supersonic Cruise Missiles to Vulnerability Module Readiness Level 4; and Hypersonic CM VM Readiness Level 3. The Smart Vulnerability Module methodology will be expanded to targets beyond the initial use in Group 1-2 Unmanned Aerial Vehicles. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned completion of Vulnerability Modules workflows of Class 2 and 3 Unmanned Aerial Systems.			
Accomplishments/Planned Programs Subtotals	7.788	8.987	7.750

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602150A / *Air and Missile Defense Technology*				Project (Number/Name) DA9 / *Radar Survivability through Dis Sensing Tech*			
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**
DA9: *Radar Survivability through Dis Sensing Tech*	-	5.591	4.703	4.084	-	4.084	2.271	-	-	-	0.000	16.649

A. Mission Description and Budget Item Justification

This project investigates and develops critical radar capability enhancements to defeat advanced Air and Missile threats and protect Army maneuver forces and critical assets. Radar enhancements are required for advanced Electronic Protection (EP) techniques against advanced jammers, electronic Combat Identification (CID), and resource optimization across the threat spectrum while retaining 360?coverage capability. Technology development includes providing capabilities for: dispersed multi-static operation, classifying/tracking emerging threats and high-volume threats; adaptive digital beam forming to enable resource efficiency, performance in a dynamic clutter environment and enhanced survivability in a contested battlespace; and multi-modal tracking and additional discrimination models to support diverse and emerging threats, such as swarms and guided munitions. Enhanced development for the state-of-the-art scalable, digital array radar testbed to include advanced algorithms, transmitted power, antenna gain, detection range and angle accuracy/resolution upgrades to the existing/new radar front/back ends will allow greater performance characterization for Multi-mission Army Radar systems supporting the Multi-domain Operations (MDO).

This research is coordinated with Army Program Element (PE) 0602141A (Lethality Technology) / Project CG4 (Advanced Radar Concepts); PE 0602148A (Future Vertical Lift Technology) / Project CC3 (FVL Radar Technology); and PE 0601102A (Defense Research Sciences) / Project AA8 (Foundational Distributed Radar); Additionally, this project leverages and works closely with Navy, Air Force, DARPA, and MDA radar research and development efforts.

This research complements Program Element (PE) 0602141A (Lethality Technology) / Project CJ7 (Future Air Defense Missile Enabling Technology) and PE 0603466A (Air and Missile Defense Advanced Technology) / Project DB3 (Radar Survivability through Dis Sensing Adv Tech).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Radar Survivability through Dis Sensing (RSDS) Tech	5.591	4.703	4.084
Description: Investigates and develops critical radar capability enhancements to defeat advanced Air and Missile threats and protect Army maneuver forces and critical assets			
FY 2024 Plans: Will develop RSDS software technology and radar representative hardware to minimize risks associated with integration into Army Radar systems; continue modeling and simulation efforts to develop concepts in the areas of operations analysis, radar resource optimization, and radar communications; inform performance metrics of distributed sensing in a multi-static radar			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602150A / *Air and Missile Defense Technology*	**Project (Number/Name)** DA9 / *Radar Survivability through Dis Sensing Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
configuration; utilize the low-cost multi-static radar testbed and execute data collections in distributed sensing configurations in contested environments; perform data analysis to aid with modeling and simulation and the development of a software based RSDS capability for future and current air defense radar systems. ***FY 2025 Plans:*** Will develop a multi-static sensing concept of operations (CONOPS) to inform future requirements for Lower Tier Air and Missile Defense Sensor (LTAMDS); develop a strategy and framework to integrate multi-static awareness in the Integrated Air and Missile Defense Battle Command System (IBCS). Enhance the modeling and simulation efforts and concepts in the areas of operations analysis, radar resource optimization, and radar communications; inform performance metrics of distributed sensing in a multi-static radar configuration. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	5.591	4.703	4.084

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602150A / *Air and Missile Defense Technology*				Project (Number/Name) DC1 / *Next Generation DE Concept Development & Analysis*			
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**
DC1: *Next Generation DE Concept Development & Analysis*	-	6.149	6.446	8.303	-	8.303	8.329	8.356	10.505	12.704	0.000	60.792

A. Mission Description and Budget Item Justification

This Project researches and investigates lethality effectiveness, adaptive optics, beam control, laser sources, target and beacon illuminator lasers, new tracking algorithms, laser and beam control equipping for High Energy Laser experimentation to improve future High Energy Laser weapon system effectiveness. This Project determines critical activities to enable next generation directed energy technical innovations and funds core competencies in Lethality and Directed Energy.

Research in this Project complements other Army Directed Energy efforts conducted under (PE) 0602150A (Air and Missile Defense Technology)/Project CV7 (High Energy Laser Direct Diode Apl Tech), Project DE3 (Advanced Beam Control Component Development for Counter-Cruise Missile), Project CV8 (Vulnerability Modules (VM) for Multi-Domain Operations), and PE 0603466A (Air and Missile Defense Advanced Technology)/Project CV6 (Optimized High Energy Laser Source Advanced Technology), Project IB1 (Integrated Beam Control Systems Demonstration for Counter-Cruise Missile).

The cited research is consistent with the Army's modernization programs, the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and supports the Army's future capability opportunities for leap-ahead technology for Directed Energy.

Research is performed by the United States Army Space and Missile Defense Command - Technical Center (USASMDC-TC) in coordination with RCCTO.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Next Generation Direct Energy Concept Development and Analysis	6.149	6.446	8.303
Description: This effort funds foundational core competencies to develop and maintain a competent and skilled Directed Energy workforce as well as develop Science and Technology Labs to support future Directed Energy components, subsystems and system upgrades. This effort funds foundational research for future High Energy Laser weapons to effectively engage an array of threats. Research includes: - Basic physics modeling and investigating of target vulnerability from material analysis through data collection of High Energy Laser engagements using dynamic targets. - Identifying and prioritizing threat aim points by analyzing the time to kill for each aimpoint. - Validating Core Modeling and Simulations tools used in lethality and beam propagation. - Evaluating and prototyping High Energy Laser subsystems for adaptive optics, beam control, laser diodes and laser illuminators.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602150A / *Air and Missile Defense Technology*	**Project (Number/Name)** DC1 / *Next Generation DE Concept Development & Analysis*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will research and investigate laser sources, beam control and advanced adaptive optics for increased high energy laser (HEL) system effectiveness against a range of threats. Conducts experiments to characterize high energy laser components and subsystem effectiveness. Continues to research and investigate laser source concepts to improve, size, weight, and power (SWaP) of HEL weapon systems. Determines critical activities to enable next generation DE technical innovations and core competencies. ***FY 2025 Plans:*** Will research and investigate laser sources, beam control and lethal effectiveness for emerging threats and increased high energy laser (HEL) system effectiveness against a range of existing threats. Will perform analysis on HEL weapon systems in varying architectures against emerging threats and develop concept architectures that will provide advanced warfighting capabilities. Develop technical research strategies and funding requirements for future advanced HEL capabilities. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects a planned increase of the Directed Energy modernization priorities and an increase of foundational core competencies in Directed Energy technologies to support future Directed Energy weapon systems.			
Accomplishments/Planned Programs Subtotals	6.149	6.446	8.303

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602150A / *Air and Missile Defense Technology*	Project (Number/Name) DE3 / *Adv Beam Control Component Development for C-CM*	

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
DE3: *Adv Beam Control Component Development for C-CM*	-	-	8.286	5.361	-	5.361	5.752	11.739	10.921	10.921	0.000	52.980

A. Mission Description and Budget Item Justification

This project researches and develops advanced Beam Control technology to create new sensors, illuminators, deformable mirrors, wave front sensors (WFS), other optical components, and acquisition and tracking concepts. Design and develop a 50-cm class off-axis beam expander with innovative cost savings research on components. Develop algorithms for WFS and laser quality tracking. Design a 1-meter class segmented Beam Director for Phased Array High Energy Laser beam inputs. This effort will increase the effective range of the Indirect Fire Protection Capability High Energy Laser weapon system.

Work is this Project complements (PE) 0602150A (Air and Missile Defense Technology)/Project DC1 (Next Generation Directed Energy Concept Development and Analysis) and PE 0603466A (Air and Missile Defense Advanced Technology)/Project IB1 (Integrated Beam Control Systems Demonstration for Counter-Cruise Missile).

The cited research is consistent with the Army's modernization programs, the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and supports the Army's future capability opportunities for leap-ahead technology for Directed Energy.

Research is performed by the United States Army Space and Missile Defense Command - Technical Center (USASMDC-TC) in coordination with RCCTO.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Beam Control Component Developments for C-CM	-	8.286	5.361
Description: Support Advanced Beam Control Phase I (extend effective range of the Indirect Fire Protection Capability High Energy Laser weapon system). Support Advanced Beam Control Phase II (extend effective range of the Indirect Fire Protection Capability High Energy Laser weapon system). Develop New Technologies for Beam Director Assemblies. Support the Space and Missile Defense Commands efforts in developing Counter Cruise Missile Components/Subsystems.			
FY 2024 Plans: Research and develop advanced beam control technology to improve weapon system effectiveness and extend the effective range.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602150A / *Air and Missile Defense Technology*	**Project (Number/Name)** DE3 / *Adv Beam Control Component Development for C-CM*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Investigate optimal algorithms and hardware configuration for multiple wavefront sensor architectures. ***FY 2025 Plans:*** Continue research and development of beam control technologies that will enable a high energy laser weapon system to extend the effective range. Continue development of 50-cm class high energy laser beam expander with Technology Readiness Level (TRL) 4 laboratory validation. Continue development of advanced adaptive optics systems in a laboratory environment with a TRL 4 demonstration. Continue development of laser quality tracking improvements. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects a planned completion of workflows of applied research and the transition of technology to integration and demonstration.			
Accomplishments/Planned Programs Subtotals	-	8.286	5.361

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602150A / *Air and Missile Defense Technology*	Project (Number/Name) SU1 / *Counter Small Unmanned Aircraft Sys (C-sUAS) Tech*	

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
SU1: *Counter Small Unmanned Aircraft Sys (C-sUAS) Tech*	-	-	-	7.694	-	7.694	12.738	11.924	11.443	12.895	0.000	56.694

Note

Counter Small Unmanned Aircraft Sys (C-sUAS) Tech is a new start within the Air and Missile Defense Technology program in FY 2025.

This is an Army priority effort for Counter-small Unmanned Aircraft System (C-sUAS) capability.

A. Mission Description and Budget Item Justification

This Project investigates, designs and develops novel Counter-small Unmanned Aircraft System (C-sUAS) kinetic missile interceptor capabilities. Project will transition technologies for increased range, reduce reaction time, increase lethality, improve reliability, reduce reload time for fixed site and mobile C-sUAS configurations. Provides maneuver forces a quick-response, high speed, long-range kinetic interceptor capabilities against Group 3 small Unmanned Aircraft Systems (sUAS) that operate at higher altitudes with greater standoff ranges for Multi-Domain Operations (MDO). Designs and develops small, lightweight, and low-cost missile interceptor technologies for increased magazine depth (stowed kills) to enable brigade/maneuver force kinetic defeat numerous sUAS at short range. Provides deeper magazine against sUAS threats with versatile employment options at a low cost provides maneuver forces increased freedom of movement and protection during large scale combat operations. This project supports Air and Missile Defense Modernization priority efforts.

This research is coordinated with PE 0602141A (Lethality Technology) / Project CJ7 (Future Air and Missile Defense Enabling Technology); PE 0602147A (Long Range Precision Fires Technology / Project AF8 (Affordable Extended Range Precision Technology) and will transition for further maturation to PE 0603464A (Air and Missile Defense Advanced Technology) / Project SU2 (Counter s-UAS Advanced Tech)

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Extended Range C-sUAS (XRC) Tech	-	-	7.694
Description: This effort investigates concepts, performs trade studies, and provides component technology development to increase range, reduce reaction time, increase lethality, improve reliability, and reduce reload time for C-sUAS kinetic interceptor capabilities for the maneuver forces fixed site and mobile C-sUAS configurations.			
FY 2025 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602150A / *Air and Missile Defense Technology*	**Project (Number/Name)** SU1 / *Counter Small Unmanned Aircraft Sys (C-sUAS) Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will investigate critical component technology to address small form factor C-sUAS missile systems; design and develop novel propulsion concepts through component evaluation and analysis; investigate small form factor seeker technology to meet long range missile intercept requirements; design and develop small form factor critical missile components for extended range UAS targets. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** In Fiscal Year (FY) 2025 this Project is a New Start.			
Accomplishments/Planned Programs Subtotals	-	-	7.694

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A