Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army											Date: March 2023	
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 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	-	89.285	194.717	85.578	-	85.578	86.406	95.443	96.819	95.751	Continuing	Continuing
AH6: *Disruptive Energetics and Propulsion Technologies*	-	8.106	8.682	8.752	-	8.752	8.805	8.816	8.822	8.919	0.000	60.902
AH7: *Lethal and Scalable Effects Technologies*	-	1.841	1.346	1.574	-	1.574	1.574	1.576	1.577	1.594	Continuing	Continuing
AH8: *Lethality Materials and Processes Technology*	-	3.872	1.868	1.906	-	1.906	1.906	1.907	1.909	1.930	0.000	15.298
AH9: *Advanced Warheads Technology*	-	24.118	26.780	24.326	-	24.326	27.237	29.256	31.958	32.306	0.000	195.981
BS6: *Lethality Technology (CA)*	-	27.500	107.000	-	-	-	-	-	-	-	0.000	134.500
CF7: *Solid-state Laser Concepts and Architectures*	-	7.271	8.567	9.892	-	9.892	9.892	9.904	9.911	10.019	0.000	65.456
CF8: *Terminal Effects Against Critical Targets Tech*	-	3.893	3.938	2.180	-	2.180	1.032	5.174	4.331	3.729	0.000	24.277
CG4: *Advanced Radar Concepts and Technologies*	-	4.516	5.891	6.008	-	6.008	6.030	8.990	8.995	9.093	0.000	49.523
CI1: *Advanced Armaments Lethality Technology*	-	-	1.544	1.684	-	1.684	8.694	7.460	6.732	5.329	0.000	31.443
CIA: *Applied Armaments Tech for Distributed Lethality*	-	-	-	3.445	-	3.445	-	-	-	-	0.000	3.445
CIB: *Sensor to Shooter (STS) Applied Research*	-	-	-	6.468	-	6.468	-	-	-	-	0.000	6.468
CIC: *Fire Control Lethality Technology*	-	-	-	1.462	-	1.462	-	-	-	-	0.000	1.462
CJ1: *Lethality Enabling University Applied Research*	-	5.583	6.570	7.197	-	7.197	7.858	8.338	8.344	8.435	0.000	52.325
CJ6: *Advanced Energetics for Missile Technologies*	-	1.142	-	-	-	-	-	-	-	-	0.000	1.142

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army												Date: March 2023
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*							
CJ7: *Future Air Defense Missile Enabling Tech*	-	1.443	14.655	2.324	-	2.324	4.599	4.604	4.607	4.658	0.000	36.890
CZ9: *Foundational Hypersonic Weapons Research*	-	-	7.876	8.360	-	8.360	8.779	9.418	9.633	9.739	0.000	53.805

Note

Project CI1 (Advanced Armaments Lethality Technology) and Project CZ9 (Foundational Hypersonic Weapons Research) are New Starts for Fiscal Year 2023 (FY23). Project CJ6 (Advanced Energetics for Missile Technologies) is Terminated starting in FY23.

A. Mission Description and Budget Item Justification

Work done in this Program Element (PE) researches 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.

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

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army	Date: March 2023
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*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	91.626	87.717	77.976	-	77.976
Current President's Budget	89.285	194.717	85.578	-	85.578
Total Adjustments	-2.341	107.000	7.602	-	7.602
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	107.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-2.341	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	7.602	-	7.602

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: BS6: *Lethality Technology (CA)*		
Congressional Add: *Program increase - Next Generation Remote Sensing*	3.000	-
Congressional Add: *Program Increase- Hybrid Additive Manufacturing*	5.000	-
Congressional Add: *Program Increase - Hypersonic Wind Tunnel Development*	6.500	-
Congressional Add: *Program Increase - Materials Processing Manufacturing Technology*	10.000	12.000
Congressional Add: *Program Increase - Universal Nanocrystalline Alloys*	3.000	5.000
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	27.500	107.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army	Date: March 2023
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 2022	FY 2023
Congressional Add Totals for all Projects	27.500	107.000

Change Summary Explanation

Increase in funding to support sensor to shooter design and development efforts.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AH6: *Disruptive Energetics and Propulsion Technologies*	-	8.106	8.682	8.752	-	8.752	8.805	8.816	8.822	8.919	0.000	60.902

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 builds upon 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 United States (US) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Synthesis, Formulation and Diagnostics of Energetic Materials ***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 also investigates and develops revolutionary ways to release energy and characterize energetic behavior at early time and small length scales for rapid determination of detonation and propellant performance parameters to enable a "fail early, fail often" strategy.	4.838	-	-
Title: Modeling and Simulation of Energetics and Munitions ***Description:*** This effort develops, codes, and subsequently employs advanced models to predict multiscale response of energetic materials for both propellant and explosive purposes. Develops new simulation methods for understanding and design of advanced concepts and energetic formulations to rapidly iterate and optimize towards increased range and enhanced lethality.	1.738	-	-
Title: Advanced Weapon Concepts ***Description:*** This effort investigates new propellants and grain designs, burn rate/combustion modifier ingredients, as well as new gun and munition designs for extended range.	1.530	-	-
Title: Synthesis, Formulation, Modeling, and Diagnostics of Energetic Materials for Explosive and Propellant Applications	-	8.576	8.752

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
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 2023 Plans:*** Synthesize, scale up, and formulate high temperature resistant energetic materials, energetic polymers, and novel high energy density metallic fuels into new higher performing explosives and propellants; develop rapid laboratory scale diagnostic techniques to rapidly screen candidate materials and formulations, mitigating need for mass production for evaluation and therefore achieve faster time-to-solution for extended range and enhanced lethality; develop and experimentally validate mesoscale models an order of magnitude larger than FY21 state of the art and link with engineering scale software for explosive modeling; develop chemical kinetics for solid fuel ramjet continuum modeling for enhanced ranges; develop machine learning models of performance and material sensitivity to reduce phase space for synthetic chemists to explore; develop and transition novel propellant grain designs and initiation schemes to enable increased range for very large caliber cannon systems; develop capability to design solid fuel ramjets for increased rocket ranges; develop lightweight, increased muzzle velocity Soldier weapon systems. ***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 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 2023 to FY 2024 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
Funding increase supports planned lifecycle of this effort.			
Title: SBIR/STTR Transfer	-	0.106	-
Description: Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	8.106	8.682	8.752

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AH7: *Lethal and Scalable Effects Technologies*	-	1.841	1.346	1.574	-	1.574	1.574	1.576	1.577	1.594	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 is coordinated with Project AH5 (Projectile and Multi-Function Warhead Technologies) and Project AH6 (Disruptive Energetics and Propulsion Technologies) within this PE and builds upon disruptive energetic and ballistic sciences research in PE 06011102A 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 United States (US) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Munition Efficiency and Scalability	1.841	1.297	1.574
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 2023 Plans: Conduct experiments to quantify the performance of the devices designed and built in FY2022; provide model updates and revised lethality analyses based on the outcome of terminal ballistic experiments conducted in Fiscal Year 2022 (FY22); continue design studies to examine performance gains provided by improved manufacturing techniques, novel energetics, and metals designed for warhead applications.			
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,			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
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 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase supports planned lifecycle of this effort.			
Title: SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638	-	0.049	-
Accomplishments/Planned Programs Subtotals	1.841	1.346	1.574

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AH8: *Lethality Materials and Processes Technology*	-	3.872	1.868	1.906	-	1.906	1.906	1.907	1.909	1.930	0.000	15.298

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 is coordinated with Project AH6 (Disruptive Energetics and Propulsion Technology) and Project AH7 (Lethal and Scalable Effects Technologies) within this PE, 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 United States (US) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Materials for Advanced Lethality	3.872	1.863	1.906
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 2023 Plans:*** Print and validate various energetic systems, including three-dimensional (3D) printed rocket motor, topology-optimized gun propellant, and shaped-charge explosive; develop energetic polymer feedstocks for additive manufacturing; develop additive manufacturing capable high-strength energetics binder for gun-launch applications; perform thermal drawing of nanocrystalline-based energetic materials and solid filled energetic materials. ***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 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase supports planned lifecycle of this effort.			
Title: SBIR/STTR Transfer	-	0.005	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602141A / *Lethality Technology*	**Project (Number/Name)** AH8 / *Lethality Materials and Processes Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	3.872	1.868	1.906

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AH9: *Advanced Warheads Technology*	-	24.118	26.780	24.326	-	24.326	27.237	29.256	31.958	32.306	0.000	195.981

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. 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 PE 0602147A (Long Range Precision Fires Technology) / AG6 (Energetic Materials and Advanced Processing Techno), PE 0603464A (Long Range Precision Fires Advanced Technology / AG7 (Energetic Materials and Adv Processing Adv Tech),PE 0602150A (Air and Missile Defense Technology), PE 0602148A (Future Vertical Lift Technology), and 0602145A (Next Generation Combat Vehicle 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 United States (US) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Advanced Warheads	10.370	11.506	7.665
Description: This effort explores multiple pathways to enhance lethal effects for future warheads against emerging peer/near peer target sets; Investigates synergistic effects of novel warheads using advanced concepts of operations, materials, geometries, and manufacturing processes.			
FY 2023 Plans: Design reactive and novel materials, including advanced fragmentation, and alternate disruptive effects to enhance lethal effects on target operating in a high-g environment. Investigate potential lethal mechanism technologies for potential unmanned, multi-mission, ground & aerial target engagements. Investigate technology advances to mature warhead designs that are effective across multiple domains. Continue to develop advanced Modeling and Simulation capabilities using available technologies, including advanced algorithms to optimize Shape Charge, Fragmentation and EFP Designs. Conduct experiments to validate materials and advanced warheads designs In a high-G environment.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
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 2023 to FY 2024 Increase/Decrease Statement:*** The funding for this effort was decreased in FY24 to accelerate the Army's Precision Strike Missile Inc IV under PE 0603464/AF2, Long Range Maneuverable Fires Advanced Tech.			
Title: Advanced Energetics ***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 2023 Plans:*** Continue to investigate novel energetic materials; design enhanced lethality explosive formulations; conduct experiments of enhanced novel propellant formulations for use in representative munitions. Develop advanced initiation concepts and advanced ignition concepts. Conduct experiments to: prepare energetic components via additive manufacturing processing technologies; validate modeling and simulation tools required to accurately predict energetic materials performance in novel and unique geometries; embed ignition for additively manufactured gun propulsion charges. Design analytical and experimental capabilities to characterize advanced energetic materials. ***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 2023 to FY 2024 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	12.342	12.833	13.815
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	1.406	1.506	2.846

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
of novel pyrotechnic technologies that will enable disruptive capabilities for Multidomain Operations. This effort supports the Army Modernization Priorities. ***FY 2023 Plans:*** Design novel pyrotechnic materials, components, and configurations. Design advanced pyrotechnic concepts and assess the performance and effectiveness for military utility through modeling and experimental validation. Continue to conduct experiments on pyrotechnic components and formulations supporting Army Modernization and Multi-Domain Operations. ***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 2023 to FY 2024 Increase/Decrease Statement:*** Increase due to investigation and development of critical pyrotechnic, mixtures, and components.			
Title: SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638	-	0.935	-
Accomplishments/Planned Programs Subtotals	24.118	26.780	24.326

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
BS6: *Lethality Technology (CA)*	-	27.500	107.000	-	-	-	-	-	-	-	0.000	134.500

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 2022	FY 2023
Congressional Add: Program increase - Next Generation Remote Sensing ***FY 2022 Accomplishments:*** Congressional Interest Item funding provided for Next Generation Remote Sensing	3.000	-
Congressional Add: Program Increase- Hybrid Additive Manufacturing ***FY 2022 Accomplishments:*** Congressional Interest Item funding provided for Hybrid Additive Manufacturing for Advanced Lethality	5.000	-
Congressional Add: Program Increase - Hypersonic Wind Tunnel Development ***FY 2022 Accomplishments:*** Congressional Interest Item funding provided for Hypersonic Wind Tunnel Development	6.500	-
Congressional Add: Program Increase - Materials Processing Manufacturing Technology ***FY 2022 Accomplishments:*** Congressional Interest Item funding provided for Materials Processing Manufacturing Technology ***FY 2023 Plans:*** Congressional Interest Item funding provided for Lethality Technology.	10.000	12.000
Congressional Add: Program Increase - Universal Nanocrystalline Alloys ***FY 2022 Accomplishments:*** Congressional Interest Item funding provided for Universal Nanocrystalline Alloys ***FY 2023 Plans:*** Congressional Interest Item funding provided for Lethality Technology.	3.000	5.000
Congressional Add: Program Increase - ADVANCED MATERIALS AND MANUFACTURING FOR MODERNIZATION	-	20.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023
FY 2023 Plans: Congressional Interest Item funding provided for Lethality Technology.		
Congressional Add: Program Increase - CERAMIC PROTECTION MATERIALS ***FY 2023 Plans:*** Congressional Interest Item funding provided for Lethality Technology.	-	3.000
Congressional Add: Program Increase - COLLABORATIVE NETWORKED ARMAMENT LETHALITY TECHNOLOGY ***FY 2023 Plans:*** Congressional Interest Item funding provided for Lethality Technology.	-	15.000
Congressional Add: Program Increase - ENHANCED ARMAMENT FIRE CONTROL ***FY 2023 Plans:*** Congressional Interest Item funding provided for Lethality Technology.	-	10.000
Congressional Add: Program Increase - HIGH TEMPERATURE POLYMER COMPOSITES ***FY 2023 Plans:*** Congressional Interest Item funding provided for Lethality Technology.	-	10.000
Congressional Add: Program Increase - INTELLIGENT NEXT-GENERATION ADDITIVE MANUFACTURING HUB ***FY 2023 Plans:*** Congressional Interest Item funding provided for Lethality Technology.	-	2.000
Congressional Add: Program Increase - NOVEL ARMAMENT SYSTEMS ***FY 2023 Plans:*** Congressional Interest Item funding provided for Lethality Technology.	-	15.000
Congressional Add: Program Increase - QUANTUM TECHNOLOGIES FOR ARMAMENT SYSTEMS ***FY 2023 Plans:*** Congressional Interest Item funding provided for Lethality Technology.	-	10.000
Congressional Add: Program Increase - TURRET GUNNER SURVIVABILITY AND SIMULATION ENVIRONMENT ***FY 2023 Plans:*** Congressional Interest Item funding provided for Lethality Technology.	-	5.000
Congressional Adds Subtotals	27.500	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 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CF7: *Solid-state Laser Concepts and Architectures*	-	7.271	8.567	9.892	-	9.892	9.892	9.904	9.911	10.019	0.000	65.456

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 United States (US) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: High Energy Laser (HEL) Enabling Technologies for Tactical Directed Energy Weapons	7.271	8.556	2.250
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; and develops increased power while reducing size and weight, and complexity of all HEL components			
FY 2023 Plans: Investigate potential of fiber laser power scaling out of a single fiber aperture by a factor of upwards 10X based on state-of-the-art glass laser fibers with modified glass composition aimed at: significantly reducing losses and instabilities from optical and thermal non-linearities; improve C4 fiber designs by adding a splicing capability of C4 fibers with silica-based pump couplers and pump-signal combiners; improve designs and further power scale directly-diode-pumped fiber lasers; assess new thermal storage materials and thermal management techniques; funds research of new compact and efficient DE specific power conversion topology concepts.			
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 2023 to FY 2024 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
Funding decrease in this effort supports the planned lifecycle shift from primarily materials development to materials and power scaling which will be supported in the Advanced High Energy Laser Technology effort within this Project.			
Title: SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638	-	0.011	-
Title: Advanced High Energy Laser Technology ***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; 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 2023 to FY 2024 Increase/Decrease Statement:*** Funding realigned from PE 0602146A Project AR1 Robust, Resilient and Intelligent C3I Technology and PE 0602145A Project BH5 Platform Electrification and Mobility Tech to support research in Advanced High Energy Laser Technology.	-	-	7.642
Accomplishments/Planned Programs Subtotals	7.271	8.567	9.892

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CF8: *Terminal Effects Against Critical Targets Tech*	-	3.893	3.938	2.180	-	2.180	1.032	5.174	4.331	3.729	0.000	24.277

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 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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Advanced Terminal Weapons Effects Technology	3.893	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 2023 Plans:*** Investigate low velocity and low aspect ratio impact conditions for penetration code prediction capabilities of army warheads, develop models for shock propagation to expand predictive capabilities for enhanced blast effects, will implement single-degree-of-freedom (SDOF) models into BlastX tool for coupled blast/frag interactions with structures, and will develop two-dimensional (2D) to three-dimensional (3D) rapid conversion capabilities for NLOS BDA methods. ***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 2023 to FY 2024 Increase/Decrease Statement:*** Funding decrease reflects the transition technologies to PE 0603116A (Lethality Advanced Technology) / Project CH5 (Terminal Effects Against Critical Targets Adv Tech) for maturation and demonstration.			
Title: SBIR/STTR Transfer	-	0.087	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
Description: Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	3.893	3.938	2.180

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 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CG4: *Advanced Radar Concepts and Technologies*	-	4.516	5.891	6.008	-	6.008	6.030	8.990	8.995	9.093	0.000	49.523

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 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 United States Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Antennas and Radio Frequency (RF) Device Components for Advanced Electronic Systems	4.516	4.930	5.054
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 2023 Plans: Conduct assessment of RF phased array beam steering embodiments and down select to optimal design in terms of SWaP and manufacturability; assess techniques for high polarization isolation and minimizing grating lobes from wideband and distributed antennas; fabricate and characterize diamond and boron nitride substrates and device test structures for correlation between the fundamental properties and the measured electrical performance.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
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 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 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase supports 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 2023 Plans:*** Design spatially distributed radar nodes experiments to validate wireless time synchronization and frequency synchronization for coherent microwave beamforming; determine antenna requirements for individual nodes and develop SWaP-efficient approaches to optimize radar network performance; design and validate algorithms for node synchronization to establish time, phase, and frequency lock and to reduce antenna beam sidelobes created by the distributed, sparse apertures. ***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 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase supports planned lifecycle of this effort.	-	0.939	0.954
Title: SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:***	-	0.022	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	4.516	5.891	6.008

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CI1: *Advanced Armaments Lethality Technology*	-	-	1.544	1.684	-	1.684	8.694	7.460	6.732	5.329	0.000	31.443

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 United States Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Advanced Armaments Lethality Technology	-	1.493	1.684
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 2023 Plans:*** Investigate novel multi-role and multi-mission armament concepts, increasing lethal effectiveness across calibers and platforms; investigate novel payloads, effects, and deployment schemes across current and future platforms to defeat and/or disrupt: material, personnel, and broad spectrum targets. ***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 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.			
Title: SBIR/STTR Transfer	-	0.051	-
FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602141A / *Lethality Technology*	**Project (Number/Name)** CI1 / *Advanced Armaments Lethality Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	-	1.544	1.684

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CIA: *Applied Armaments Tech for Distributed Lethality*	-	-	-	3.445	-	3.445	-	-	-	-	0.000	3.445

Note

In FY 2024 this effort is administratively realigned from PE 0602145 CU5 / Platform Agnostic Armaments Applied Technology.

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 United States Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
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 2023 to FY 2024 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
In FY 2024 this effort is administratively realigned from PE 0602145 Project CU5 Platform Agnostic Armaments Applied Technology			
Accomplishments/Planned Programs Subtotals	-	-	3.445

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CIB: *Sensor to Shooter (STS) Applied Research*	-	-	-	6.468	-	6.468	-	-	-	-	0.000	6.468

Note

In FY24, funding is realigned from PE 0602181A / CM7 Collaborative Convergence Applied Research.

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.

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 United States Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Lethal Effects Architecture for Decision Synchronization Technology	-	-	6.468
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 2023 to FY 2024 Increase/Decrease Statement:*** This effort begins in FY24 with funding realigned from PE 0602181A / Project CM7 Collaborative Convergence Applied Research.			
Accomplishments/Planned Programs Subtotals	-	-	6.468

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CIC: *Fire Control Lethality Technology*	-	-	-	1.462	-	1.462	-	-	-	-	0.000	1.462

Note

Fire Control Lethality Technology is a new start within the Lethality Technology program in FY 2024.

This Project is a new start within the Lethality Technology program in FY 2024.

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 United States Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Future Fire Control Tech (F2CT)	-	-	1.462
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 2023 to FY 2024 Increase/Decrease Statement:*** In FY2024 this effort is a new start.			
Accomplishments/Planned Programs Subtotals	-	-	1.462

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CJ1: *Lethality Enabling University Applied Research*	-	5.583	6.570	7.197	-	7.197	7.858	8.338	8.344	8.435	0.000	52.325

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 United States Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Laser Diagnostics for Hypersonics and Directed Energy	1.925	1.609	1.842
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 2023 Plans: Will continue to investigate methods to expand laser diagnostics and the flight envelope of the existing glide body, accelerate design of future hypersonic glide bodies; reduce flight test risks. Will investigate methods to improve directed energy system lethality. Will investigate methods to improve correction for atmospheric distortion. Will conduct experiments to inform the development of the B.A.M. range for testing and evaluation of hypersonic and directed energy systems.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
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 measurement of turbulent aero-optical environments. Will investigate directed energy applications and effectiveness of various types of laser systems. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.			
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 2023 Plans:*** Will continue to design and develop modeling techniques to expand the flight envelop and control of the existing glide body. Will investigate methods to accelerate design of future hypersonic glide bodies and systems. Investigate methods to reduce flight test risk through modeling and sub-scale wind tunnel testing of effects of new design features. Will conduct experiments to inform the development of the B.A.M. range for testing and evaluation of aerothermodynamic performance at hypersonic speeds. ***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 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.	1.800	1.703	1.976
Title: Novel Materials for Extreme Environments ***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 2023 Plans:*** Will continue to develop critical high temperature materials and characterize for the design of thermal protection systems to overmatch from high temperatures and high kinetic energy impacts. Will investigate material ablation models and the effect of material layering on ballistics and hypervelocity impact energy absorption, damage mitigation, and penetration resistance. Will	1.047	1.200	1.309

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
investigate models that account for high strain rate materials performance. Will conduct experiments to inform the development of the B.A.M. range for materials testing at hypersonic speeds. ***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 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.			
Title: Intelligent Hypersonics and Other Vehicle Systems ***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 2023 Plans:*** Will continue to develop intelligent defense vehicle systems using DL algorithms for improved surveillance, detection, and tracking and overcoming line-of-sight constraints. Will develop axisymmetric scramjet propulsor with transpiration fuel delivery system for high-speed projectiles. ***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 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.	0.811	1.818	2.070
Title: SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC §638	-	0.240	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	5.583	6.570	7.197

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602141A / *Lethality Technology*	Project (Number/Name) CJ6 / *Advanced Energetics for Missile Technologies*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CJ6: *Advanced Energetics for Missile Technologies*	-	1.142	-	-	-	-	-	-	-	-	0.000	1.142

A. Mission Description and Budget Item Justification

This Project directly supports Army Modernization Priorities through funding research 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 PE 0602147A (Long Range Precision Fires Technology), PE 0602150A (Air and Missile Defense Technology); and 0602141A (Lethality Technology) / Project AH9 (Advanced Warheads 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 United States (US) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Advanced Energetics Technology (Missiles) ***Description:*** This effort investigates new and emerging energetic ingredients and processes for propellant formulations to enable enhanced performance and mission flexibility by extending the reach and effects of tactical and strategic missile systems.	1.142	-	-
Accomplishments/Planned Programs Subtotals	1.142	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CJ7: *Future Air Defense Missile Enabling Tech*	-	1.443	14.655	2.324	-	2.324	4.599	4.604	4.607	4.658	0.000	36.890

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 is coordinated with 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 United States Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Future Air Defense Missile Enabling Technology	1.443	14.310	2.324
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 2023 Plans: Develop hardware, software, and algorithms for reduced space, weight, power and cost improved future Air Defense missile seeker, guidance and control, aerostructures, and propulsion technologies. Design, develop and evaluate an Active Electronically Scanned Array (AESA) radar seeker capable of supporting a variety of missions, weapon sizes and threats. Develop and evaluate seeker-based fuzing; Develop and evaluate strap-down guidance techniques for maneuvering targets. Perform trade studies with industry to identify next generation concepts and emerging technology development (including resilient sensors, advanced warhead/fuzing, and propulsion) that is interoperable, scalable and affordable to reduce risk for future air and missile defense interceptor capabilities; assess and mature component designs using high-fidelity models and simulation tools against future threats.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
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 2023 to FY 2024 Increase/Decrease Statement:*** Funding decrease reflects completion of advanced AESA seeker and seeker based fuzing technology development and evaluation. Funding in FY24 supports continued trade studies and missile technology development for lethal C-UAS capabilities against near and future threats.			
Title: SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638	-	0.345	-
Accomplishments/Planned Programs Subtotals	1.443	14.655	2.324

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CZ9: *Foundational Hypersonic Weapons Research*	-	-	7.876	8.360	-	8.360	8.779	9.418	9.633	9.739	0.000	53.805

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 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 United States Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Foundational Hypersonic Weapon Materials	-	5.926	6.279
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 2023 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
Investigate means of reducing processing costs for carbon-carbon composites; formulate initial materials-by-design workflow on high temperature metallic alloys and ceramics for leading edges (any regions of a body that encounters the free-stream flow); research manufacturing methods for ceramics and ceramic matrix composites for guidance. ***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; investigate ablation and oxidation resistance through torch assessments; characterize mechanical performance of various window and dome materials of interest. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase supports planned lifecycle of this effort.			
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 2023 Plans:*** Improved state-of-the-art toolsets and preliminary flight characterization including boundary layer transition and shock-boundary layer interactions on Army-relevant high-speed vehicle; conduct hypersonic ballistic range experimental capability improvements to refine and enhance the Army's ability to measure hypersonic vehicle behaviors; develop high-speed munition flight control algorithms to reduce cycle time and compensate for uncertainties. ***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 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase supports planned lifecycle of this effort.	-	1.663	2.081
Title: SBIR/STTR Transfer ***FY 2023 Plans:***	-	0.287	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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 2022	FY 2023	FY 2024
Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	-	7.876	8.360

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A