Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602141A / *Lethality 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	-	180.191	85.578	96.094	-	96.094	107.415	117.115	106.238	110.217	Continuing	Continuing
AH6: *Disruptive Energetics and Propulsion Technologies*	-	8.576	8.752	8.823	-	8.823	8.833	8.839	8.936	9.026	0.000	61.785
AH7: *Lethal and Scalable Effects Technologies*	-	1.297	1.574	1.577	-	1.577	1.579	1.580	1.597	1.613	Continuing	Continuing
AH8: *Lethality Materials and Processes Technology*	-	1.863	1.906	1.910	-	1.910	1.911	1.913	1.934	1.953	0.000	13.390
AH9: *Advanced Warheads Technology*	-	25.845	24.326	27.292	-	27.292	28.712	30.320	32.840	35.197	0.000	204.532
BS6: *Lethality Technology (CA)*	-	107.000	-	-	-	-	-	-	-	-	0.000	107.000
CF7: *Solid-state Laser Concepts and Architectures*	-	8.556	9.892	9.912	-	9.912	7.920	6.924	6.532	7.133	0.000	56.869
CF8: *Terminal Effects Against Critical Targets Tech*	-	3.851	2.180	1.034	-	1.034	5.184	4.339	3.736	2.462	0.000	22.786
CG4: *Advanced Radar Concepts and Technologies*	-	5.869	6.008	7.044	-	7.044	12.014	15.039	12.123	9.202	0.000	67.299
CI1: *Advanced Armaments Lethality Technology*	-	1.493	1.684	4.352	-	4.352	4.518	6.493	6.121	5.960	0.000	30.621
CIA: *Applied Armaments Tech for Distributed Lethality*	-	-	3.445	-	-	-	-	2.204	2.825	8.476	0.000	16.950
CIB: *Sensor to Shooter (STS) Applied Research*	-	-	6.468	7.909	-	7.909	9.264	9.371	-	-	0.000	33.012
CIC: *Fire Control Lethality Technology*	-	-	1.462	2.958	-	2.958	2.957	2.956	1.508	1.523	0.000	13.364
CJ1: *Lethality Enabling University Applied Research*	-	6.330	7.197	7.874	-	7.874	8.354	8.360	8.451	8.536	0.000	55.102
CJ7: *Future Air Defense Missile Enabling Tech*	-	1.922	2.324	4.608	-	4.608	4.613	4.616	4.667	4.714	0.000	27.464

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army													Date: March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602141A / *Lethality Technology*								
CZ9: *Foundational Hypersonic Weapons Research*	-	7.589	8.360	10.801	-	10.801	11.556	14.161	14.968	14.422	0.000	81.857

A. Mission Description and Budget Item Justification

Work done in this Program Element (PE) supports research technologies, methodologies, and models required to enable next generation lethality. The effort focuses on: lethal mechanism technologies for projectiles and warheads that provide revolutionary capability to defeat Tier 1 adversary vehicle and body armors; selection of propulsion and energetic materials and technology to validate novel energetic materials concepts to exploit controllable energy release for future gun/missile systems; scalable effects for mixed target defeat while simultaneously decreasing warhead mass; development of materials solutions for improvement of weight and volume efficiency, lethal effects and sustainability for the warfighter in the Army of today and beyond; and multiple pathways to enhance lethal effects by investigating synergistic effects of novel micro warheads using advanced materials. Funding in this PE is a continuation of work done in PEs 0602105A (Materials Technology), 0602618A (Ballistics Technology), and 0602624A (Weapons and Munitions Technology).

Work in this PE complements PEs 0602147A (Long Range Precision Fires Technology), 0602150A (Air and Missile Defense Technology), 0602143A (Soldier Lethality Technology), 0602144A (Ground Technology), 0602145A (Next Generation Combat Vehicle Technology), and 0603116A (Lethality 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. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	194.717	85.578	86.406	-	86.406
Current President's Budget	180.191	85.578	96.094	-	96.094
Total Adjustments	-14.526	0.000	9.688	-	9.688
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-12.389	-			
• SBIR/STTR Transfer	-2.137	-			
• Adjustments to Budget Years	-	-	9.688	-	9.688

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Project: BS6: *Lethality Technology (CA)*		
Congressional Add: *Program Increase - Materials Processing Manufacturing Technology*	12.000	-
Congressional Add: *Program Increase - Universal Nanocrystalline Alloys*	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 0602141A *I Lethality Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Congressional Add: *Program Increase - ADVANCED MATERIALS AND MANUFACTURING FOR MODERNIZATION*	20.000	-
Congressional Add: *Program Increase - CERAMIC PROTECTION MATERIALS*	3.000	-
Congressional Add: *Program Increase - COLLABORATIVE NETWORKED ARMAMENT LETHALITY TECHNOLOGY*	15.000	-
Congressional Add: *Program Increase - ENHANCED ARMAMENT FIRE CONTROL*	10.000	-
Congressional Add: *Program Increase - HIGH TEMPERATURE POLYMER COMPOSITES*	10.000	-
Congressional Add: *Program Increase - INTELLIGENT NEXT-GENERATION ADDITIVE MANUFACTURING HUB*	2.000	-
Congressional Add: *Program Increase - NOVEL ARMAMENT SYSTEMS*	15.000	-
Congressional Add: *Program Increase - QUANTUM TECHNOLOGIES FOR ARMAMENT SYSTEMS*	10.000	-
Congressional Add: *Program Increase - TURRET GUNNER SURVIVABILITY AND SIMULATION ENVIRONMENT*	5.000	-
Congressional Add Subtotals for Project: BS6	107.000	-
Congressional Add Totals for all Projects	107.000	-

Change Summary Explanation

Funding increase was due to realignment for Sensor to Shooter from 0602181A CM1 Collab Battlefield Networked Leth Sys App Tech and 0602141A CI1 Advanced Armaments Lethality Technology.

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 0602141A / *Lethality Technology*				Project (Number/Name) AH6 / *Disruptive Energetics and Propulsion Technologies*			
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**
AH6: *Disruptive Energetics and Propulsion Technologies*	-	8.576	8.752	8.823	-	8.823	8.833	8.839	8.936	9.026	0.000	61.785

A. Mission Description and Budget Item Justification

This Project investigates, models, and assesses energetic material and propulsion technologies to validate novel concepts such as maximizing total energy density and power delivered on target. This Project also optimizes propellant grains for increased range and altering gun configurations to increase energy on target in order to exploit the controllable/scalable energy release required for improving effectiveness and reducing vulnerability of future gun/missile systems.

This Project complements disruptive energetic materials discovery efforts to synthesize new materials with energy content from 50% to up to two times that of Research Department Explosive (RDX) in PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics). This Project also leverages the advanced additive manufacture efforts of PE 0602144A (Ground Technology) / Project BL1 (Materials and Manufacturing Research Technology).

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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Synthesis, Formulation, Modeling, and Diagnostics of Energetic Materials for Explosive and Propellant Applications	8.576	8.752	8.823
Description: This effort pursues novel approaches to synthesize and scale up disruptive and traditional energetic materials with increased performance as well as design new formulation avenues in order to discover new materials and formulations to extend range and increase effect on target. This effort develops, codes, and subsequently employs advanced models to predict multiscale response of energetic materials for both propellant and explosive purposes. This effort develops new simulation and small scale experimental methods and techniques for understanding and design of advanced concepts and energetic formulations to rapidly iterate and optimize parameters to enable a "fail early, fail often" strategy towards increased range and enhanced lethality. This effort also investigates new propellants and grain designs, burn rate/combustion modifier ingredients, as well as new gun and munition designs for extended range.			
FY 2024 Plans: Will scale up, formulate, and assess novel energetic materials, energetic polymers, and novel metallic fuels for use in explosive and propellant applications; further development of machine learning models for predicting performance and physical metrics in order to guide synthesis; miniaturize diagnostic techniques in order to "fail early, fail fast" in assessing novel materials, models, and concepts; develop and validate mesoscale models for use in explosive applications and apply said models to Army relevant notional formulations and materials; develop novel chemical kinetics for rocket motors and initiation trains; develop validated			

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 0602141A / *Lethality Technology*	**Project (Number/Name)** AH6 / *Disruptive Energetics and Propulsion Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
models of wear and erosion to determine mitigation routes for increased flame temperature, as well as enhanced pressure propellants and charge designs; model alternative initiation schemes for improved weapon performances; develop and validate post-launch propulsion concepts; develop and validate advanced grain and pressure chamber designs in order to enhance range without requiring propellant formation engineering; continue to develop lightweight, increased muzzle velocity Soldier weapon systems. ***FY 2025 Plans:*** Will assess novel energetic materials and fuels previously discovered for scale up and formulation. Conduct experiments and validate the in-house integrated materials engine and mesoscale model framework to assess strength models that incorporate higher-fidelity physics such as crystal plasticity, crystallographic slip, and/or shear banding. Determine final candidate reactive materials for further validation and transition. Assess quantum mechanical and/or machine learning models of reaction kinetics for computational fluid dynamic simulations of propellant initiation. Design and develop advanced grains for increased muzzle velocity and range for gun propellants. Develop and validate novel models of erosion for large caliber systems; develop novel gun tube designs for performance and thermal management to provide design paths for autocannon firepower from reduced weapon form factor. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects an economic adjustment.			
Accomplishments/Planned Programs Subtotals	8.576	8.752	8.823

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 0602141A / *Lethality Technology*	Project (Number/Name) AH7 / *Lethal and Scalable Effects Technologies*	

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
AH7: *Lethal and Scalable Effects Technologies*	-	1.297	1.574	1.577	-	1.577	1.579	1.580	1.597	1.613	Continuing	Continuing

A. Mission Description and Budget Item Justification

Work in this Project designs, determines, and assesses technology options for scaling warhead lethality and providing extreme efficiency for highly effective, simultaneous mixed/multi target defeat and collateral damage. This Project will also design and assess scalable structure defeat to mitigate collateral damage for disruptive urban Warfighting. This research complements Program Element (PE) 0602141A (Lethality Technology) / Project AH5 (Projectile and Multi-Function Warhead Technologies) and PE 0602141A (Lethality Technology) / Project AH6 (Disruptive Energetics and Propulsion Technologies) within this PE and builds upon disruptive energetic and ballistic sciences research in PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics).

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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Munition Efficiency and Scalability	1.297	1.574	1.577
Description: This effort investigates, designs, determines, and assesses technologies to produce blast-fragment warheads with tailored fragment geometries to optimize target defeat. This effort identifies and develops warhead impact patterns to optimize target defeat with reduced collateral damage. This effort also designs, models, and assesses technologies for the cost effective, preprogrammed delivery of multiple scalable warheads capable of simultaneously engaging multiple targets. This effort leverages guidance technologies from PE 0602147A (Long Range Precision Fires) / Project AH4 (Precision and Coop Weapons in a Denied Env Tech), and metal additive manufacturing from PE 0602144A (Ground Technology) / Project BL1 (Materials and Manufacturing Research Technology).			
FY 2024 Plans: Will investigate energy-efficient warhead concepts to increase fragment velocity to include improved explosive-to-metal coupling using two-phase flow computational modeling complemented by terminal ballistic experiments; mature distributed, collaborative, and synergistic effects by improving understanding of multiple lethal mechanisms (e.g., blast-fragmentation and penetration) and multiple high-speed weapons on single, simple, and complex targets; model lethality of energy-efficient warheads and distributed, collaborative, and synergistic effects for analytical campaign on Diverse, Disruptive Effects for Artillery with partners.			
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 0602141A / *Lethality Technology*	**Project (Number/Name)** AH7 / *Lethal and Scalable Effects Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will investigate promising mechanisms which maximize lethality across a broad range of targets through the study and modeling of multipurpose warhead technologies and multi-warhead collaborative engagement techniques. Develop lethality models and conduct experiments for validating terminal ballistic outcomes. Fund research and investigate compact and efficient warheads with more complex case designs by incorporating novel energetics and new materials. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	1.297	1.574	1.577

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 0602141A / *Lethality Technology*	Project (Number/Name) AH8 / *Lethality Materials and Processes 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
AH8: *Lethality Materials and Processes Technology*	-	1.863	1.906	1.910	-	1.910	1.911	1.913	1.934	1.953	0.000	13.390

A. Mission Description and Budget Item Justification

Work in this Project designs, determines, and assesses innovative materials solutions aimed at achieving leap ahead increases in lethality and weapons effectiveness through improvements in weight and volume efficiency, lethal effects, and sustainability of military systems. This research complements Program Element (PE) 0602141A (Lethality Technology) / Project AH6 (Disruptive Energetics and Propulsion Technology) and Project AH7 (Lethal and Scalable Effects Technologies), and PE 0602147A (Long Range Precision Fires Technology) / AH4 (Precision and Cooperative Weapons in a Denied Environment) and builds upon and ballistic sciences research in PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics).

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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Materials for Advanced Lethality	1.863	1.906	1.910
Description: This effort researches innovative materials aimed at achieving leap-ahead increases in lethality and weapons effectiveness through improvements in weight and volume efficiency, lethal effects, and sustainability of military systems that can only be achieved through advances in materials technology.			
FY 2024 Plans: Will print and validate topology optimized additively-manufactured (AM) rocket motor; print and assess solids loading energetic polymers; assess energetic Orzo material; use Orzo on topology-optimized propellants; print high-strength energetic binder for gun-launch application; develop multi-material-capable print head and develop g-code.			
FY 2025 Plans: Will mature the printed Orzo topology propellant technology. Investigation of materials and manufacturing methods for solid fuels for future air breathing propulsion: design and develop materials-by-design workflow to determine and mature novel alloy compositions to reduce gun barrel wear and erosion.			
FY 2024 to FY 2025 Increase/Decrease Statement: Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	1.863	1.906	1.910

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 0602141A / *Lethality Technology*	**Project (Number/Name)** AH8 / *Lethality Materials and Processes Technology*

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 0602141A / *Lethality Technology*	Project (Number/Name) AH9 / *Advanced Warheads 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
AH9: *Advanced Warheads Technology*	-	25.845	24.326	27.292	-	27.292	28.712	30.320	32.840	35.197	0.000	204.532

A. Mission Description and Budget Item Justification

This Project explores multiple pathways to enhance lethal efforts for future warheads against emerging peer/near peer target sets and investigates synergistic effects of novel micro warheads using advance materials. This Project investigates innovative energetic materials and novel processing techniques for the next generation of explosives and propulsion applications to enable an increase in range, lethality, and utility of munitions. It also directly supports Army Modernization Priorities through researching and developing energetic (propellant) technologies and processes for increased performance, expanded operation temperature bounds, and improved safety and environmental compliance of missile systems.

Work in this Project complements Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology) / Project BK5 (Adv Direct In-Direct Armament Sys (ADIDAS) Tech) and Program Element (PE) 0603464A (Long Range Precision Fires Advanced Technology) / Project CE9 (Armaments 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.

Work in this Project is performed by the Armaments Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Warheads	11.506	7.665	-
Description: This effort explores multiple pathways to enhance lethal effects for future warheads against emerging peer/near peer target sets and investigates synergistic effects of novel warheads using advanced concepts of operations, materials, geometries, and manufacturing processes. ***FY 2024 Plans:*** Will investigate novel designs, advanced materials, and manufacturing enablers to develop innovative lethal defeat mechanisms. Will develop advanced algorithms to optimize shape charge, fragmentation, and explosively formed penetrators through state of the art modeling and simulation. Will research munition warhead technologies for providing disruptive effects and/or defeating ground and aerial manned and unmanned targets. Will design and develop novel warheads for enhanced armor penetration and defeat that are survivable in high-g environments. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned life cycle conclusion of this effort.			
Title: Advanced Energetics	12.833	13.815	-

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 0602141A / *Lethality Technology*	**Project (Number/Name)** AH9 / *Advanced Warheads Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort develops advanced energetic materials and novel processing techniques for future explosives and propulsion applications that enable an increase in range, lethality, and utility of ammunitions. ***FY 2024 Plans:*** Will design and develop novel energetic materials utilizing advanced processing methodologies. Will investigate new propellant and explosive materials and formulations for increased energy and performance. Will develop advanced manufacturing methods for additively manufactured explosive and propellant components. Will investigate novel propellant grain geometries in concert with new propellant formulations as well as investigate embedded ignition that extend lethal munition system capabilities. Will utilize experimental outputs to refine modeling and simulation algorithms to predict performance of future propellant, explosive formulations, and geometries. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned life cycle conclusion of this effort.			
Title: Advanced Pyrotechnics ***Description:*** This effort investigates compositions, components, and technologies to provide novel pyrotechnic formulations and devices to increase overall system performance and survivability. Coordinates research, strategic assessments and development of novel pyrotechnic technologies that will enable disruptive capabilities for Multidomain Operations. This effort supports the Army Modernization Priorities. ***FY 2024 Plans:*** Will develop novel pyrotechnic materials, components, and configurations to extend shelf life, operate in extreme temperatures, and provide advanced capabilities for future fuze and munition performance. Will investigate the automation of pyrotechnic processes and procedures to improve safety and performance. Will investigate pyrotechnic materials for multi-point igniters and precision self-destruct pyrotechnic components. ***FY 2025 Plans:*** Will design and develop novel pyrotechnic materials, components, and configurations to extend shelf life and operate in extreme temperatures; design and develop the automation of pyrotechnic processes and procedures to improve safety, performance, and yield. Mature pyrotechnic components for multi-point igniters, alternate igniter formulations, and precision self-destruct pyrotechnic components. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.	1.506	2.846	2.919
Title: Next Generation Warheads Technology	-	-	11.194

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 0602141A / *Lethality Technology*	**Project (Number/Name)** AH9 / *Advanced Warheads Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort designs novel warheads and lethal mechanisms for advanced payload concepts in current and future armaments. Develops methodologies to produce conventional, non-conventional, distributed, and synergistic effects and lethality in warhead payloads through advanced designs, materials, modeling, and manufacturing processes. ***FY 2025 Plans:*** Will fund research of reactive materials for blast augmentation and increased lethality through investigation of novel materials and updated equations of state. Design and develop advanced modeling techniques to optimize shaped charges, explosively formed penetrators, and advanced fragmentation lethal mechanisms. Investigate concepts for armor defeat, combined effects, and behind armor effects scalable to multiple payload sizes; investigate modular payload concepts for use in both traditional and non-traditional carriers for desired effects. Mature warhead components for survivability in high-g and other extreme environments. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** In FY2025, Warheads efforts re-aligned from Advanced Warheads to Next Generation Warheads Technology for better fidelity in funding for designs novel warheads and lethal mechanisms for advanced payload concepts, and to mature warhead components for survivability.			
Title: Next Generation Energetics Technology ***Description:*** This effort designs and develops energetics in support of increased lethality and range and seeks to reduce operational and safety risk. The effort will focus on the following areas related to energetics: additive manufacturing, tailorable outputs, survivability in extreme environments, and advanced processing techniques. ***FY 2025 Plans:*** Will design enhanced explosive fills, distributed energetic initiation, novel gun propulsion, and embedded ignition for additive and advanced manufacturing technologies; investigate energetic materials including high energy propulsion technologies and high energy explosives supporting lethal systems' capabilities; investigate energetic materials for extreme cold, extreme heat, high pressure, and extreme set-back conditions, funds research of continuous flow reactors and advanced mixing technologies for energetic materials. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** In FY2025, Energetics efforts re-aligned from Advanced Energetics to Next Generation Energetics Technology for better fidelity in funding additive manufacturing, tailorable outputs, survivability in extreme environments, and advanced processing techniques.	-	-	13.179
Accomplishments/Planned Programs Subtotals	25.845	24.326	27.292

C. Other Program Funding Summary ($ in Millions)

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 0602141A / *Lethality Technology*	**Project (Number/Name)** AH9 / *Advanced Warheads Technology*

C. Other Program Funding Summary ($ in Millions)

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 0602141A / *Lethality Technology*	Project (Number/Name) BS6 / *Lethality Technology (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
BS6: *Lethality Technology (CA)*	-	107.000	-	-	-	-	-	-	-	-	0.000	107.000

Note

Congressional Interest Item funding provided for Lethality Technology.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Lethality 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 2023	FY 2024
Congressional Add: Program Increase - Materials Processing Manufacturing Technology ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Lethality Technology.	12.000	-
Congressional Add: Program Increase - Universal Nanocrystalline Alloys ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Lethality Technology.	5.000	-
Congressional Add: Program Increase - ADVANCED MATERIALS AND MANUFACTURING FOR MODERNIZATION ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Lethality Technology.	20.000	-
Congressional Add: Program Increase - CERAMIC PROTECTION MATERIALS ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Lethality Technology.	3.000	-
Congressional Add: Program Increase - COLLABORATIVE NETWORKED ARMAMENT LETHALITY TECHNOLOGY ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Lethality Technology.	15.000	-
Congressional Add: Program Increase - ENHANCED ARMAMENT FIRE CONTROL ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Lethality Technology.	10.000	-
Congressional Add: Program Increase - HIGH TEMPERATURE POLYMER COMPOSITES	10.000	-

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 0602141A / *Lethality Technology*	**Project (Number/Name)** BS6 / *Lethality Technology (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Interest Item funding provided for Lethality Technology.		
Congressional Add: Program Increase - INTELLIGENT NEXT-GENERATION ADDITIVE MANUFACTURING HUB ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Lethality Technology.	2.000	-
Congressional Add: Program Increase - NOVEL ARMAMENT SYSTEMS ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Lethality Technology.	15.000	-
Congressional Add: Program Increase - QUANTUM TECHNOLOGIES FOR ARMAMENT SYSTEMS ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Lethality Technology.	10.000	-
Congressional Add: Program Increase - TURRET GUNNER SURVIVABILITY AND SIMULATION ENVIRONMENT ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Lethality Technology.	5.000	-
Congressional Adds Subtotals	107.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602141A / *Lethality Technology*				Project (Number/Name) CF7 / *Solid-state Laser Concepts and Architectures*			
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**
CF7: *Solid-state Laser Concepts and Architectures*	-	8.556	9.892	9.912	-	9.912	7.920	6.924	6.532	7.133	0.000	56.869

A. Mission Description and Budget Item Justification

This Project provides the research and development of advanced solid-state laser materials and architectures to support the Army Directed Energy Strategy for laser-based directed energy (DE) weapons. This Project investigates advanced laser technologies based on unconventional solid-state laser concepts and designs, scalable and intelligent power modules, and advanced thermal management systems for the development of less complex, low size, weight, and power (SWaP) Army DE weapons and tactical lasers with much improved capabilities.

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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: High Energy Laser (HEL) Enabling Technologies for Tactical Directed Energy Weapons	8.556	2.250	2.266
Description: Investigate novel solid-state laser concepts, architectures, and components in support of the Army's HEL weapons strategy. Develop innovative laser gain materials with much improved spectral, thermal, thermo-mechanical, and thermo-optical properties. Develop increased power while reducing size and weight, and complexity of all HEL components. ***FY 2024 Plans:*** Will determine critical pathways to both crystalline core/crystalline cladding (C4) and Raman fiber fabrication with the lowest achievable loss figure; mature components enabling directly-diode-cladding-pumped Raman fiber laser and C4 fiber laser power scaling to 5kW out of a single fiber; design and develop thermal material integration concepts, conduct experiments, and validate device and system-level numerical modeling optimization approaches. ***FY 2025 Plans:*** Will assess the results achieved from a crystalline core/crystalline cladding (C4) fiber laser and a directly diode-pumped Raman fiber laser for laser power scaling toward the goal of 5 kW out of a single fiber aperture; identify the most feasible laser technology for further development towards achieving higher power based on Size, Weight and Power (SWaP) and manufacturability considerations. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Advanced High Energy Laser Technology	-	7.642	7.646

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CF7 / *Solid-state Laser Concepts and Architectures*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: Investigate power scaling strategies for advanced solid-state lasers through the exploitation of the unique properties of advanced materials to develop higher power lasers with lower size, weight, and power requirements. This effort funds research to maximize output power towards theoretical limits, design and develop scalable power conversion with intelligent control for improved efficiency and resiliency, and designs and develops an optimized preliminary design fiber laser to best serve the purpose of power scaling analysis toward 5 kW and 50 kW of output power. Effort will also assess scaled 50 kW power and thermal concepts. ***FY 2024 Plans:*** Will validate major clusters of fiber laser modeling for both crystalline core/crystalline cladding (C4) and Raman fiber laser power scaling out of a single fiber aperture; identify the most promising C4 fiber fabrication technique as it pertains specifically to fiber length scaling required to achieve 5 kW power level. Will mature C4 fiber laser components to enable power scaling to 5 kW out of a single fiber. Will mature thermal management and damage resistance related concepts for achieving objective output power. ***FY 2025 Plans:*** Will mature the required components and develop conceptual designs for the breadboard 50 kW fiber laser; develop diode laser pumping designs; perform high power component damage validation and develop mitigation strategies; verify performance versus modelling as power scales beyond 5 kW; develop safety and assessment infrastructure for higher powers; develop thermal management system designs to achieve objective output power and develop experimental validation strategies. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	8.556	9.892	9.912

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 0602141A / *Lethality Technology*	Project (Number/Name) CF8 / *Terminal Effects Against Critical Targets 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
CF8: *Terminal Effects Against Critical Targets Tech*	-	3.851	2.180	1.034	-	1.034	5.184	4.339	3.736	2.462	0.000	22.786

A. Mission Description and Budget Item Justification

This Project designs and develops engineering tools and high-fidelity modeling and simulation capabilities for materials and structural response to predict and enhance weapons performance to ensure lethality against structures and critical assets. Through dynamic impact experiments for a broad range of velocities against conventional and advanced structural materials, this project develops engineering tools and technologies to rapidly evaluate and predict weapon performance.

Work in this Project complements Program Element (PE) 0603116A (Lethality Advanced Technology) / Project CH5 (Terminal Effects Against Critical Targets Adv Tech).

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 Engineer Research and Development Center Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Terminal Weapons Effects Technology	3.851	2.180	-
Description: This effort develops and validates terminal weapons effects prediction capabilities for Long Range Precision Fires (LRPF) weapons against geomaterials, structures, and other critical assets. ***FY 2024 Plans:*** Will mature Virtual Material Library (VML) which provides additional weapon/target pairing for predictive models; will develop high-fidelity predictive capabilities for blast and penetration of higher velocity warheads for key weaponeering tools; will validate semi-automated 3D change detection tool for rapid BDA capabilities. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned conclusion of this effort and transition to Program Element 0603116A (Lethality Advanced Technology) / Project CH5 (Terminal Effects Against Critical Targets Adv Tech).			
Title: Adaptive Technologies for Advanced Weapons	-	-	1.034
Description: Develops and validates the capability to predict terminal weapons effects for new advanced warheads and weapon systems with initial operational capabilities past Fiscal Year 2025 against geomaterials, structures, and other critical assets. ***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 0602141A / *Lethality Technology*	**Project (Number/Name)** CF8 / *Terminal Effects Against Critical Targets Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will conduct experiments of new advanced munitions against critical targets and target materials. Will investigate and develop fast running engineering tools to support new warhead capabilities for blast and blast/fragment effects. Design, develop and mature fast running penetration predictive models and analysis codes for high velocity impact/penetration conditions into critical targets of interest. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects planned initiation of this effort.			
Accomplishments/Planned Programs Subtotals	3.851	2.180	1.034

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 0602141A / *Lethality Technology*	Project (Number/Name) CG4 / *Advanced Radar Concepts and Technologies*	

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
CG4: *Advanced Radar Concepts and Technologies*	-	5.869	6.008	7.044	-	7.044	12.014	15.039	12.123	9.202	0.000	67.299

A. Mission Description and Budget Item Justification

This Project conducts experiments on single crystal diamond and diamond hetero-structure semiconductor materials, layered structures, and novel devices for Diamond Electronics and integrated photonics structures and devices for Radar, Communications, and improved Size, Weight, and Power (SWaP) Department of Defense systems. Efforts include multiscale modeling, material and structure growth and characterization, and novel device design and fabrication as well as two-dimensional (2-D) electronics for bio-inspired neuromorphic sensors, processors, and memory. This research has application to radars, communication systems, electronic warfare, directed energy, electronics for hypersonic systems, radiation hard systems, quantum sensing, and others. This Project directly supports Air and Missile Defense modernization priority capabilities by investigating essential component technologies for insertion into Multi-Mission Army Radar systems. This Project addresses the challenges of integrating new materials into Silicon Complementary Metal Oxide Semiconductor (CMOS) processing flows, and electronics reliability including protection against unintended adversarial use of state-of-the-art semiconductor materials, devices, and systems for Air and Missile Defense in contested environments.

Work in this Project complements Program Element (PE) 0603466A (Air and Missile Defense Advanced Technology) Project AD6 (Next Generation Fires Radar 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.

Work in this Project is performed by the Army Research Laboratory (ARL) and Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Antennas and Radio Frequency (RF) Device Components for Advanced Electronic Systems	4.930	5.054	5.062
Description: Conduct experiments into novel diamond material and silicon photonic device structures operable in the RF electromagnetic spectrum with high radiated power density for increased radar range and better target detection, improved efficiency of communications systems, smaller SWaP for electronics/cooling of autonomous systems, high temperature electronics for hypersonics, and radiation hardened electronics. ***FY 2024 Plans:*** Will conduct research of ultra-wide bandgap (diamond based) RF power amplifier test articles for improvements in RF power density, embodied by circuits that will be aligned with requirements for phased array antenna systems and low SWaP applications; conduct preliminary assessment of a phased array antenna with chip-scale beamformer photonic circuitry; investigate novel multi-function and reconfigurable antenna solutions across distributed assets for data collection and dissemination based on additive			

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CG4 / *Advanced Radar Concepts and Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
manufacturing technology; investigate methodologies for integrating materials that naturally exhibit neuromorphic function into Silicon Complementary Metal Oxide Semiconductor (CMOS) process flows; integrate and assess novel multi-frequency antenna designs and algorithms for future Army systems. ***FY 2025 Plans:*** Will investigate and validate phased array antenna with chip-scale beamformer photonic circuitry performance. Fund research of the interaction between RF signals and topological materials and determine the value of incorporating those materials into advanced RF systems. Investigate multi-layer electromagnetic metasurface designs incorporating wideband and multi-function conformal skins for smart radar enclosures. Design and develop low-SWaP multiband and distributed anti-jam antennas and algorithms for Army position, navigation and timing (PNT) and communications systems. Assess novel multiband antenna array integrated with anti-jam system testbed; mature diamond surface field effect transistor output power density, device stability, and frequency range; and investigate techniques to expand electronic grade single crystal diamond wafer diameter size. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.			
Title: Distributed Radar Architectures ***Description:*** This research seeks to validate critical functions and perform proof-of-concept laboratory experimentation to develop phase synchronous, coordinated radar and multi-function effects that enable distributed, global positioning system (GPS)-independent, autonomous capabilities. This effort validates critical synchronized distributed networked sensor functions and novel signal processing methods. This effort validates advanced antenna designs for low size, weight, power and cost (SWAP-C), multi-function systems. ***FY 2024 Plans:*** Will conduct experiments for coherent radar beamforming using a 2-node distributed transceiver. Will design and develop a model of a 5-node sensing network and a method for establishing relative position without GPS. ***FY 2025 Plans:*** Will validate coherent beamforming performance with a 2-node distributed transceiver; create a 5-node distributed transceiver and benchmark its performance; develop methods to calibrate the distributed transceivers and optimize the two-way time and frequency transfer algorithm. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.	0.939	0.954	0.980
Title: Radar Digital Twin (EXHILARAMA)	-	-	1.002

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CG4 / *Advanced Radar Concepts and Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort researches, designs, and develops a radar digital engineering environment, virtual prototype radar system architecture, and component technology to address next generation radar requirements, and quantifies performance through rapid persistent modeling and simulation. ***FY 2025 Plans:*** Will investigate and perform a technology trade study to evaluate state-of-the-art hardware and software, determine system requirements, and quantify initial impact of hardware and software components to next generation radar performance through system-level modeling. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** In Fiscal Year (FY) 2025 this effort is restructured from Program Element (PE) 0603464 (Long Range Precision Fires Advanced Technology) / CE9 (Armaments Advanced Technology).			
Accomplishments/Planned Programs Subtotals	5.869	6.008	7.044

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 0602141A / *Lethality Technology*	Project (Number/Name) CI1 / *Advanced Armaments Lethality 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
CI1: *Advanced Armaments Lethality Technology*	-	1.493	1.684	4.352	-	4.352	4.518	6.493	6.121	5.960	0.000	30.621

A. Mission Description and Budget Item Justification

This Project designs and develops novel armament systems concepts and enabling technologies in weapons, munitions, and fire control, in order to advance range and accuracy capabilities.

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 Armaments Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Armaments Lethality Technology	1.493	1.684	4.352
Description: This project designs and develops novel armament systems concepts and enabling technologies in weapons, munitions, and fire control required to enable and dominate Multi Domain Operations (MDO). This includes advancing state of the art armament system technologies to provide overmatch against current and future threats. ***FY 2024 Plans:*** Will conduct?threat based?analysis to defeat evolving and forecasted?threats, assess technological trends,?and develop enabling technologies in weapons, munitions, and fire control?to support exploration of new concepts for Multi Domain Operations; investigate complex trade space consisting of multi-role/multi-mission, kinetic/non-kinetic, and dynamic targeting. ***FY 2025 Plans:*** Will investigate prioritization algorithms for multi-target engagement scenarios involving unmanned vehicles; design and develop weapon, munition, and fire control concepts to defeat multi-target swarming scenarios; investigate solutions for combined terrain shaping and breaching operations from a single armament system. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects the planned development of lethal mechanisms, development of fire control targeting algorithms, and design of mobile terrain shaping and breaching hardware components.			
Accomplishments/Planned Programs Subtotals	1.493	1.684	4.352

C. Other Program Funding Summary ($ in Millions)

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CI1 / *Advanced Armaments Lethality Technology*

C. Other Program Funding Summary ($ in Millions)

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 0602141A / *Lethality Technology*	Project (Number/Name) CIA / *Applied Armaments Tech for Distributed Lethality*	

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
CIA: *Applied Armaments Tech for Distributed Lethality*	-	-	3.445	-	-	-	-	2.204	2.825	8.476	0.000	16.950

A. Mission Description and Budget Item Justification

Platform Agnostic Armaments Applied Tech investigates technologies that holistically maximize armament performance, minimize target engagement timelines, reduce crew workloads, enhance responsiveness and enable collaborative lethal effectiveness on target across distributed platforms & missions. This project researches cross caliber weapon, munition & fire-control technologies to enhance Remote Weapon Systems (RWS) responsiveness and single or combined platform lethality in Multi-Domain Operations (MDO) environments.

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 supports the Next Generation Combat Vehicle Army Modernization Priority.

Work in this Project is performed by the Armaments Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Platform Agnostic Armaments Applied Tech	-	3.445	-
Description: This effort designs and develops technologies that enables platform performance by increasing range without degrading accuracy, reducing size, weight, and power and impact to lighter platforms, enhancing weapon, munitions, fire control, & agnostic remote weapon automation tech to reduce the kill chain timeline. This effort enables Army Modernization and Multi-Domain Operations (MDOs) in support of the Army's future and planned vehicles. ***FY 2024 Plans:*** Will develop concepts and supporting?critical enabling technologies that include?communication mechanisms and electrically-powered weapon technologies; focus on?decreased size, weight, and power usage while increasing performance and safety of remote weapon systems; investigate reduction of remote armament system target engagement time through novel fire control techniques. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** In Fiscal Year (FY) 2025, this Project is terminated.			
Accomplishments/Planned Programs Subtotals	-	3.445	-

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CIA / *Applied Armaments Tech for Distributed Lethality*

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 0602141A / *Lethality Technology*	Project (Number/Name) CIB / *Sensor to Shooter (STS) Applied Research*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CIB: *Sensor to Shooter (STS) Applied Research*	-	-	6.468	7.909	-	7.909	9.264	9.371	-	-	0.000	33.012

A. Mission Description and Budget Item Justification

This Project designs and develops advanced algorithms for sensor to shooter decision aids and incorporates predictive tools and permissive airspace capabilities to reduce the sensor to shooter timeline and effects execution. Investigate technologies for enabling multi-sensor fusion for collaborative tracking of multi-theater threat tracks to enable tactical target engagement and counter fires across threat flight timeline.

Work in this Project complements Program Element (PE) 0603116A (Lethality Advanced Technology) / Project CID (Sensor to Shooter (STS) 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.

Work in this Project supports Next Generation Combat Vehicle, Tactical Network, Future Vertical Lift, and Long-Range Precision Fires Army Modernization Priorities.

Work in this Project is performed by the Armaments Center, Command, Control, Communication, Computers, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center, and United States Army Space and Missile Defense Technical Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Lethal Effects Architecture for Decision Synchronization Technology	-	6.468	6.199
Description: This effort designs and develops advanced adaptive algorithms and architectures to improve threat prediction, reduce the sensor to shooter timeline, and enhance airspace deconfliction in support of Large-Scale Combat Operations in a dynamic multi-domain environment.			
FY 2024 Plans: Will investigate advanced algorithm concepts to support decision aid recommendations across dynamic conditions. Will research advanced decentralized algorithms for networked lethality collaboration across manned and unmanned systems. Will investigate predictive and adaptive algorithm concepts and design algorithms to align with Decision Point methodologies. Will explore algorithms to predict threat behavior to improve current sensor to shooter decision aid systems for large scale combat operations. Will investigate advanced predictive tools to synchronize and de-conflict airspace.			
FY 2025 Plans: Will design and develop advanced algorithms to support decision aid recommendations and distributed lethality multi-effects in a dynamic environment across echelons. Funds research development of algorithms predictive threat behavioral algorithms to			

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CIB / *Sensor to Shooter (STS) Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
improve sensor to shooter decision aids for large scale combat operations; design advanced predictive algorithms to synchronize and de-conflict airspace; investigate temporal decision aids concepts to enhance algorithm predictions across time as the battlefield evolves. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease is an economic adjustment.			
Title: C-SR QC2 ***Description:*** Investigates, designs and develops counter-surveillance and reconnaissance solutions to determine optimal threat engagement in support of Large-Scale Combat Operations in a joint all-domain command and control environment. ***FY 2025 Plans:*** Will investigate counter-surveillance and reconnaissance concepts for degrading adversary capabilities. Design and develop concept of operation to achieve mission requirements. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase due to new task in Program Element (PE) 0602141A / Lethality Technology/Project CIB / Sensor to Shooter (STS) Applied Research.	-	-	1.710
Accomplishments/Planned Programs Subtotals	-	6.468	7.909

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 0602141A / *Lethality Technology*				Project (Number/Name) CIC / *Fire Control Lethality 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**
CIC: *Fire Control Lethality Technology*	-	-	1.462	2.958	-	2.958	2.957	2.956	1.508	1.523	0.000	13.364

A. Mission Description and Budget Item Justification

Work in this Project researches, investigates and develops concepts for common open architecture fire control systems to maximize distributed armament systems performance. Researches fire control architecture framework and protocols utilizing artificial intelligence and machine learning to minimize target engagement timelines, reduce cognitive processes, and enable collaborative lethal effectiveness on target across weapon platforms. Develops modular fire control concepts enabling safe, lethal, and agile integration of current systems to engage emerging threats and decrease system vulnerabilities for maximize performance and combined arms effects.

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 Armaments Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Future Fire Control Tech (F2CT)	-	1.462	2.958
Description: This effort designs and develops fire control technologies to increase interoperability and improve performance across future distributed armament systems. This effort designs and develops novel components, algorithms, and architectures necessary for future fire control systems. ***FY 2024 Plans:*** Will investigate open and common fire control architectures to improve combined arms engagement effects from future distributed manned/unmanned armament systems; investigate novel algorithms and components for reduced fire control decision time, interoperability, and insertion into future fire control open architecture designs. ***FY 2025 Plans:*** Will investigate a novel cross cutting fire control framework supporting armaments interoperability across distributed platforms; investigate the collection, processing and transmission of various target data sets and solutions across small arms, aviation, combat vehicle, mortars and artillery platforms; investigate the feasibility of an expanded fire direction center capability to include other fire support elements. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects the planned work to investigate a fire control framework that supports armaments interoperability.			
Accomplishments/Planned Programs Subtotals	-	1.462	2.958

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CIC / *Fire Control Lethality Technology*

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 0602141A / *Lethality Technology*	Project (Number/Name) CJ1 / *Lethality Enabling University Applied Research*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CJ1: *Lethality Enabling University Applied Research*	-	6.330	7.197	7.874	-	7.874	8.354	8.360	8.451	8.536	0.000	55.102

A. Mission Description and Budget Item Justification

The Project leverages research and technological innovations from academia, of lethal directed energy, laser diagnostics and accelerated design of future hypersonics and their scramjet engine combustion, deep learning (DL) guidance tools and novel materials of importance to the Army, by accelerating research and conducting experiments focused on getting technology to the warfighter more quickly. This Project performs discovery research efforts to focus more on mid to far-term Army modernization priorities while also maintaining delivery of near-term technologies critical to the Long Range Precision Fires and Air and Missile Defense. This Project focuses on employment of research technologies originating from extramural applied research in academia pertaining to lethal directed energy, laser diagnostics, future hypersonic glide body and scramjet propulsor design, DL guidance tools, novel materials, and expansion of the Ballistic, Aero-Optics and Materials (B.A.M.) range applied to lethality. This effort conducts applied research and development leading to potential emerging technologies in areas of strategic importance to the Army in directed energy, future hypersonic glide body design, DL and novel materials, etc., by bringing competitively selected Universities with research and development teams into Technical Alliances.

Work in this Project complements Program Element 0602147A (Long Range Precision Fires) and Program Element 0602150A (Air and Missile Defense Technologies)

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

Work in this Project is performed by the University Technology Development Division.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Laser Diagnostics for Hypersonics and Directed Energy	1.609	1.842	2.399
Description: This effort researched systematic expansion in laser diagnostics technologies to assess hypersonic turbulence and boundary layer transition. Work is conducted in collaboration with university partners to advance the effects of atmospheric turbulence on laser propagation and gain applied knowledge in directed energy systems effectiveness and range.			
FY 2024 Plans: Will continue to investigate methods for measuring hypersonic air flow, impacts of atmospheric and environmental conditions both close to the source, near field, and close to the target, far field. Will validate models that predict impacts those conditions have on directed energy systems. Will investigate methods of sensing for hypersonic ground test and flight applications and for the			

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CJ1 / *Lethality Enabling University Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
measurement of turbulent aero-optical environments. Will investigate directed energy applications and effectiveness of various types of laser systems. ***FY 2025 Plans:*** Will design and develop diagnostic tools and methods for quantification and visualization of hypersonic flows and hypersonic interactions to improve prediction and optimization of the performance of hypersonic systems based on well characterized ground testing. Funds research in academia to enhance the effectiveness and utility of Directed Energy (DE) systems operating under realistic atmospheric conditions to enable the prediction of the effectiveness of DE systems. Funds academic applied research in emerging aero-optic technologies for laser diagnostic and directed energy effectiveness; funds research and incorporates the Ballistic Aero-Optics and Materials (BAM) range to validate data and improve test techniques. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects an administrative realignment from task (Intelligent Hypersonics and Other Vehicle Systems) within this project.			
Title: Turbulence and Transition Modeling and Validation for Hypersonic Vehicles ***Description:*** This effort is conducted in collaboration with university partners to develop modeling tools to help inform the flight envelope of existing hypersonic vehicles to accelerate design of future hypersonic glide bodies. ***FY 2024 Plans:*** Continues to mature modeling techniques and methods to improve the design and control of future hypersonic glide bodies. Investigate commercial methods to improve the implementation of models into relevant government tools in a high performance computing environment. ***FY 2025 Plans:*** Will design and develop methods to predict and control drag and investigate thermal loading of hypersonic platforms. Develop accurate aerothermo-dynamic modeling of missile geometries with experimental validation from Mach 6 - 12 at true flight temperatures and high Reynolds numbers, including high incidence angles; funds academic applied research in emerging technologies to improve modeling for hypersonic flight activity; funds research and incorporates the Ballistic Aero-Optics and Materials (BAM) range to validate data and improve test techniques. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects an administrative realignment from task (Intelligent Hypersonics and Other Vehicle Systems) within this project.	1.703	1.976	3.342
Title: Novel Materials for Extreme Environments	1.200	1.309	1.613

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CJ1 / *Lethality Enabling University Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort produces a test environment for thermal and ablation evaluation of novel materials relevant to hypersonic vehicles. Work is conducted in collaboration with university partners to assess material characteristics and develop computational models of high strain rate materials to mitigate the effects of high kinetic energy impacts. ***FY 2024 Plans:*** Will continue to develop critical high temperature materials and characterize for the design of thermal protection systems and investigate material ablation modeling. Will investigate high temperature thermal management systems for hypersonic leading edges. Will investigate thermal resistance between dissimilar hypersonic materials. Will investigate material oxidation and determine deployable solutions, advanced materials and composites to protect the hypersonic vehicles in extreme heat. Will continue to use the Ballistic Aero-Optics and Materials (BAM) range to validate data and improve test techniques. Investigate methods to discover high entropy materials for extreme environments. ***FY 2025 Plans:*** Will develop the test environment and manufacturing techniques of materials for production of hypersonic vehicles using newly developed refractory high-entropy alloy (RHEA) materials capable of withstanding extreme environments; funds applied academic research for emerging technologies for novel materials in hypersonic applications; funds research and incorporates the Ballistic Aero-Optics and Materials (BAM) range to validate data and improve test techniques. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects an administrative realignment from task (Intelligent Hypersonics and Other Vehicle Systems) within this project.			
Title: Intelligent Hypersonics and Other Vehicle Systems	1.818	2.070	0.520
Description: This effort develops and designs geometrically relevant testing hardware required to study aerothermodynamic performance, increase impact velocity and extend range of precision strike munitions. Work is conducted in collaboration with university partners to collect experimental data and insights required to train deep learning neural networks used for the development of hypersonic vehicle flight systems with adaptability and increased lethality. ***FY 2024 Plans:*** Will continue to develop intelligent defense vehicle systems and their self health-monitoring sensors to survive and optimize path planning. Will develop dynamic adversarial machine learning (ML) and training for rapid response automated tracking, and disguised flying objects. Will recommend sensor deployment to maximize information gain for swift decision making and suggest vulnerability scores to all locations, in complex terrains, overcoming line-of-sight constraints. ***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 0602141A / *Lethality Technology*	**Project (Number/Name)** CJ1 / *Lethality Enabling University Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will fund applied academic research in emerging intelligent hypersonics systems; continues to develop relevant hardware required to study aerothermodynamic performance, collect experimental data and insights required to inform advanced technology research. The benefits of this effort improve hypersonic flight adaptability and lethality. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects an administrative realignment to tasks (Laser Diagnostics for Hypersonics and Directed Energy), task (Turbulence and Transition Modeling and Validation for Hypersonic Vehicles), and task (Novel Materials for Extreme Environments) within this project.			
Accomplishments/Planned Programs Subtotals	6.330	7.197	7.874

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 0602141A / *Lethality Technology*	Project (Number/Name) CJ7 / *Future Air Defense Missile Enabling 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
CJ7: *Future Air Defense Missile Enabling Tech*	-	1.922	2.324	4.608	-	4.608	4.613	4.616	4.667	4.714	0.000	27.464

A. Mission Description and Budget Item Justification

This Project investigates, develops, and evaluates critical missile technologies and components necessary for advanced lethal capability in support of future/mid to far term affordable short range air defense interceptor capability to defeat Cruise Missile (CM), Rotary Wing (RW), Tactical / Lethal Unmanned Aerial System (UAS), and Fixed Wing (FW) threats. This effort designs and develops technologies to provide advanced materials, seekers, guidance and control, and propulsion for reduced size weight and power and cost for Maneuver Short Range Air Defense (MSHORAD), Short Range Air Defense (SHORAD), and Lower Tier essential to maintain overmatch against mid-/far-term threats. This project supports Air and Missile Defense Modernization priority efforts.

This research complements Program Element (PE) 0602147A (Long Range Precision Fires Technology / Project AF3 (Extended Range Propulsion Technology) and Project AF8 (Affordable Extended Range Precision Technology).

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: Future Air Defense Missile Enabling Technology	1.922	2.324	4.608
Description: Designs and develops reduced cost advanced Air Defense missile critical components essential to maintain overmatch against mid/far term M-SHORAD, SHORAD, and Lower Tier threats. ***FY 2024 Plans:*** Will investigate and develop novel missile technologies that inform future lower tier and SHORAD capabilities; investigate solid fuel ramjet (SFRJ) propulsion technology in the current Stinger form factor for increased range while maintaining current system compatibility; design and develop missile attitude control systems (MACS) for increased maneuverability and investigate reactive material warhead technologies to improve lethality for Lower Tier Future Interceptor. ***FY 2025 Plans:*** Will develop and evaluate SFRJ propulsion technology in the current Stinger form factor to achieve increased range while maintaining current launcher compatibility; validate MACS design by conducting experiments on component technology for various missile defense applications; develop and evaluate reactive material warhead technologies to improve lethality for lower-tier air and missile defense applications; investigate, develop concepts, perform trade studies, improve modeling and simulation			

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CJ7 / *Future Air Defense Missile Enabling Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
capabilities, and develop critical missile component technologies required to defeat emerging Air and Missile Defense (AMD) threats. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects technology development and evaluation for reactive material warheads for lower-tier air and missile defense applications. Additional investments in missile component technology required to outpace AMD threats and inform future AMD capabilities.			
Accomplishments/Planned Programs Subtotals	1.922	2.324	4.608

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 0602141A / *Lethality Technology*				Project (Number/Name) CZ9 / *Foundational Hypersonic Weapons Research*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CZ9: *Foundational Hypersonic Weapons Research*	-	7.589	8.360	10.801	-	10.801	11.556	14.161	14.968	14.422	0.000	81.857

A. Mission Description and Budget Item Justification

This Project investigates foundational problems associated with high-speed weapons and informs the future strategic fires echelon of Long-Range Precision Fires (LRPF) capabilities. This Project funds the research of material science subjects such as extreme thermal loading and aero-thermodynamics and control technologies for high- speed vehicles which may encounter high mechanical loads at launch.

Work in this Project transitions foundational research obtained in Program Element (PE) 0601102A (Defense Research Sciences) / AA7 (Mechanics and Ballistics) and complements PE 0602141A (Lethality Technology) / AH4 (Precision and Cooperative Weapons in Denied Environments), AH5 (Projectile and Multi-Function Warhead Technologies), Project AH6 (Disruptive Energetics and Propulsion Technologies), AH7 (Lethal and Scalable Effects Technologies), and AH8 (Lethality Materials and Processes Technology), PE 0602144A (Ground Technology) / BL1 (Materials and Manufacturing Research Technology), and PE 0602145A (Next Generation Combat Vehicle) / BI4 (Materials Application and Integration Tech).

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

This work is consistent with the needs of the Army Research Priority of Hypersonic Flight.

Work in this Project is performed by the Army Research Laboratory (ARL) and the United States Army Space and Missile Defense Command, Technical Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Foundational Hypersonic Weapon Materials	5.926	6.279	6.389
Description: This effort investigates materials synthesis and processing (including innovative approaches such as high-throughput materials-by-design using artificial intelligence and machine learning algorithms), novel experimental techniques, and fundamental theoretical modeling to decrease cost, increase availability, and model thermal and mechanical survivability on hypersonic vehicles. Specific research topics include polymer/resin synthesis for composites, novel three-dimensional composite weave architectures, composite processing (process by which the material is made), ceramic window/dome materials, high-temperature metallic alloys, and joining techniques. ***FY 2024 Plans:*** Will continue to reduce processing costs of carbon-carbon composites and characterize resulting materials in comparison to industrial materials; execute materials-by-design workflow on refractory alloy compositions and high temperature ceramic blends;			

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CZ9 / *Foundational Hypersonic Weapons Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
investigate ablation and oxidation resistance through torch assessments; characterize mechanical performance of various window and dome materials of interest. ***FY 2025 Plans:*** Will investigate ultra-high temperature ceramic matrix composites for use as ablation-resistant, shape stable leading edges. Design and develop a matrix of composite chemistries and processing methods to infiltrate fiber pre-forms with ceramic material. Develop processing methods to produce coupons of novel alloys and execute high temperature characterization of optimized compositions. Investigate processing methods to join dissimilar materials such as composites to metal or composites to ceramic; examine functionally graded materials for use as window and dome materials; develop processing methods to fabricate layered structures and form them into curved structures. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Foundational Hypersonic Weapons Flight and Control ***Description:*** This effort increases understanding of hypersonic vehicle flight behavior and control approaches for more aggressive, rapid, low risk multi-disciplinary designs of future hypersonic vehicles featuring enhanced agility/stability necessary for survivable delivery to advanced threats of the future. Research includes fundamental flow physics and chemistry, guidance and flight control algorithms, vehicle maneuver control mechanisms, novel vehicle shapes, and the theoretical modeling, computational toolsets, and experimental techniques to achieve these advancements. ***FY 2024 Plans:*** Will continue to explore aero-thermodynamics related to Army hypersonic vehicle concepts through advanced computational and experimental techniques; discover flight mechanisms and algorithms that overcome barriers to help enable affordable, high magazine depth, high-speed weapons. ***FY 2025 Plans:*** Will mature diagnostics for measuring hypersonic vehicle behaviors on free-flight ballistic ranges; investigates models coupling fluid-thermal-structural interactions with chemistry effects on hypersonic weapons; determines high-level control of hypersonic weapons to include dynamic path planning that considers adversarial response. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase supports additional research in the area of dynamic path planning for hypersonic weapons.	1.663	2.081	2.408
Title: Foundational Hypersonic System Component	-	-	2.004

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 0602141A / *Lethality Technology*	**Project (Number/Name)** CZ9 / *Foundational Hypersonic Weapons Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort supports the investigation, design and development of hardware and software components, models and simulations to further advance Hypersonic capabilities. ***FY 2025 Plans:*** Will fund research and investigate novel materials for development of hypersonic components to increase performance of radio frequency radomes, electro-optic windows, and advanced structures in extreme hypersonic conditions. Investigates alternative navigation, guidance and control techniques and algorithms in GPS-denied and extreme flight dynamics environments for defense applications. Designs and develops novel lethality enhancers, energetics, and deployables.to increase endgame and battlefield damage assessments. Determines requirements for advance hypersonic architectures and simulation testbeds developments to enable, test and verify research. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase in FY2025 to further advance Hypersonic capabilities by investigating, designing and developing of hardware and software components, models and simulations as well as determining requirements for advance hypersonic architectures.			
Accomplishments/Planned Programs Subtotals	7.589	8.360	10.801

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A