Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army											Date: April 2022	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603466A *I Air and Missile Defense Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
Total Program Element	-	173.244	145.826	11.147	-	11.147	9.715	9.603	4.766	3.329	0.000	357.630
AD1: *High Energy Laser Tactical Vehicle Demo Adv Tech*	-	26.247	26.089	-	-	-	-	-	-	-	0.000	52.336
AD4: *Maneuver Air Defense Advanced Technology*	-	16.937	19.737	-	-	-	-	-	-	-	0.000	36.674
AD6: *Next Generation Fires Radar Advanced Technology*	-	6.899	-	-	-	-	-	-	-	-	0.000	6.899
AE1: *Close Combat High Energy Laser Advanced Technology*	-	2.407	-	-	-	-	-	-	-	-	0.000	2.407
AE3: *Unconventional Countermeasures-Survivability ATech*	-	1.254	3.000	0.512	-	0.512	1.159	1.773	0.780	0.780	0.000	9.258
BN7: *Weapons Components Adv Technology (CA)*	-	119.500	97.000	-	-	-	-	-	-	-	0.000	216.500
CV6: *Optimized High Energy Laser Source Adv Tech*	-	-	-	7.112	-	7.112	5.505	4.157	-	-	0.000	16.774
DB3: *Radar Survivability through Dis Sensing Adv Tech*	-	-	-	3.523	-	3.523	3.051	3.673	3.986	2.549	0.000	16.782

Note

In Fiscal Year 2023 (FY23) Project CV6 (Optimized High Energy Laser Source Adv Tech) and Project DB3 (Radar Survivability through Dis Sensing Adv Tech) are New Start Projects.

A. Mission Description and Budget Item Justification

This Program Element (PE) matures demonstrates technology in support of Army Modernization Priority Air and Missile Defense by maturating, demonstrating and conducting system level experimentation for the development of advanced air defense technologies that reduce the cost curve of missile defense, restore overmatch, survive volley-fire attacks, and operate within sophisticated Anti-Access/Area Denial (A2/AD) and contested domains.

Research in this PE complements PE 0602150A (Air and Missile Defense Technology).

This PE is directly aligned to the Air & Missile Defense (AMD) Army Modernization Priority.

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army	Date: April 2022
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603466A *I 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 the United States (U.S.) Army Futures Command (AFC), the United States Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT), and the Engineer Research and Development Center (ERDC), and the United States Army Rapid Capabilities and Critical Technologies Office (RCCTO).

B. Program Change Summary ($ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	175.703	48.826	0.000	-	0.000
Current President's Budget	173.244	145.826	11.147	-	11.147
Total Adjustments	-2.459	97.000	11.147	-	11.147
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	97.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-2.459	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	11.147	-	11.147

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2021	FY 2022
Project: BN7: *Weapons Components Adv Technology (CA)*		
Congressional Add: *Silicon Carbide Power Electronics Packaging*	8.000	-
Congressional Add: *Enterprise Science and Technology Demonstration Prototyping*	7.000	-
Congressional Add: *Program Increase*	20.000	-
Congressional Add: *HEL for All-Terrain Vehicles*	-	5.000
Congressional Add: *Program Increase - cUAS Integration with Robotic Vehicles*	5.000	-
Congressional Add: *Program Increase - Thermal Management System for High Energy Laser*	7.500	12.000
Congressional Add: *Program Increase - HEL Risk Reduction*	50.000	46.000
Congressional Add: *Program Increase - HEL System Characterization Lab*	22.000	-
Congressional Add: *Armored Combat Vehicle HEL Integration*	-	11.000
Congressional Add: *Missile Mentor*	-	15.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army	Date: April 2022
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603466A *I Air and Missile Defense Advanced Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2021	FY 2022
Congressional Add: *Silicon Carbide Electronics*	-	8.000
Congressional Add Subtotals for Project: BN7	119.500	97.000
Congressional Add Totals for all Projects	119.500	97.000

Change Summary Explanation

FY23 funding increase reflects the fact that the FY22 President's Budget request did not include out-year funding.

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*	Project (Number/Name) AD1 / *High Energy Laser Tactical Vehicle Demo Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AD1: *High Energy Laser Tactical Vehicle Demo Adv Tech*	-	26.247	26.089	-	-	-	-	-	-	-	0.000	52.336
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates a greater than 100 kW-class mobile high energy laser (HEL) weapon system on a tactical platform to protect fixed and semi-fixed sites from rocket, artillery and mortar (RAM), unmanned aerial system (UAS), and advanced air defense threats. The major effort under this Project is the phased approach for mobile high power solid state laser (SSL) technology demonstrations that are traceable to the form, fit, and function requirements for a HEL weapon. This effort utilizes open systems architecture to ensure growth, interoperability, and opportunity for technology insertions for maturation of laser, beam control, sensor/radar, integration of power and thermal management subsystems, as well as Battle Management Command, Control, and Computers (BMC3).

Research in this Project complements Program Element (PE) 0602150A (Air and Missile Defense Technology) / Project AC9 (High Energy Laser Tactical Vehicle Demonstrator Te).

The cited research is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, and 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 (US) Army Rapid Capabilities and Critical Technologies Office (RCCTO).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: High Energy Laser Tactical Vehicle Demonstrator (HEL TVD) Advanced Technology	26.247	25.137	-
Description: This effort integrates and demonstrates HEL technologies on an Army tactical platform for transition to the future Indirect Fire Protection Capability Increment 2-Intercept Program of Record. Effort includes integrating technologies developed under PE 0602307A/AC9 into HEL TVD and demonstrating the system against an array of RAM and UAS targets. Technology and knowledge gained from demonstration will be used to inform prototyping decisions by Army Rapid Capabilities and Critical Technologies Office and future material development decisions by Program Executive Office Missiles and Space.			
FY 2022 Plans: Will demonstrate a HEL-TVD system integration and a laboratory demonstration of a greater than 100kW laser weapon system for transition to the future Indirect Fire Protection Capability Program of Record.			
FY 2022 to FY 2023 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** AD1 / *High Energy Laser Tactical Vehicle Demo Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Work in the High Energy Laser Tactical Vehicle Demonstrator (HEL TVD) Advanced Technology effort is realigned to PE 0604019A (Expanded Mission Area Missile (EMAM)) / Project BU9 (IFPC High Energy Laser) in FY23.			
Title: SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.952	-
Accomplishments/Planned Programs Subtotals	26.247	26.089	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*	Project (Number/Name) AD4 / *Maneuver Air Defense Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AD4: *Maneuver Air Defense Advanced Technology*	-	16.937	19.737	-	-	-	-	-	-	-	0.000	36.674
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

This Project is Terminated in Fiscal Year 2023 (FY23).

A. Mission Description and Budget Item Justification

This Project directly supports Army Modernization Priority Air and Missile Defense capabilities. Matures and demonstrates key missile technologies for an affordable short range interceptor to defeat advanced Maneuver-Short Range Air Defense (M-SHORAD) threats (e.g. Rotary Wing, Fixed Wing, Tactical / Lethal Unmanned Aerial Systems, and Subsonic Cruise Missile.

Research in this Project complements Program Element (PE) 0602150A (Air and Missile Defense 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 in this Project is performed by the United States Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Maneuver Air Defense Advanced Technology	16.937	19.016	-
Description: Mature and demonstrate missile technologies and components necessary for an affordable short range air defense interceptor capability to defeat Rotary Wing, Fixed Wing, Tactical / Lethal Unmanned Aerial System, and cruise missile threats. ***FY 2022 Plans:*** Will continue integration of an interceptor Control Test Vehicle (CTV), then will conduct a CTV flight test to demonstrate expected control, navigation, and mid-course guidance performance; will complete Guidance Test Vehicle (GTV) Integration in a dynamic Hardware-in-the-loop (HWIL) environment to verify performance of all major Guidance Electronics Unit (GEU) and control subsystems prior to GTV flight test. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** This effort Terminates in FY23.			
Title: FY2022 SBIR/STTR Transfer	-	0.721	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** AD4 / *Maneuver Air Defense Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	16.937	19.737	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*	Project (Number/Name) AD6 / *Next Generation Fires Radar Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AD6: *Next Generation Fires Radar Advanced Technology*	-	6.899	-	-	-	-	-	-	-	-	0.000	6.899
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project directly supports Army Modernization Priority Air and Missile Defense capabilities by demonstrating scalable radar open systems architecture software allowing the insertion of modular software components.

Research in this Project complements Program Element (PE) 0602150A (Air and Missile Defense Technology) / Project AD5 (Next Generation Fires Radar 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 in this Project is performed by the United States Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Next Generation Fires Radar Advanced Technology	6.899	-	-
Description: This effort matures and demonstrates the architectures, processing and components necessary to deliver next generation capability, flexibility and supportability to the fires family of radar systems. Efforts focus on development of a modular and scalable open architecture that is extensible to multiple radar systems technologies in support of air defense and fixed- and semi-fixed site protection.			
Accomplishments/Planned Programs Subtotals	6.899	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*	Project (Number/Name) AE1 / *Close Combat High Energy Laser Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AE1: *Close Combat High Energy Laser Advanced Technology*	-	2.407	-	-	-	-	-	-	-	-	0.000	2.407
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies for compact, highly efficient lasers, and compact beam control for close-combat platforms. This Project investigates and develops advanced technologies for High Energy Laser (HEL) weapon systems to enable more efficient laser systems with greater power output, which in-turn enables laser weapons on smaller platforms for additional missions. This includes technologies to support development of alternate laser sources, precision optical pointing and tracking components, adaptive optics to overcome laser degradation due to atmospheric effects, more compact and lighter weight energy generation and storage devices, and more efficient thermal management systems to remove excess heat.

Research in this Project complements Program Element (PE) 0602150A (Air and Missile Defense Technology) / Project AD9 (Close Combat High Energy Laser Technology).

The cited research is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, and 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 (US) Army Rapid Capabilities and Critical Technologies Office (RCCTO).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Close Combat High Energy Laser Advanced Technology	2.407	-	-
Description: This effort develops laser and beam control technologies with extremely low size, weight, and power (SWaP) requirements enabling high energy lasers in smaller, close combat platforms. Extremely low SWaP laser systems will expand the laser weapons mission set. Reduction in SWaP also benefits higher power systems on the large tactical vehicles to counter the current threat set as well as laser-hardened threats more quickly or at longer ranges.			
Accomplishments/Planned Programs Subtotals	2.407	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** AE1 / *Close Combat High Energy Laser Advanced Technology*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*	Project (Number/Name) AE3 / *Unconventional Countermeasures-Survivability ATech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AE3: *Unconventional Countermeasures-Survivability ATech*	-	1.254	3.000	0.512	-	0.512	1.159	1.773	0.780	0.780	0.000	9.258
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies to increase survivability of personnel and critical assets using integrated unconventional countermeasures. These countermeasures include tone down concepts for signature management using novel materials, rapidly deployable, low-cost, multisprectral survivability enhancement technologies as well as intuitive decision support technologies to select and assess non-kinetic protective measures.

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

Research in this Project is conducted by the United States (U.S.) Army Engineer Research and Development Center and coordinated with U.S. Army Futures Command.

Research in this Project complements Program Element (PE) 0602150A (Air and Missile Defense Technology) / Project AE2 (Unconventional Countermeasures-Survivability Tech).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Development of Unconventional Countermeasures for Enhanced Survivability (DeUCES) Demonstrations	0.970	2.652	-
Description: This effort matures and demonstrates countermeasures to detect and defeat near-peer advanced weapons through computational simulations and physical countermeasures and enhanced tonedown measures. ***FY 2022 Plans:*** Demonstrate integrated unconventional countermeasure solutions and optimize their design and employment in fixed and semi-fixed Air and Missile Defense assets, and document best practices for employment. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort completing in Fiscal Year 2022.			
Title: Applications of Environmentally-Inspired Unconventional Countermeasures	0.284	0.238	-
Description: This effort matures and demonstrates rapidly-deployable, eco-friendly materials with spectral signatures that alter or obscure underlying target spectral signatures.			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** AE3 / *Unconventional Countermeasures-Survivability ATech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
FY 2022 Plans: Make use of modeling and simulation tools to optimize countermeasure spectral feature selection matching for specific operating environments. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort completing in Fiscal Year 2022.			
Title: Advanced Integrated Unconventional Countermeasures Applications Demonstrations ***Description:*** This effort demonstrates 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 2023 Plans:*** Will demonstrate a system incorporating organic materials for targeting hyperspectral and multispectral sensor bands. And demonstrate advanced thermal generation technologies for lightweight structural panels for integration into survivability enhancement systems. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle for this Project to provide for application of advancements in material science and computational prototyping.	-	-	0.512
Title: FY 2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.110	-
Accomplishments/Planned Programs Subtotals	1.254	3.000	0.512

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** AE3 / *Unconventional Countermeasures-Survivability ATech*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*	Project (Number/Name) BN7 / *Weapons Components Adv Technology (CA)*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BN7: *Weapons Components Adv Technology (CA)*	-	119.500	97.000	-	-	-	-	-	-	-	0.000	216.500
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Congressional Interest Item funding provided for Weapons Components Advanced Technology.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Weapons Components Advanced Technology.

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 2021	FY 2022
Congressional Add: Silicon Carbide Power Electronics Packaging ***FY 2021 Accomplishments:*** Program Increase supported advanced research on Silicon Carbide Power Electronics Packaging. Work executed under the direction of the Army Futures Command.	8.000	-
Congressional Add: Enterprise Science and Technology Demonstration Prototyping ***FY 2021 Accomplishments:*** Program Increase supported advanced research on Enterprise Science and Technology Demonstration Prototyping. Work executed under the direction of the Army Futures Command.	7.000	-
Congressional Add: Program Increase ***FY 2021 Accomplishments:*** Program increase supporting advanced technology development of High Energy Laser Systems. This effort has performed research and development on advanced weapons technology leading to a high energy laser system for vehicles supporting Army Brigade and below operations. It further addressed Size, Weight, and Power/Cost (SWaP-C) and target requirements for enhanced capabilities of current directed energy	20.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** BN7 / *Weapons Components Adv Technology (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
prototyping efforts. The effort builds upon the advanced laser technologies being developed and integrated on larger vehicles. Work performed by the Rapid Capabilities and Critical Technologies Office (RCCTO), in Huntsville, Alabama.		
Congressional Add: HEL for All-Terrain Vehicles ***FY 2022 Plans:*** Program increase supporting advanced technology development of high energy lasers for all-terrain vehicles. Furthers efforts executed under FY 2021 $20M congressional add Program Increase. This project will perform research and development on coherently combined phased array high energy laser advanced weapons technology to support the mobile Counter-small Unmanned Aircraft Systems (C-sUAS) efforts at Army Brigade and below operations. The effort matures current Joint C-sUAS Office supported efforts and will perform graded field demonstrations against relevant targets. Work performed by the Rapid Capabilities and Critical Technologies Office (RCCTO), in Huntsville, Alabama.	-	5.000
Congressional Add: Program Increase - cUAS Integration with Robotic Vehicles ***FY 2021 Accomplishments:*** Program increase supporting advanced technology development of Counter-Small Unmanned Aerial Systems Integration with Robotic Vehicles. This effort supports the integration of proven Commercial-Off-The-Shelf (COTS) technologies to provide a modular multi-mission capability to include surveillance (with small Unmanned Aerial Systems (sUAS) detection), Counter-sUAS (C-sUAS) electronic warfare & other hard kill capabilities including High Energy Laser (HEL). This effort will produce a single integrated prototype system delivered and demonstrated in support of an initial demonstration. Work performed by the Rapid Capabilities and Critical Technologies Office (RCCTO), in Huntsville, Alabama.	5.000	-
Congressional Add: Program Increase - Thermal Management System for High Energy Laser ***FY 2021 Accomplishments:*** Program increase supporting advanced technology development of thermal management systems for high energy lasers.	7.500	12.000

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** BN7 / *Weapons Components Adv Technology (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
This effort improves laser diode fiber amplifier cooling with smaller, lighter and more energy efficient thermal management technology. Recent developments in parallel Army programs has proven that novel phase change materials, coordinative complex compound sorption technology, and integrated combinations with vector-drive vapor compression technology, can dramatically reduce size, weight and power (SWaP) of directed energy weapons systems. Work performed by the Rapid Capabilities and Critical Technologies Office (RCCTO), in Huntsville, Alabama. ***FY 2022 Plans:*** Congressional Interest Item funding provided for Thermal Management System for 10KW to 50KW Lasers Program increase supporting advanced technology development of thermal management systems for high energy lasers. This project will improve laser diode fiber amplifier cooling with smaller, lighter and more energy efficient thermal management technology and demonstrate that capability in a relevant environment. This effort continues work in phase change materials and vapor compression technologies to reducing the size, weight, power, and cost of direct energy weapons technologies. Work performed by the Rapid Capabilities and Critical Technologies Office (RCCTO), in Huntsville, Alabama.		
Congressional Add: Program Increase - HEL Risk Reduction ***FY 2021 Accomplishments:*** Program increase supporting advanced technology development of High Energy Laser Risk Reduction. The Indirect Fire Protection Capability-High Energy Laser (IFPC-HEL) pre-prototype demonstrator proves out a 300 kW HEL system in a laboratory by the end of FY2022. This effort accelerates subsystem development and integration of HEL, Beam Control System (BCS), Beam Director Assembly (BDA), and power and thermal technologies. Integration of these subsystems into an enclosure and onto the platform for range / field demonstrations. Enabling final verification of the system against its defined threat portfolio, and providing a potential path forward for follow-on prototype systems delivery to the Warfighter as residual combat capability. Work performed by the Rapid Capabilities and Critical Technologies Office (RCCTO), in Huntsville, Alabama. ***FY 2022 Plans:*** Congressional Interest Item funding provided for IFPC HEL Risk Reduction Program increase supporting advanced technology development of High Energy Laser Risk Reduction.	50.000	46.000

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** BN7 / *Weapons Components Adv Technology (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
The Indirect Fire Protection Capability-High Energy Laser (IFPC-HEL) pre-prototype demonstrator proves out a 300 kW HEL system in a laboratory by the end of FY 2022. This effort supports the post laboratory demonstration system integration of all subsystems into an enclosure and onto the platform for range / field demonstrations to enable final verification of the system against its defined threat portfolio and potential path forward for follow-on prototype systems to be delivered to the warfighter as residual combat capability. Work performed by the Rapid Capabilities and Critical Technologies Office (RCCTO), in Huntsville, Alabama.		
Congressional Add: Program Increase - HEL System Characterization Lab ***FY 2021 Accomplishments:*** Program increase supporting advanced technology development of high energy laser systems characterization lab. This effort has worked to develop the equipment and instrumentation for a directed energy Systems Characterization Lab (SCL), integrate SCL equipment within High Energy Laser (HEL) lab, and create a capability for government validation of Science & Technology (S&T) performance and testing of HEL prototypes and weapons. Additionally, developed government owned surrogate HEL weapon subsystem performance evaluation frameworks necessary for the stimulation, test, and assessment of new HEL components and subsystems. Finally, this effort is developing laboratory instrumentation to measure HEL Weapon Systems, components, or subsystems. Work 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.	22.000	-
Congressional Add: Armored Combat Vehicle HEL Integration ***FY 2022 Plans:*** Program increase supporting advanced technology development of armored combat vehicle high energy laser integration. This project will provide a system representative high energy laser asset to independently characterize and score Direct Energy systems to validate weapon effectiveness as part of developmental and operational testing, as well as Outside Continental United States (OCONUS) operational assessments. This effort will inform	-	11.000

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** BN7 / *Weapons Components Adv Technology (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
engagement tactics against threat representative Unmanned Aircraft Systems (UAS) and UAS swarms. Enables Rapid Capabilities and Critical Technologies Office (RCCTO) test events for counter UAS activities. Work performed by the Rapid Capabilities and Critical Technologies Office (RCCTO), in Huntsville, Alabama.		
Congressional Add: Missile Mentor ***FY 2022 Plans:*** Congressional Interest Item funding provided for Missile Mentor	-	15.000
Congressional Add: Silicon Carbide Electronics ***FY 2022 Plans:*** Congressional Interest Item funding provided for Silicon Carbide Electronics	-	8.000
Congressional Adds Subtotals	119.500	97.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*	Project (Number/Name) CV6 / *Optimized High Energy Laser Source Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
CV6: *Optimized High Energy Laser Source Adv Tech*	-	-	-	7.112	-	7.112	5.505	4.157	-	-	0.000	16.774
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

This is a new start in FY 2023.

A. Mission Description and Budget Item Justification

This Project matures and demonstrates Optimized High Energy Laser Source advanced technology establishing a more affordable laser source for application in High Energy Laser weapon systems. This Project will deliver a lower cost laser weapon source and leverages prior laser source development work to ruggedize and integrate for transition into the Maneuver-Short Range Air Defense Program of Record.

Research in this Project compliments other Army Directed Energy efforts conducted under Program Element (PE) 0602150A (Air and Missile Defense Technology) and PE 0603466A (Air and Missile Defense Advanced Technology).

The cited research is consistent with the Army's 31+4 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).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Optimized High Energy Laser Source Advanced Technology	-	-	7.112
Description: This effort matures and demonstrates Optimized High Energy Laser Source Advanced Technology to demonstrate a more affordable laser source for application in High Energy Laser weapon systems. This effort will provide a low-cost, rugged and compact laser source. Delivering an affordable direct replacement 50 kW-class laser subsystem with 50% efficiency and 80% fractional Power in the Bucket enabling improvements in efficiency and Size, Weight, and Power laser source resulting in a smaller footprint while reducing logistics requirements.			
FY 2023 Plans: This effort will design and integrate a 50 kW class semiconductor high energy laser subsystem module by leveraging commercially available single mode laser diodes. This effort builds on current industry capabilities that utilize spectral beam			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** CV6 / *Optimized High Energy Laser Source Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
combining of multimode diode lasers for manufacturing capabilities. Current research efforts in the Army that have proven this concept is feasible will be leveraged in this effort. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** This is a New Start Project in FY23.			
Accomplishments/Planned Programs Subtotals	-	-	7.112

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*	Project (Number/Name) DB3 / *Radar Survivability through Dis Sensing Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
DB3: *Radar Survivability through Dis Sensing Adv Tech*	-	-	-	3.523	-	3.523	3.051	3.673	3.986	2.549	0.000	16.782
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

This is a new start in FY 2023.

A. Mission Description and Budget Item Justification

This Project matures, and demonstrates 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 degree coverage capability. Technology maturation in the project 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. Multiple soldier touchpoints and demonstrations of developed technology to autonomously synchronize multiple radars across a distributed battlefield in the presence of countermeasures and the denial of Global Positioning System (GPS) will be performed in lab and field environments.

This research is coordinated with Army Program Element (PE) 0602141A (Lethality Technology) / Project CG4 (Advanced Radar Concepts and Technologies); PE 0602148A (Future Vertical Lift Technology) / Project CC3 (FVL Radar Technologies); PE 0602150A (Air and Missile Defense Technology) / Project AD5 (Next Generation Fires Radar Technology); and PE 0601102A (Defense Research Sciences) / Project AA8 (Sensing and Electromagnetics).

This Research complements Program Element (PE) 0602141A (Lethality Technology) / Project CJ7 (Future Air Defense Missile Enabling Tech) and PE 0602150A (Air and Missile Defense Technology) / Project DA9 (Radar Survivability through Dis Sensing Tech).

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

Research in this Project is performed by the United States Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Radar Survivability through Dis Sensing (RSDS) Adv Tech	-	-	3.523
Description: Matures, and demonstrates critical radar capability enhancements to defeat advanced Air and Missile threats and protect Army maneuver forces and critical assets.			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** DB3 / *Radar Survivability through Dis Sensing Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
FY 2023 Plans: Will mature RSDS software and evaluate utilizing high fidelity simulations representative of current and future Army Air Defense radars. Will begin to generate test concepts and demonstration plans for multi-static radar operations. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** This is a new start effort, initiated as high priority critical effort to mature and demonstrate radar capability enhancements to defeat advanced Air and Missile threats and protect Army maneuver forces and critical assets.			
Accomplishments/Planned Programs Subtotals	-	-	3.523

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A