Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army											Date: May 2021	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
Total Program Element	-	141.154	201.750	105.168	-	105.168	-	-	-	-	-	-
AN1: *Narrowband SATCOM Technology*	-	3.836	-	-	-	-	-	-	-	-	-	-
AY6: *Soldier Squad Small Arms Armaments Technology*	-	17.590	13.122	8.825	-	8.825	-	-	-	-	-	-
AY8: *Small Arms Fire Control Technology*	-	-	1.828	4.172	-	4.172	-	-	-	-	-	-
AZ2: *Body Armor & Integrated Headborne Technology*	-	8.081	6.575	6.664	-	6.664	-	-	-	-	-	-
AZ5: *Soldier Protection Technology - Vulnerability*	-	7.770	11.974	9.357	-	9.357	-	-	-	-	-	-
AZ9: *Soldier Protection Advanced Tech - Detectability*	-	4.314	3.278	1.883	-	1.883	-	-	-	-	-	-
BB4: *Dismounted Soldier Survivability Materials*	-	4.742	2.991	2.828	-	2.828	-	-	-	-	-	-
BB5: *Physical Augmentation: Tech for Human Interactions*	-	1.438	1.451	1.332	-	1.332	-	-	-	-	-	-
BB7: *Exoskeleton: Technology for Man-Machine Interface*	-	1.534	1.541	-	-	-	-	-	-	-	-	-
BB9: *Human Performance Tech for Mobility & Lethality*	-	2.397	2.997	2.961	-	2.961	-	-	-	-	-	-
BC2: *Next Gen Mobility & Lethality Tech for Warfighters*	-	5.444	7.245	7.725	-	7.725	-	-	-	-	-	-
BC3: *Soldier Decision Making & Comms Performance Tech*	-	10.316	4.378	-	-	-	-	-	-	-	-	-
BC6: *Human Perf - Tech for Warfighter Enhancement*	-	2.566	2.918	3.350	-	3.350	-	-	-	-	-	-
BC7: *Training Technology (Other than STE)*	-	-	13.651	14.244	-	14.244	-	-	-	-	-	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army												Date: May 2021
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*							
BD1: *Adv Soldier Sensors/ Displays Tech for Dismounts*	-	4.763	11.100	11.651	-	11.651	-	-	-	-	-	-
BD6: *Soldier Sys Interfaces/ Integration- Sensor Tech*	-	1.077	1.084	0.513	-	0.513	-	-	-	-	-	-
BD8: *Soldier & Sm Unit Tactical Energy Tech*	-	8.769	9.043	4.467	-	4.467	-	-	-	-	-	-
BE1: *Support Technology to Mission Command*	-	0.696	-	-	-	-	-	-	-	-	-	-
BE3: *Joint Service Combat Feeding Technology*	-	3.832	4.109	4.024	-	4.024	-	-	-	-	-	-
BE6: *Reactive/Resp Surfaces & Matls-Soldiers & Sys*	-	2.632	6.215	2.955	-	2.955	-	-	-	-	-	-
BE8: *Synthetic Training Environment (STE) Technology*	-	14.802	13.649	14.741	-	14.741	-	-	-	-	-	-
BP9: *Soldier Lethality Technologies (CA)*	-	30.626	79.000	-	-	-	-	-	-	-	-	-
BR9: *Personnel & Airdrop Safety Technology*	-	3.929	3.601	3.476	-	3.476	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This PE conducts fundamental research on Soldier Lethality technologies to develop an integrated Soldier and Squad architecture of equipment and systems that improve Soldier and Small Combat Unit survivability, sustainability, mobility, combat effectiveness, and individual cognitive and physical readiness. To address the challenges of integrating multiple technologies and sub-systems, research conducted in this PE, significant Science and Technology applied research investments in all areas of Soldier Lethality, focus on how to improve the effectiveness of the technologies a Soldier utilizes and apply systems-level practices to mitigate constraints from size and weight of the equipment. Research areas encompass individual and crew-served weapon designs and technologies as well as applied research in lightweight and transparent armor materials to mitigate effects from blast and ballistic threats, counter explosive hazard detection, counter-sensor capabilities, and signature management of weapons, equipment, personnel and high value targets. This PE investigates, develops and designs materials, technologies, methodologies and system models required to experiment and optimize Soldier lethality and survivability through investments in mobility, human-agent teaming, and improved situational awareness interfaces and display technologies as well as to provide Soldier-borne power and energy materials and components that support multiple Soldier-borne systems. This PE also investigates Warfighter training technologies and develops the underpinning technologies to establish architecture standards and interfaces necessary for creating realistic synthetic environments to create a single, interconnected synthetic training system to enable Army units and leaders to conduct realistic multi-echelon / multi-domain combined arms maneuver and mission command training, increasing proficiency through repetition. Human Factors Engineering projects conduct applied research to design weapon systems standards, guidelines, handbooks, and Soldier training curriculum and tools.

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army	Date: May 2021
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*

Results of these efforts are transitioned within the Army Futures Command, the Program Executive Offices, Army Training and Doctrine Command (TRADOC), Army Medical Command (MEDCOM), Human Systems Integration (HSI) Directorate (Army G1), and the Army Test and Evaluation Command (ATEC).

Work in this PE complements PE 0603118A (Soldier Lethality Advanced Technology).

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

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	145.900	125.435	130.599	-	130.599
Current President's Budget	141.154	201.750	105.168	-	105.168
Total Adjustments	-4.746	76.315	-25.431	-	-25.431
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	79.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-4.746	-2.685			
• Adjustments to Budget Years	-	-	-25.431	-	-25.431

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: BP9: *Soldier Lethality Technologies (CA)*		
Congressional Add: *Medical simulation and training*	3.626	-
Congressional Add: *Active and passive camouflage concealment and deception*	3.000	-
Congressional Add: *Human systems integration*	10.000	-
Congressional Add: *Expeditionary mobile base camp technology*	2.000	-
Congressional Add: *SOCOM communications capability*	2.500	-
Congressional Add: *Soldier Lethality Technologies Program Increase*	5.000	-
Congressional Add: *Harnessing Emerging Soldier Lethality Technology Research*	4.500	-
Congressional Add: *Program increase - pathfinder airborne*	-	8.000
Congressional Add: *Program Increase - Pathfinder Air Assault*	-	10.000
Congressional Add: *Program increase - Rapidly deployable shelters*	-	3.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army	Date: May 2021
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Congressional Add: *Program increase - UTDD catalyst*	-	5.000
Congressional Add: *Program increase - lightweight body armor mechanisms and materials*	-	10.000
Congressional Add: *Program increase - advanced textile-based products*	-	6.000
Congressional Add: *Program increase - HEROES program*	-	5.000
Congressional Add: *Program increase - soldier ballistic technologies*	-	5.000
Congressional Add: *Program increase - medical simulation and training*	-	4.000
Congressional Add: *Program increase - body armor study*	-	4.000
Congressional Add: *Program increase - academic accelerator pilot program*	-	15.000
Congressional Add: *Program increase - Advanced ballistics technology for personal protective systems*	-	4.000
Congressional Add Subtotals for Project: BP9	30.626	79.000
Congressional Add Totals for all Projects	30.626	79.000

Change Summary Explanation

Program element decrease primarily due to the creation of a new program element, 0602184A - Soldier Applied Research. This PE has a focus on enabling technologies that are fundamental to Warfighter success and advancement.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) AN1 / *Narrowband SATCOM Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AN1: *Narrowband SATCOM Technology*	-	3.836	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project designs and develops technologies to enable gateway communications across disparate Narrowband Satellite Communications (SATCOM) networks, enabling resiliency in contested environments. The Narrowband SATCOM network is the largest tactical network operated by the Army to provide situational understanding across all echelons. This Project investigates technologies and protocols to enable risk mitigation solution sets and awareness through adaptive learning capabilities.

Work in this Project complements PE 0603463A (Network C3I Advanced Technology) / Project AN2 (Narrowband SATCOM 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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Narrowband Satellite Communication Technology	3.836	-	-
Description: This research effort designs and develops technologies to enable gateway communications across disparate Narrowband SATCOM networks, enabling resiliency in contested environments. The Narrowband SATCOM network is the largest tactical network operated by the Army to provide situational understanding across all echelons. This project investigates technologies and protocols to enable risk mitigation solution sets and awareness through adaptive learning capabilities.			
Accomplishments/Planned Programs Subtotals	3.836	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army											Date: May 2021	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*				Project (Number/Name) AY6 / *Soldier Squad Small Arms Armaments Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
AY6: *Soldier Squad Small Arms Armaments Technology*	-	17.590	13.122	8.825	-	8.825	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates individual and crew-served weapon designs and technologies that enhance the fighting capabilities and survivability of the dismounted Warfighter in support of all of the Services. In addition, it conceives and advances weapon concepts based on innovative ballistic and advanced incapacitation technologies that will enhance the defeat of hard and soft infantry targets at extended ranges based upon the Joint Service Small Arms Technology Development Strategy (JSATDS). The Project will continue to support technology needs from the all Services to include the Next Generation Family of Weapons. In addition, this Project will develop the technology/weapons concepts that will upgrade medium and heavy support weapons at echelons. Finally, this Project will perform research directed toward non-kinetic modalities to incapacitate combatants.

Work in this Project supports key Army needs and leverages the technical research of several PEs to include PE 0601102A (Defense Science Research) / Project AA7 (Mechanics and Ballistics), PE 0603118A (Soldier Lethality Advanced Technology), and PE 0602141A (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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Soldier/Squad Lethality Technology	2.072	4.103	4.027
Description: This effort conceives and investigates advanced weapons concepts based on innovative ballistic technologies that will enhance the defeat of hard and soft infantry targets at extended ranges to ensure overmatch in Soldier and Squad lethality. This effort will also perform research directed toward non-ballistic modalities to incapacitate combatants.			
FY 2021 Plans: Continue to identify novel lethal mechanisms for future weapons concepts and technical approaches for increased lethality at reduced energy for behind armor/barrier threats; utilize state of the art instrumentation to further characterize technology concepts to enable a reduction in dispersion for complex projectiles; determine benefits in capability for novel weapons systems for increased performance of heavy small caliber weapons as well as precision systems; and assess biological effects and incapacitation potential of advanced high powered microwave and acoustic directed energy technologies in small and large animal models.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** AY6 / *Soldier Squad Small Arms Armaments Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will design the basic theory for dispersion to reduce the dispersion complex lethal mechanisms required by next generation individual and precision (sniper) weapons; investigate advanced experimental capabilities to reduce the time and significantly increase the capacity of free flight spark ranges; investigate the potential capability for medium and heavy weapons that offer significant improvements in size, weight (reductions), and lethality (classified) performance; continue pursuing incapacitation potential of advanced high powered microwave and acoustic directed energy technologies in small and large animal models using new experimental facilities for determining underlying theory of these technologies. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Human-Agent Interactions for Intelligent Squad Weapons ***Description:*** This effort investigates enhanced target acquisition, situational awareness, and shooting performance through Soldier-centered integration of intelligent technologies and distributed information in augmented squad weapons. Enhances operational performance of individuals and teams of Soldiers through novel weapon and human-agent interaction technologies. ***FY 2021 Plans:*** Develop and document knowledge products, including data analysis documentation and guidelines for Soldier/Advanced Target Recognition (ATR) interaction methods, contributing to a framework for bidirectional ATR display and interaction techniques, aimed at maximizing Soldier-intelligent fire control teamed target acquisition performance and situational awareness within the usable field of view. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, effort has been realigned to PE 0602184A Project CN2.	3.408	3.713	-
Title: Next Generation Carbine Technology (NGCT) ***Description:*** This effort develops next generation squad weapon systems and ammunition by providing tech insertions to augment capabilities and mitigate risks. Mature small arms weapon system components and validate them through experimentation in support of the Joint Warfighter?s capability needs. Mature weapon system technology readiness levels and validate confidence of functionality in advanced operating scenarios.	1.333	-	-
Title: Next Generation Family of Ammo (NGFoA) ***Description:*** This effort designs and develops a family of ammunition for automatic rifles and carbine weapons with the objective of decreasing weight, increasing lethality and hit performance over current fielded systems; develops capabilities to defeat threat targets at extended ranges.	6.412	1.677	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** AY6 / *Soldier Squad Small Arms Armaments Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2021 Plans: Finalize maturation of component technologies for the next generation of small arms training rounds, training tracer projectiles, and ammunition training aides; conduct experiments with mature tracer component technologies to validate tracer design performance characteristics. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** NGFoA effort ends in FY 2021			
Title: Small Arms Enabling Technologies ***Description:*** This effort designs and develops small arms weapon systems, enablers, and ammunition technologies that will maintain decisive lethal overmatch capabilities to the Joint Warfighter. This effort matures small arms weapon system designs through experimentation in support of Joint Warfighter's capability needs. ***FY 2021 Plans:*** Investigate emerging small arms technologies to develop remote powered armament systems, advanced target recognition and aim augmentation, alternate barrel materials and coatings, signature reduction technologies, etc.; continue investigation of small arms remote armament component technologies for increasing the overall probability of hit. ***FY 2022 Plans:*** Will Investigate and conduct experiments on remote armaments for precision, volume, and counter defilade fires; augmentation technologies for increased weapon system/man-in-the loop performance; non-line of sight, three-dimensional battlefield target sensing and reconstruction; and technologies that reduce small arms weapon maintenance. Will investigate component technologies for future small arms concepts to enable a more efficient, effective, and lethal Joint Warfighter. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The increase provides for investigation and experiments for the Dismounted Soldier advances in denied and austere environments in the areas of NGSW supporting component technologies, passive technologies to reduce weapon system signature, and leverage and integrate emerging AI technology to weapon enablers.	4.365	3.629	4.798
Accomplishments/Planned Programs Subtotals	17.590	13.122	8.825

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** AY6 / *Soldier Squad Small Arms Armaments Technology*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) AY8 / *Small Arms Fire Control Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AY8: *Small Arms Fire Control Technology*	-	-	1.828	4.172	-	4.172	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project designs and develops enabling technology for advanced small arms fire control in order to achieve lethality overmatch by supporting target prioritization, enhancing processing of information from multiple sources, and investigating aim assistance tools which remove Soldier aim error. This Project specifically supports the Army Science and Technology Soldier Lethality modernization priority.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and the Soldier Lethality Cross Functional Team (CFT) efforts. All FY21 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

This Project complements work done in PE 0603118A (Soldier Lethality Advanced Technology) / AY7 (Small Arms Fire Control Advanced Technology).

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Adv. Fire Control Tech	-	1.828	4.172
Description: This Project investigates software and hardware mechanisms to enable enhanced kill chain processes on small arms platforms. This includes investigating artificial intelligence and neural network hardware, conducting experiments on both Commercial and Government Off-The-Shelf (COTS and GOTS) artificial intelligence and machine learning algorithms, and validating Soldier accuracy performance models. It also includes investigation of lightweight optical components and determines viability of weight reduction and balancing approaches.			
FY 2021 Plans: Refine technical requirements based on capability needs; investigate existing artificial intelligence and machine learning algorithms on COTS & GOTS; determine implementation and validation approaches as well as research of human-system integration and pairing; and mature components of polymer lens and housing technologies, and three-dimensional printing solutions.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** AY8 / *Small Arms Fire Control Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will investigate and validate mature technology development work for enhanced dismounted combatant/non-combatant automated target recognition algorithms; design improved decision aides for small arms maneuver; validate technical approaches through modeling and simulation; conduct investigations into the ability to recognize threats based on behavior. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The increase builds on the requirements defined in FY21 by way of engineering tasks execution in support of iterative designs and development for Small Arms Fire Control technologies for the Dismounted Soldier.			
Accomplishments/Planned Programs Subtotals	-	1.828	4.172

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) AZ2 / *Body Armor & Integrated Headborne Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AZ2: *Body Armor & Integrated Headborne Technology*	-	8.081	6.575	6.664	-	6.664	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates and develops materials for Soldier-borne protective equipment, such as body armor and combat helmets, to increase protection from ballistic, blast, and blunt impact threats. This Project also investigates and executes systematic studies to mature and develop materials, devices, systems and methods that enable the identification of protective solutions against ballistic, blast and directed energy threats. Included are investigations of emerging technologies, novel materials, and test methods and integration of personnel armor, combat helmets, hearing protection, eyewear, and other personal protective equipment items.

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 2020	FY 2021	FY 2022
Title: Body Armor & Integrated Headborne Technology	8.081	6.575	6.664
Description: This research effort supports the investigation of novel materials, component designs, and material modeling to design and develop technologies that protect Soldiers against ballistic, blast, and directed energy threats. This effort utilizes a cross-disciplinary, human-focused approach to develop technologies which optimize tradeoffs in ballistic and blast protective component design. This effort addresses the Army challenge of easing overburdened Soldiers in small units and aligns to Soldier protection modernization priorities.			
FY 2021 Plans: Mature components of an integrated single lens substrate for use in Soldier vision protection system that includes anti-fog, variable light transmission, and lenses with laser flash and dazzle protection capabilities; conduct analytical and laboratory studies to physically validate the performance of high hardness and anti-fog coatings to protect and extend the operational life of various Soldier-borne display technologies; validate the operating performance capability of the advanced blast simulator and its correlation to free field blast overpressure conditions from artillery and antipersonnel threats as a means to systematically study headborne equipment in a controlled blast environment; validate material composite pre-stress processing methods and investigate its use with multiple material substrates as a means to enhance the ballistic performance of multiple end-items.			
FY 2022 Plans: Will investigate the application of single lens technology with variable light transmission and active and passive anti-fog mitigation approaches from single curve substrates to complex curves shapes for incorporation into future head mounted displays and eye			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** AZ2 / *Body Armor & Integrated Headborne Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
protection; execute concept exploration efforts to study alternative headborne protection concepts from blast overpressure threats utilizing the advanced blast simulator to systematically study headborne equipment in a controlled blast environment; conduct experiments to systematically study emerging high performance materials, associated processing conditions to include layups, consolidation methods, temperature and pressure consolidation conditions with the objective of increasing protection against future small arms threat requirements. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	8.081	6.575	6.664

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) AZ5 / *Soldier Protection Technology - Vulnerability*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AZ5: *Soldier Protection Technology - Vulnerability*	-	7.770	11.974	9.357	-	9.357	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates and develops materials, methods, and models that enable design and integration of emerging material technologies into lightweight, flexible and modular Soldier equipment to protect against the range of existing and emerging threats for head, torso, and extremity protection. Specific research thrusts include the development of materials and mechanisms to enhance ballistic protection; computational models and associated experiments to provide a fundamental understanding of material properties and failure mechanisms, as well as correlation to ballistic/blast/blunt impact performance of Soldier personal protective equipment (PPE) and improved fibers, composite, and ceramic materials. Specific technologies support experimental helmets that reduce impact and blast loading to the head, Soldier torso protection systems to increase protection from ballistic and blunt impacts, and novel fibers and fabrics that provide additional survivability mechanisms.

Work in this Project supports key Army needs and is fully coordinated with several PEs and Projects to include PE 0602143A (Soldier Lethality Technology) and 0603118A (Soldier Lethality Advanced Technology); and leverages the technical research of several PEs to include PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics) and 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 Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Soldier Protection Technologies	4.043	3.936	3.640
Description: This effort develops integrated lightweight, flexible, and modular protection equipment that is tailored to support the 'Soldier as a system' approach for defeat of emerging threats. Research areas encompass high fidelity ballistic impact injury models for hard and soft tissues, novel ceramic architectures to include graded and hierarchically structured ceramics, and novel fiber solutions for backing materials to deliver Soldier protection systems to meet emerging ballistic and signature management threats. This effort supports small caliber lethal mechanisms research in PE 0602143A (Soldier Lethality Technology) / Project AY6 (Soldier Squad Small Arms Armaments Technology). ***FY 2021 Plans:*** Design and develop armor mechanisms to protect dismounted Soldiers from emerging ballistic threats through experimental and computational analysis; increase head protection through determination of advanced mitigation techniques; investigate thoracic			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** AZ5 / *Soldier Protection Technology - Vulnerability*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
soft tissue and hard tissue injury mechanisms; continue to explore new concepts in limb protection from blast events; validate armor model for behind armor blunt trauma metrics. ***FY 2022 Plans:*** Will validate armor mechanisms to protect dismounted Soldiers from advanced ballistic threats through experimental and computational analysis; conduct simulations and analyze results for active armor concepts across anthropometric spectrum (e.g. body measurements and proportions such as height and weight); explore helmet material designs to improve protection against ballistic impacts and blast exposure while reducing helmet weight ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, funding reduced as work in the area of hard tissue injury mechanisms was reduced.			
Title: Soldier-Borne Composite Materials ***Description:*** Utilizing understanding of fibers, fabrics, and composite materials, conduct applied research of emerging lightweight materials and structures to enable affordable designs for head, torso, and extremity protection systems. Provide quantitative scientific basis for modeling and simulation that result in materials that utilize new schemes to enhance Warfighter survivability. This effort supports Soldier Protection Technologies bullet. ***FY 2021 Plans:*** Explore the processing and layout of novel fibers and films as a composite for potential soft body/torso armor and head protection (helmets); and investigate computational methodology processes and the resulting structure-performance relationships of composites for helmets. ***FY 2022 Plans:*** Will assess improved material composite backers and helmet shells that utilize computational geometry and layering, improved fibers and films, and novel manufacturing methods such as pressure processing and fiber placement. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, funding increased to support additional assessments of composite materials utilizing novel manufacturing processes.	2.556	2.311	2.725
Title: Soldier-Borne Advanced Protection Materials ***Description:*** Utilizing understanding of protection materials such as armor ceramics and associated failure mechanisms, conduct applied research of emerging armor materials to enable affordable design of lightweight ballistic protective systems for the future Soldier. Provide quantitative scientific basis for modeling and simulation that result in materials that utilize new lethal mechanisms/ protection schemes for the individual Warfighter. This effort supports Soldier Protection Technologies bullet and small caliber	1.171	2.730	2.992

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** AZ5 / *Soldier Protection Technology - Vulnerability*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
lethal mechanisms research in PE 0602143A (Soldier Lethality Technology) / Project AY6 (Soldier Squad Small Arms Armaments Technology), ***FY 2021 Plans:*** Will explore novel ceramics and ceramic structures for ballistic applications; develop processing pathways for multiscale architectures and assess their ballistic performance; research experimental techniques to assess failure mechanisms for multiscale architectures under ballistically-relevant states of stress. ***FY 2022 Plans:*** Will explore computational methods to capture failure mechanisms in different material architectures, allowing pathways for future rifle projectile defeat materials development; investigate alternative processing methodologies for multi-scale architecture that provide higher resolution, broader geometric flexibility, or tailored interfaces, and explore novel ceramic blends and ceramic structures for improved ballistic performance at reduced weight; design high throughput modeling and experimental methodologies to accelerate correlations between material structure, properties, and processing with ballistic performance. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, funding increased to support additional work in the area of computational methods to capture failure mechanisms in different material architectures.			
Title: Multifunctional Soldier Materials - Soldier Augmentation ***Description:*** This effort researches novel multifunctional Soldier protection materials and associated processing science aimed at enabling critical Army applications in survivability via Soldier augmentation technologies. Research efforts include: multifunctional fibers, films, and coatings; adaptive and responsive materials for passive biomechanical assistance; materials for sensing body forces and kinematics; materials for high power and high speed actuation; actuator fibers and textiles; functionally graded materials; and color-changing materials. ***FY 2021 Plans:*** Explore the development of new materials and structures, both passive and active that can be integrated with the human body to modify human biomechanics, and /or change color on demand; determine metamaterial structures that can be reconfigured rapidly and with spatial complexity to re-direct load paths or enhance energy absorption in real time. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding realigned to support higher priority efforts in PE 0602181 (All Domain Convergence Applied Research), Project CM7 (Collaborative Convergence Applied Research).	-	2.997	-
Accomplishments/Planned Programs Subtotals	7.770	11.974	9.357

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** AZ5 / *Soldier Protection Technology - Vulnerability*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) AZ9 / *Soldier Protection Advanced Tech - Detectability*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AZ9: *Soldier Protection Advanced Tech - Detectability*	-	4.314	3.278	1.883	-	1.883	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates and designs novel materials, technologies, techniques and applications increasing the capabilities of camouflage and concealment against known and emerging sensor threats. The results of this Project enable effective deception capabilities, combinations of physical and electronic signature decoy components, and determination of analytical processes for modeling signature management technologies during multi-domain operations. These technologies will provide subsystems and concepts that shall decrease the probability of detection and targeting by peer and near-peer adversaries, enabling freedom of movement of semi-independent and dispersed formations and increased protection of dismounted soldiers. Components designed under this Project will transition to Advanced Technology Development efforts in Soldier Lethality protection/survivability Projects to provide disruptive Camouflage, Concealment and Deception technologies to the Operational Army to support expeditionary maneuver in the Multi-Domain Battle Environment and retain windows of advantage.

Work in this Project supports key Army needs and leverages/complements the technical research of several PEs to include PE 0601102A (Defense Research Sciences), PE 0602143A (Soldier Lethality Technology) / Project BB4 (Dismounted Soldier Survivability Materials), Project AZ5 (Soldier Protection Technology - Vulnerability), Project BE1 (Support Technology to Mission Command), PE 0603118A (Soldier Lethality Advanced Technology) / Project AZ8, (Soldier - Small Unit Detectability Adv Technology), and PE 0602712A (Countermine Systems) / Project H35 (Camouflage and Counter-Recon Tech).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Camouflage, Concealment and Decoys Technologies for Soldier and High-Value Assets	4.314	3.278	1.883
Description: This effort investigates and designs materials, processes, and concepts for innovative camouflage, concealment and deception technologies for Soldier and High-Value assets to defeat advanced current and emerging adversary Intelligence, Surveillance and Reconnaissance (ISR) threats including multispectral, hyperspectral and Light Detection and Ranging (LiDAR) sensors, and to reduce the probability of detection in multi-domain operations. Investigates analytical processes to model material and system performance and predict probability of detection in the multi-domain operational environment, assisting in closing the capability gap between current camouflage, concealment, and deception technologies and defeating enemy sensorial capabilities in future operating environments.			
FY 2021 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** AZ9 / *Soldier Protection Advanced Tech - Detectability*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Leverage performance effectiveness of camouflage materiel technologies to mature components of most promising solutions; determine design metrics that will be relevant for defeating known emerging sensor threats; leverage data showing vulnerability against ground surveillance radar for experimenting with flexible Soldier worn materials to reduce Soldier radar cross section; investigate technologies to alert Soldiers if detected by ground surveillance radar; design and mature components of active color changing materials for future integration into Soldier clothing and individual equipment; research alternative active and passive identification of friend versus foe capabilities for the individual Soldier to provide tailorable mission-dependent capability; validate performance effectiveness of new camouflage technologies against continuously emerging and changing threats based on previous results; evaluate camouflage system solutions in support of new/emerging hyperspectral and LiDAR sensor defeat; interrogate candidate deception solutions; continue to investigate color and optical property changing materials for high value asset concealment, utilizing varying environments. ***FY 2022 Plans:*** Will conduct systematic studies of fiber processing, additives, coatings and complex geometries to assess new techniques that enable heat transfer and emission control of Soldier thermal signatures against near peer and peer sensor threats operating in the electromagnetic spectrum; investigate virtual reality based methods to assess operational impact of camouflage effectiveness against direct line of sight small arms engagement scenarios and developing advanced (lifelike) Soldier camouflage avatars; continue to design and mature components of active color changing materials assessing film based materials incorporating recent advancements in electrowetting, electrodesposition, and plasmonics, for future integration into Soldier clothing and individual equipment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding in this effort was realigned to PE 0602146A (Network C3I Technology) / AQ9 (Expeditionary Data to Decisions Technology).			
Accomplishments/Planned Programs Subtotals	4.314	3.278	1.883

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BB4 / *Dismounted Soldier Survivability Materials*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BB4: *Dismounted Soldier Survivability Materials*	-	4.742	2.991	2.828	-	2.828	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates fibers, textiles, components, and materials focused on enhancing Soldier survivability from combat threats (flame and thermal, blast and ballistic, multispectral sensor, and laser threats) and environmental threats (e.g., cold, heat, wet, vector, antimicrobial, etc.) to increase operational effectiveness while decreasing the Soldier's physical and cognitive burden. The results from this Project will transition knowledge, materials, subcomponents and methods to Advanced Technology Development efforts in support of enhancing Soldier Lethality by providing protective material solutions focused on the aspects of dismounted movement and maneuver operations of the Army. This Project develops and applies validation methods that enable systematic studies of human systems integration principles and practices to protective equipment materials and designs to advance the understanding of trade-offs between protection, lethality, and mobility.

Work in this Project supports key Army needs and leverages/complements the technical research of several PEs to include PE 0601102A (Defense Research Sciences), PE 0602143A (Soldier Lethality Technology) / Project AZ5 (Soldier Protection Technology - Vulnerability), and PE 0603118A Soldier Lethality Advanced Technology / Project BB3 (Dismounted Soldier Survivability Equip/Tech Integ).

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 2020	FY 2021	FY 2022
Title: Dismounted Soldier Survivability Materials	4.742	2.991	2.828
Description: This effort investigates materials, devices and methods that aid in the design and development of multifunctional materials for Soldier protective clothing and individual equipment. This effort conducts research to investigate and identify multi-functional material properties at the micron and sub-micron level to mitigate Soldiers susceptibility and vulnerability to operational threat, i.e., flame, thermal, environmental, and multispectral sensors. Efforts also investigate and develop devices and systems that enable extended dismounted mission duration by reducing the demand for water resupply and enabling Squad organic water filtration systems			
FY 2021 Plans: Conduct experiments on novel multi-component fiber architectures and fabric treatments to incorporate functionalities for improved durability over the life of the garment, providing more effective protection against operational threats for a longer period; design fibers and fabrics that can transmit power supporting integration of wearable electronics for situational awareness			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BB4 / *Dismounted Soldier Survivability Materials*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
and decreased load; continue to investigate and validate materials and processes that enable individual Soldiers to desalinate contaminated water such that proper hydration levels can be maintained from any indigenous water source. ***FY 2022 Plans:*** Will explore the incorporation of additional dimensions to fabric structures by researching approaches to take fibers and fabrics from traditional two-dimensional substrates to a third dimension, adding functionality within the substrate, to include stimuli-responsive fibers and yarns for real-time situational awareness, physiological monitoring, and environmental protection; investigate non-traditional procedures and techniques using additive approaches to tailor multi-functionality of Soldier personnel protective equipment at very small length scales and incorporate the results of prior year?s multi-functional and e-textile findings; in support of developing personal water filtration capabilities to enable Soldiers to filter and hydrate from contaminated water sources, conduct experiments of leading candidate sophisticated breadboard hardware, capable of separating salt and other contaminants from brackish and salt water sources; investigate the potential of handheld or embedded sensing concepts to provide continuous monitoring of water quality, before and after treatment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding decrease reflects realignment to support higher priority efforts in PE 0602181 (All Domain Convergence Applied Research) / CM7 (Collaborative Convergence Applied Research) and PE 0603041 (All Domain Convergence Advanced Research) / CM2 (Collaborative Convergence Adv Tech Development).			
Accomplishments/Planned Programs Subtotals	4.742	2.991	2.828

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BB5 / *Physical Augmentation: Tech for Human Interactions*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BB5: *Physical Augmentation: Tech for Human Interactions*	-	1.438	1.451	1.332	-	1.332	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project advances the understanding of human augmentation and interaction for enhanced operational performance with a focus on adaptation, training, human variability, metrics/methodologies for assessment, and task quantification. Research encompasses conducting applied research to develop metrics, measures, tools, and techniques to quantify and understand the relationships that enable maximum effectiveness of integrated Soldier-augmentation technologies. The resulting data are the basis for physical augmentation systems and equipment design standards, guidelines, and intelligent agent requirements to improve equipment operation and Soldier-system synergy. Application of this research will yield reduced workload, reduced Soldier training requirements, enhanced Soldier lethality/survivability, user acceptance, and allow Soldiers to achieve maximum performance. Major efforts explore novel techniques for Soldier assessment, characterization of individual variability effects on performance, development of evidence based design guidance for the application of augmentation technologies, exploration of the relationship of exoskeleton and physical assist device adaptation and baseline Soldier parameters such as gait, neuromuscular motor control and proprioception. This Project will also explore novel training paradigms for reduced Soldier-augmentation technology adaptation times to address current and future warrior performance issues. Individual efforts exploit wearable sensor technologies, translate surrogate task performance to operational outcomes, develop approaches to distinguish tasks and individual state and intent of movement, establish database of human movement variability to inform intelligent system design, and identify high impact applications of augmentation.

Work in this Project supports key Army needs and leverages the technical research of several PEs to include PE 0602143A (Soldier Lethality Technology) / Project BC2 (Next Gen Mobility & Lethality Tech for Warfighters), Project BB9 (Human Performance Tech for Mobility & Lethality), Project BC6 (Human Perf - Tech for Warfighter Enhancement), and Project BB7 (Exoskeleton: Technology for Man-Machine Interface); and supports PE 0603118A (Soldier Lethality Advanced Technology) / Project BC1 (Human Performance AdvTech for Mobility & Lethality), Project BB6 (Physical Augmentation: Adv Tech for Field Demo), and Project BB8 (Soldier Centric Advanced Technology). Additionally, work in this Project complements and is fully coordinated with the Medical Research and Development Command under the Military Operational Medicine Research Program within PE 0602787A (Medical Technology) / Project 869 (Warfighter Health Prot & Perf Stnds), and the Veteran Administration's exoskeleton research area. This Project also complements and is fully coordinated with work performed across Army, Navy, and Air Force under the Reliance 21 Human Systems Community of Interest: Protection, Sustainment, and Warfighter Performance and with our international partners through The Technical Cooperation Program / Human Resources and Performance Group / Panel JP1 (TTCP HUM JP1).

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 2020	FY 2021	FY 2022
Title: Training Adaptation and Movement Science	1.438	1.451	1.332

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BB5 / *Physical Augmentation: Tech for Human Interactions*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Description: This effort investigates the science behind movement for physical augmentation to maximize mobility capacity and training adaptation to decrease learning curve with physical augmentation systems (e.g. physical assist devices, exoskeletons). This work will enable the Army to make informed decisions on the ultimate effectiveness of human augmentation technologies before significant resources are expended. ***FY 2021 Plans:*** Mature design criteria and develop training interventions to optimize physical augmentation systems for the greatest performance benefit; validate design criteria for smart controls of augmentation systems that are capable of anticipating changes in movement states (e.g. walk to sprint) and adjusting in real time based on previously categorized Soldier movement characteristics; conduct experiments that manipulate control parameters of augmentation systems to determine optimal control settings for various tasks and individuals. ***FY 2022 Plans:*** Will refine and modify training interventions for more complex, potentially multi-joint devices that may require novel or adjusted training interventions to optimize physical interactions between the Soldier and augmentation systems; improve robustness of smart control systems for characterizing movement and predicting movement intent, and will evaluate in varied environments; expand experiments to include additional Soldier loads, grades, and speeds, that manipulate control parameters of augmentation systems to determine optimal control settings for additional Soldier tasks (e.g., loaded walking, running) and to account for individual variability. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding decrease reflects realignment to support higher priority efforts in PE 0602181 (All Domain Convergence Applied Research) and PE 0603041 (All Domain Convergence Advanced Research).			
Accomplishments/Planned Programs Subtotals	1.438	1.451	1.332

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army											Date: May 2021	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*				Project (Number/Name) BB7 / *Exoskeleton: Technology for Man-Machine Interface*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
BB7: *Exoskeleton: Technology for Man-Machine Interface*	-	1.534	1.541	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project conducts applied research on metrics, measures, tools, and techniques to understand the relationships which enable maximum effectiveness of integrated Soldier-augmentation technologies. The resulting data are the basis for physical augmentation systems and equipment design standards, guidelines, and intelligent agent requirements to improve equipment operation and Soldier-system synergy. Application of this research will yield reduced workload, reduced Soldier training requirements, enhanced Soldier lethality/survivability, user acceptance, and allows the Soldier and systems to jointly achieve maximum performance. Major efforts explore novel techniques for Soldier assessment, characterization of individual variability effects on performance, and development of evidence based design guidance for the application of augmentation technologies to address current and future warrior performance issues. Individual efforts exploit wearable sensor technologies, translate surrogate task performance to operational outcomes, develop approaches to distinguish tasks and individual state, establish database of human movement variability to inform intelligent system design, and identify high impact applications of augmentation.

Results of these efforts supports key Army needs and leverages the technical research of PEs 0602143A (Soldier Lethality Technology) and 0603118A (Soldier Lethality Advanced Technology). Additionally, this work complements and supports the Medical Research and Development Command under PE 0602787A (Medical Technology), Army Training and Doctrine Command (TRADOC), Human Systems Integration (HSI) Directorate (Army G1), and the Army Test and Evaluation Command (ATEC).

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 2020	FY 2021	FY 2022
Title: Exoskeleton	1.534	1.541	-
Description: This effort will accelerate Soldier lifting and mobility capabilities through applied research on exoskeleton systems with improved safety and reduced training requirements.			
FY 2021 Plans: Conduct experiments with integrated operational scenario and performance metrics for assessment of dismounted Soldier performance; expand models of human movement variability and performance outcomes to inform development of adaptive system designs and control approaches.			
FY 2021 to FY 2022 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BB7 / *Exoskeleton: Technology for Man-Machine Interface*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Funding realigned in FY 2022 to higher priority Artificial Intelligence efforts within in this PE 0602143A.			
Accomplishments/Planned Programs Subtotals	1.534	1.541	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BB9 / *Human Performance Tech for Mobility & Lethality*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BB9: *Human Performance Tech for Mobility & Lethality*	-	2.397	2.997	2.961	-	2.961	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates human performance based information portrayal system design parameters that integrate mobility & lethality considerations (such as cognitive workload, target discrimination and engagement, and fatigue) into training/education tools, mission command platforms, and technologies that help Soldiers more rapidly and efficiently acquire complex skills and make decisions quickly from training through mission planning and execution. This Project supports the Measuring and Advancing Soldier Tactical Readiness and Effectiveness (MASTR-E) Science and Technology program supported by the Office of the Secretary of Defense Close Combat Lethality Task Force.

Work in this Project directly supports integration of design guidance for multiple PE/Projects including PE 0603118A (Soldier Lethality Advanced Technology) / Project BD7 (Soldier Sys Interfaces/ Integration-Sensor Adv Tech), Project AY9 (Body Armor & Integrated Headborne Advanced Tech), and Project BC9 (Adv Soldier Sensors/ Displays AdvTech for Dismounts).
This Project is fully coordinated and complementary with the other PE/Projects in support of MASTR-E to include the following: PE 0602143A (Soldier Lethality Technology) / Projects BC6 (Human Perf-Tech for Warfighter Enhancement), BC2 (Next Gen Mobility & Lethality Tech for Warfighters), and PE 0603118A (Soldier Lethality Advanced Technology)/ Projects BC1 (Human Performance AdvTech for Mobility & Lethality). This Project also leverages PE 0603118A (Soldier Lethality Advanced Technology) / Project BD7 (Soldier Sys Interfaces/ Integration-Sensor Adv Tech), Project AY9 (Body Armor & Integrated Headborne Advanced Tech), and Project BC9 (Adv Soldier Sensors/ Displays AdvTech for Dismounts).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy and the Soldier Lethality Cross Functional Team (CFT), as well as the Office of the Secretary of Defense's Close Combat Lethality Task Force.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Human Interaction for Situational Understanding	2.397	2.997	2.961
Description: This effort investigates, designs, and develops design guidance for information portrayal systems and sub-systems in augmented/virtual reality that enable Soldiers to make better, faster decisions for close combat operations at the small unit level. This effort also conducts experiments to populate performance models that have application across materiel and non-materiel solutions.			
FY 2021 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BB9 / *Human Performance Tech for Mobility & Lethality*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Investigate the impact of virtual reality and augmented reality design parameters (e.g. graphical level of detail, uncertainty, degraded network conditions, focal depth) on decision-making, situational awareness, and navigation; continue to investigate Soldiers? response time, cognitive burden, and behavioral measures of performance to inform what and how information should be portrayed to a Soldier in order for it to be meaningful and actionable. ***FY 2022 Plans:*** Will conduct experiments to determine the best approaches for visually cueing Soldiers for rapid target acquisition via augmented reality displays; continue to investigate the impact of mixed reality design parameters (e.g., graphical level of detail, uncertainty, degraded network conditions, focal depth) in ambulatory settings on decision-making, situational awareness, and navigation (including subterranean environments). This work will transition for further maturation and demonstration to a variety of partners including TRADOC Mobile (for schoolhouse distribution), CCDC Armaments Center, CCDC Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center, the Synthetic Training Environment-CFT, and PM-Integrated Visual Augmentation System (IVAS). ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflective of planned project lifecycle.			
Accomplishments/Planned Programs Subtotals	2.397	2.997	2.961

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army											Date: May 2021	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*				Project (Number/Name) BC2 / *Next Gen Mobility & Lethality Tech for Warfighters*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
BC2: *Next Gen Mobility & Lethality Tech for Warfighters*	-	5.444	7.245	7.725	-	7.725	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates the means to monitor, assess and predict Soldier and squad shoot and move performance to provide design guidance for individual and mission specific equipment (e.g. individual protection, small arms, load carriage, etc.). Research conducted focuses on translating mission tasks to measures of human performance. These measures of human performance will inform predictive algorithms and human based modeling and simulation that enable Soldier performance trade space analysis for acquisition, training, and operations. These data and algorithms will allow us to determine the impact of new capabilities on Soldier and Squad performance and effectiveness. This Project supports the Measuring and Advancing Soldier Tactical Readiness and Effectiveness (MASTR-E) Science and Technology program supported by the Office of the Secretary of Defense Close Combat Lethality Task Force.

This Project is fully coordinated and complementary with the other PE/Projects in support of MASTR-E to include the following: PE 0602143A (Soldier Lethality Technology) / Projects BC6 (Human Perf-Tech for Warfighter Enhancement), BB9 (Human Performance Tech for Mobility & Lethality), and PE 0603118A (Soldier Lethality Advanced Technology)/ Projects BC1 (Human Performance AdvTech for Mobility & Lethality). This Project also leverages PE 0603118A (Soldier Lethality Advanced Technology) / Project AY9 (Body Armor & Integrated Headborne Advanced Tech), Project AY5 (Soldier Squad Small Arms Armaments Advanced Technology), Project BD7 (Soldier Sys Interfaces/Integration-Sensor AdvTech), and Project BB6 (Physical Augmentation: Adv Tech for Field Demo).

Work in this Project complements and is fully coordinated with the Medical Research and Development Command under the Military Operational Medicine Research Program as well as Defense Medical Research and Development Program under Military Operational Medicine (JPC-5) to include Projects in PE 0602787A (Medical Technology). This Project also complements and is fully coordinated with work performed across Army, Navy, and Air Force under the Reliance 21 Human Systems Community of Interest: Protection, Sustainment, and Warfighter Performance.
The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and the Soldier Lethality Cross Functional Team (CFT), as well as the Office of the Secretary of Defense Close Combat Lethality Task Force.

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

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2020**	**FY 2021**	**FY 2022**
Title: Human Interaction for Mobility & Lethality	5.444	7.245	7.725
Description: This effort investigates and develops human performance based design guidance for protection and weapon systems and sub systems to improve the mobility and lethality of individuals and small units. The applied research translates traditional means for measuring and understanding human performance to the means to conduct assessment for Warfighter and small unit readiness and/or new capabilities.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BC2 / *Next Gen Mobility & Lethality Tech for Warfighters*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2021 Plans: Identify, validate, and mature components of innovative wearable sensors and algorithms for monitoring and assessment of situational awareness, cognitive state, and decision-making during critical Soldier tasks to provide the means for Soldier and Squad assessment for both training and test & evaluation purposes; identify predictive measures for Soldier shoot, move, communicate, navigate, and decide tasks during conditions of physical and cognitive stress in future operating scenarios; determine quantitative data and algorithms to populate commander decision aids, a predictive squad performance model, and the Synthetic Training Environment (STE). ***FY 2022 Plans:*** Will design processing pipeline to prepare data for analysis and interpretation; validate innovative wearable sensors for maturity of the technology and evaluate dimensionality reduction techniques; validate predictive algorithms for monitoring and assessment of situational awareness, cognitive state and decision-making during critical Soldier tasks to provide the means for Soldier and Squad assessment for both training and test & evaluation purposes; refine predictive measures for Soldier shoot, move, communicate, navigate, and decide tasks during conditions of physical and cognitive stress in future operating scenarios; through machine learning, develop performance algorithms and a predictive squad performance model for validation in a relevant environment; develop additional head supported mass requirements based on Soldier task performance, design guidance for maxillofacial protection, and guidance for the design of headborne displays that enables cognitive/perceptual performance, including decision making and situation awareness ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	5.444	7.245	7.725

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BC3 / *Soldier Decision Making & Comms Performance Tech*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BC3: *Soldier Decision Making & Comms Performance Tech*	-	10.316	4.378	-	-	-	-	-	-	-	-	-

Note

This project was realigned from 0602143A / BC3 to 0602184A / CO2.

A. Mission Description and Budget Item Justification

This Project conducts applied research to create analytical and empirical capabilities to characterize, model, and forecast human behavior related to cyber electromagnetic events through experimentation and field data collection. The result is increased mission effectiveness that enables strong mission command, intelligence operations, and cyber defenses, which lead to high information sharing, situational awareness, and collaboration. Major efforts focus on applied research to understand the conduct of effective cyber electromagnetic operations in that knowledge is required to create and effectively deploy cyber work systems that optimize human-machine interactions and account for operator and adversary behavior to achieve maximum effects.
Results of these efforts are provided to Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) Program Managers, Human Systems Integration (HSI) Directorate (Army G1), and the Army Test and Evaluation Command (ATEC).

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 2020	FY 2021	FY 2022
Title: Soldier Performance in Sociotechnical Environments	10.316	2.929	-
Description: This research provides human cyber operations assessment and advanced human decision-support capabilities to deploy cyber work systems that optimize human-machine interactions and account for operator and adversary behavior. Without these capabilities, future cyber work systems will be too complex and burdensome for operator use and training resulting in critical bottlenecks as operators have to ?catch-up? with the speed of cyber activity. This research also supports technologies for Squad-level SA assessment (information visualization) that provide command-level decision support with communication and intervention capabilities. Research focuses on algorithms for the quantification and visualization of collective uncertainty at the squad level for mission command decision making. This effort also supports the monitoring and assessing of Soldier tactical readiness and effectiveness through technologies and approaches for opportunistic human sensing.			
FY 2021 Plans: Develop and document knowledge products capturing best-practices and frameworks for the creation and exploitation of a physiological time-series database to enable Soldier performance prediction; conduct experiments with advanced machine			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BC3 / *Soldier Decision Making & Comms Performance Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
learning algorithms on physiological time-series data to quantify situational awareness and predict performance of the dismounted Soldier/Squad. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, this effort is being realigned to PE 0602184A Project CO2 Soldier-Intelligent Technology Research.			
Title: Algorithms for Sensing Soldier in Mission Context ***Description:*** This effort investigates enhanced decision making under conditions of uncertain, complex, time sensitive, and dynamically changing information to optimize human-artificial intelligence (AI) shared situational understanding. Enhances operational performance of individuals and teams of Soldiers through novel visualization technologies that represent complex time-sensitive information in uncertain dynamic environments. ***FY 2021 Plans:*** Develops techniques for customized and intuitive visualizations to translate disparate and uncertain sources of complex, dynamic information into actionable knowledge for improved mission critical decision making. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, this effort is being realigned to PE 0602184A Project CO2 Soldier-Intelligent Technology Research.	-	1.449	-
Accomplishments/Planned Programs Subtotals	10.316	4.378	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BC6 / *Human Perf - Tech for Warfighter Enhancement*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BC6: *Human Perf - Tech for Warfighter Enhancement*	-	2.566	2.918	3.350	-	3.350	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates and develops mechanisms for safely and effectively optimizing and enhancing Warfighter ability to shoot, move, communicate, and decide. These mechanisms have the potential to exploit the Soldier and Squad as the capability platform beyond materiel solutions provided to the individual and small unit. This project also conducts experiments to populate human performance models that enable tradespace analysis for portions of doctrine, organization, training, materiel, leadership and education, personnel and facilities (DOTMLPF) analysis. This Project supports the Measuring and Advancing Soldier Tactical Readiness and Effectiveness (MASTR-E) Science and Technology program supported by the Office of the Secretary of Defense Close Combat Lethality Task Force.

This Project is fully coordinated and complementary with the other PE/Projects in support of MASTR-E to include the following: PE 0602143A (Soldier Lethality Technology) / Projects BC2 (Next Gen Mobility & Lethality Tech for Warfighters), BB9 (Human Performance Tech for Mobility & Lethality), and PE 0603118A (Soldier Lethality Advanced Technology)/ Projects BC1 (Human Performance AdvTech for Mobility & Lethality). This Project also leverages PE 0603118A /BD7 (Soldier Sys Interfaces/Integration-Sensor AdvTech)), PE 0602143A /BE3 (Joint Service Combat Feeding Technology) and PE 0603118A /BE2 (Joint Service Combat Feeding Advanced Technology). It also has potential to inform materiel solutions within PE 0603118A (Soldier Lethality Advanced Technology) for the Soldier/Small unit.

Work in this Project complements and is fully coordinated with the Medical Research and Development Command under the Military Operational Medicine Research Program as well as Defense Medical Research and Development Program under Military Operational Medicine (JPC-5) to include Projects in PE 0602787A (Medical Technology). This Project also complements and is fully coordinated with work performed across Army, Navy, and Air Force under the Reliance 21 Human Systems Community of Interest: Protection, Sustainment, and Warfighter Performance. Work in this Project complements and is fully coordinated with research at the US Army Combat Capabilities Development Command Army Research Laboratory (ARL).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and the Soldier Lethality Cross Functional Team (CFT), as well as the Office of the Secretary of Defense Close Combat Lethality Task Force.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Human Performance Technology for Warfighter Enhancement	2.566	2.918	3.350
Description: This effort investigates mechanisms for exploiting human physiology to develop safe and effective interventions that create smarter, faster, more lethal Close Combat Warfighters. This work will result in a Soldier's ability to shoot, move,			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BC6 / *Human Perf - Tech for Warfighter Enhancement*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
communicate, and decide faster than an adversary. Findings from these experiments will leverage existing systems and platforms to get the greatest human performance return in training and operations. ***FY 2021 Plans:*** Conduct experiments to investigate the trade space for whom, when, and how neurostimulation is effective for improving tactically relevant skill acquisition and performance; compare and validate available neurostimulation systems for administration and efficacy for performance enhancement; validate the individualized Soldier benchtop gut microbiome model to determine inter and intra personnel variations for enabling higher precision recommendations for nutritional interventions that enhance Soldier performance via the gut/brain connection. ***FY 2022 Plans:*** Will design beta neurostimulation trade space tool and continue experiments to investigate for whom, when, and how neurostimulation is effective for improving tactically relevant skill acquisition and performance; conduct experiments and collect data to quantify the impact of neurostimulation on measures of small arms kill chain performance including threat detection, classification, and marksmanship; investigate biomarkers from the gut microbiome related to Soldier performance outcomes; conduct experiments to characterize candidate probiotic interventions to augment Soldier performance and recovery in stressful operational environments. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase reflects support of increased effort on the neurostimulation trade space tool development and quantifying the impact on small arms kill chain performance measures.			
Accomplishments/Planned Programs Subtotals	2.566	2.918	3.350

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BC7 / *Training Technology (Other than STE)*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BC7: *Training Technology (Other than STE)*	-	-	13.651	14.244	-	14.244	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates novel medical training simulations that address all levels of care through improvements in haptic feedback and automated performance assessments in support of Army medical Individual Critical Task Lists (ICTLs). This Project designs and develops early proof-of concept training systems to support non-traditional medical areas, such as dental training simulations. This Project conducts research in immersive virtual, mixed, and augmented reality environments that stimulate human senses (e.g. sight, sound, and touch) and also conducts experiments to understand how users interface with the technology in order to improve the realism of simulation environments and therefore create enhanced immersion and more effective training systems. Research is also conducted to support the modernization of the current Live Training Environment (LTE) to allow fair fight engagements across all training environments and training devices, to include the cyberspace domain.

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) and at the Institute for Creative Technologies (ICT) University Affiliated Research Center (UARC) at the University of Southern California.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Medical Training Technology	-	3.190	3.644
Description: Included in this effort will be the development of new medical training simulations to train medical personnel across all levels of care. Improvements in haptic capabilities will ensure hyper bio-fidelity for all levels of care. Automated measures of student performance will support Army medical Individual Critical Task Lists (ICTLs). Research areas will also include more realistic tissue properties supporting part-task trainers and modular patient simulator systems. Initial exploration of Army ICTLs will result in early proof-of-concept development of proof-of concept training systems to support non-traditional medical areas, such as dental training simulations. ***FY 2021 Plans:*** Develop haptics capabilities supporting augmented, mixed, and virtual reality by extending sense of hyper bio-fidelity and integrating emerging research into automated objective performance measures supporting Individual Critical Task Lists (ICTLs); develop proof-of-concept training systems to close capability gaps between current simulation technologies and ICTL requirements; validate usability studies and training effectiveness evaluations to gauge value of initial proof-of-concept development efforts; investigate updates to military medical training protocols (e.g., new emphasis on prolonged field care);			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BC7 / *Training Technology (Other than STE)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
develop research plans to include proof-of-concept development, usability studies, technology, and training effectiveness evaluations. ***FY 2022 Plans:*** Will design automated, multi-sensor, computer vision and AI-based medical grading and mentoring capabilities; determine if direct brain measures can be correlated to medical knowledge transfer; investigate additive manufacturing capabilities to create soft and hard tissues based on human anatomic measures; determine smart medical device surrogates for training on dumb patient manikins; investigate the usability of hyper fidelity haptic delivery in mixed and virtual medical training environments. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Warfighting M/S Concepts and Design (ICT) ***Description:*** This Project designs and develops photorealistic synthetic environments, multi-sensory interfaces, artificially intelligent agents, and human performance assessment technologies to create virtual, augmented, and mixed reality simulation environments for training. This Project uses advanced modeling, simulation, and leadership development techniques to leverage the emerging immersive technologies of industry and the research and development community to advance the Army's capabilities. ***FY 2021 Plans:*** Conduct research on immersive, virtual, mixed, and augmented reality environments that incorporate senses such as sight, sound, and touch; will develop tools, techniques and technologies to understand how users interface with technology to improve perceptions of immersion in simulated environments to create enhanced realism and more effective training systems. ***FY 2022 Plans:*** Will investigate visual abstraction techniques to portray objects in resource constrained (low bandwidth, reduced computing power) virtual environments without a loss in training effectiveness; design a common framework allowing collaboration across multiple disciplines to design virtual human appearances and behaviors to create interactive artificially intelligent characters for training. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding realigned from another task within this Project (Innovative Synthetic Training) reflecting a shift in research focus from the near term development of the Synthetic Training Environment (STE) capabilities to longer term research supporting training of multi-domain operations through the application of artificial intelligence.	-	1.272	3.872
Title: Cyberspace Electromagnetic Activities (CEMA) Effects Modeling and Simulation	-	1.464	1.472

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BC7 / *Training Technology (Other than STE)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Description: This effort investigates and develops capabilities to more accurately model and simulate Cyberspace Electromagnetic Activities (CEMA) necessary to support training events for Corps and below. ***FY 2021 Plans:*** Mature cloud-based network simulation components to support collective Army cyber training events; determine standard data representations to tag information on simulated networks sufficient for training Information Warfare techniques relevant to the conduct of Multi-Domain Operations (MDO); investigate collective training measurement methods for CEMA training assessments. ***FY 2022 Plans:*** Will investigate the training fidelity of cloud-based network simulation services to support collective Army cyber training events; design and develop software to tag information on simulated networks to enable training Information Warfare techniques relevant to the conduct of Multi-Domain Operations (MDO); investigate techniques to validate collective training measurement methods for CEMA training assessments. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Innovative Synthetic Training Technology ***Description:*** This effort investigates and designs methods of applying Artificial Intelligence (AI) into the STE to simulate a fully immersive environment in large urban settings with a population of adaptable, noncombatant virtual human agents for increasing the realism and complexity of training scenarios. In addition, it develops tools, techniques and technologies for improving the immersion of human senses within simulation environments with the goal of creating enhanced realism within the simulated environment. ***FY 2021 Plans:*** Investigate neural networks and reinforcement learning techniques to simulate a ?fabric of Life? or fully immersive environment in a large urban setting with the population of adaptable, noncombatant virtual human agents to increase the realism and complexity of training scenarios; design and develop photorealistic synthetic environments, multi-sensory interfaces, artificially intelligent agents, and human performance assessment technologies to create virtual, augmented, and mixed reality simulation environments for training; investigate and design techniques and methods for integrating different sensory cues into virtual environments that result in enhanced training and leader development; and validate the design of virtual humans that embody natural language, gesture, gaze, and language understanding to simulate conversational speech within virtual humans. ***FY 2022 Plans:*** Will investigate reinforcement learning techniques using neural networks to create artificially intelligent entities in synthetic, virtual training environments to simulate complex military training behaviors; investigate the use of photogrammetric techniques	-	5.507	2.994

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BC7 / *Training Technology (Other than STE)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
to create photorealistic 3D synthetic terrains for the use in virtual and augmented reality training applications; investigate using advanced virtual humans using sensory feedback, natural language, and cognitive architectures to create simulated social engagements focused on leader development; design a simulation environment to accelerate the design and assessment of emerging simulation technologies using artificial intelligence. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding realigned to another task within this Project (Warfighting M/S Concepts and Designs) reflecting a shift in research focus from the near term development of the Synthetic Training Environment (STE) capabilities to longer term research supporting training of multi-domain operations through the application of artificial intelligence.			
Title: STE Live Training ***Description:*** This effort investigates technology to enhance the fidelity of live training systems and investigates future live training capabilities for conducting force-on-force, combined arms exercises to enhance readiness at Army home stations and Combat Training Centers. ***FY 2021 Plans:*** Investigate eBullet capability to simulate tactical engagements with realism equivalent (or near) to Infantry weapon systems; investigate capability to simulate combat vehicle ballistic fly-out of munitions to a precise point of impact on target and accurately adjudicate weapon effects based on lethality/vulnerability models; investigate capability to simulate friendly and enemy combat vehicle vulnerability/lethality for battle damage assessment. ***FY 2022 Plans:*** Will investigate state-of-the-art sensor technologies to establish a baseline sensor suite with acceptable size, weight, power and performance characteristics; design capability to simulate tactical engagements using high fidelity micro terrain; design and develop algorithms to simulate ballistic fly-out of various infantry munitions to determine validity of geo-pairing solution in a virtual environment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort	-	2.218	2.262
Accomplishments/Planned Programs Subtotals	-	13.651	14.244

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BC7 / *Training Technology (Other than STE)*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army									Date: May 2021			
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*				Project (Number/Name) BD1 / *Adv Soldier Sensors/Displays Tech for Dismounts*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
BD1: *Adv Soldier Sensors/ Displays Tech for Dismounts*	-	4.763	11.100	11.651	-	11.651	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project designs and develops low power, next generation modular sensor and display components for detection and identification of both threats and friendlies in all environments to increase situational awareness, decrease fratricide, and enable Soldiers to respond more quickly for greater lethality. Work in this Project supports the Army Science and Technology Soldier Lethality, Next Generation Combat Vehicle, and Future Vertical Lift Army Modernization Priorities.

This effort supports work done in PE 0603118A (Soldier Lethality Advanced Technology) / BC9 (Adv Soldier Sensors/Displays AdvTech for Dismounts).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and supports the Soldier Lethality Cross Functional Team (CFT).

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Advanced Soldier Sensors/Displays Technology for Dismounts	4.763	11.100	11.651
Description: This effort models, simulates, investigates, designs, and develops novel low power, modular electro-optic / infrared (EO/IR), displays, augmented reality approaches and integrates aided/automatic target detection and recognition algorithms to enable improved Soldier maneuver and lethality through greater information fidelity to increase Soldier probability of recognition/ identification and tracking of all threats. This effort is coordinated with PE 0603118A (Soldier Lethality Advanced Technology), PE 0603462A (Next Generation Combat Vehicle Advanced Technology), PE 0603463A (Network C3I Advanced Technology), PE 0603465A (Future Vertical Lift Advanced Technology), and PE 0602145A (Next Generation Combat Vehicle Technology).			
FY 2021 Plans: Validate computer-aided prototyping design models and augmented reality (AR) applications; develop synthetic image generation techniques to enable optimized designs of advanced electro-optic / infrared (EO/IR) sensors and algorithms; mature components of virtual prototyping capabilities to support validation of sensor performance against various threats; model performance of advanced low-light sensors in multiple, simulated battlefield conditions; investigate designs for backside illuminated silicon (BSI) complementary metal-oxide-semiconductor (CMOS) to validate approaches for improved quantum efficiency (QE) in near-IR for advanced low light level imaging; develop low power, high performance application specific integrated chips (ASIC) to reduce the			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BD1 / *Adv Soldier Sensors/Displays Tech for Dismounts*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
size, weight, power, and cost of solid state low light level sensors; develop readout integrated circuits (ROICs) with pixel bins that provide high resolution, high definition imagery in darkest conditions. ***FY 2022 Plans:*** Will conduct experiments with mixed reality (MR) applications to validate sensor system target performance; investigate atmospheric simulation techniques to improve the generation of images in the visible and infrared spectrums; examine tools that support image generation from a synthetic low light level sensor to enable data augmentation and virtual prototyping efforts; design high quantum efficiency (QE) low light level focal plane arrays; determine dark current and system noise reduction techniques to improve the sensitivity for low light level sensor performance under starlight; investigate digital readout integrated circuits (ROICs) with the Application Specific Integrated Chips (ASIC) and processing approaches to enable dynamically binned readouts for high resolution, high definition imagery in light conditions, and improved sensitivity in dark conditions; investigate frame rate throttling of sensors to adapt to environmental and usage conditions including low-light to avoid degradation of situational awareness. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	4.763	11.100	11.651

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BD6 / *Soldier Sys Interfaces/Integration-Sensor Tech*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BD6: *Soldier Sys Interfaces/ Integration- Sensor Tech*	-	1.077	1.084	0.513	-	0.513	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates, designs, and validates advanced technologies and algorithms for enhancing dismounted Soldier deployed robotics and autonomous systems used to improve the Small Unit's situational awareness, survivability, and lethality. Technologies to be investigated may include: algorithms for dismounted robotic systems to enable autonomous navigation, automated object recognition, persistent surveillance, launch and recovery from vehicles, networked lethality, manned-unmanned teaming, and collaborative behaviors; and advanced user interfaces to optimize human-robotic interaction during dismounted operations. These advanced technologies will enable Squad and Platoon level autonomous reconnaissance using robotic systems to minimize the operator's dedicated control of the systems and reduce their cognitive burden, thus allowing Soldiers to be more lethal and survivable.

Work in this Project supports key Army needs and leverages the technical research of several PEs to include PE 0603118A (Soldier Lethality Advanced Technology) / Project BD7 (Soldier Sys Interfaces/Integration-Sensor AdvTech) and Project BC9 (Adv Soldier Sensors/Displays AdvTech for Dismounts).

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 2020	FY 2021	FY 2022
Title: Soldier System Interfaces & Integration (Sensor Technology)	1.077	1.084	0.513
Description: This effort will investigate, design, and validate advanced dismounted Soldier robotic and autonomous systems technologies to enable autonomous navigation, manned-unmanned teaming, and networked reconnaissance to improve Soldier lethality, situational awareness, and survivability during tactical operations.			
FY 2021 Plans: Investigate, design, and develop autonomous navigation algorithms, such as obstacle avoidance algorithms for fast flights and operations during night, to enhance the movement and maneuver of dismounted Small Unmanned Aerial Systems (UAS); investigate, design, and develop autonomous search and sensing algorithms to enable resource constrained Small UAS to perceive, detect, identify, and recognize objects in the environment; investigate, design, and develop mission and path planning algorithms and associated user interfaces for autonomous Small UAS; investigate, design, and develop algorithms to enable precision landing, recharging, and launch capabilities for Small UAS to enable extended operations; validate functionality of			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BD6 / *Soldier Sys Interfaces/Integration-Sensor Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
algorithms on open architecture Small UAS platforms in laboratory and simulated environment to reduce risk and improve system design. ***FY 2022 Plans:*** Will investigate, design, and develop autonomous navigation algorithms (e.g. collaborative autonomy, dynamic retasking and task decomposition), to enhance the movement and maneuver of dismounted Small Unmanned Aerial Systems (SUAS); investigate, design, and develop algorithms to enable perch and stare and precision landing capabilities for SUAS to enable extended operations; investigate, design, and develop target pose estimation and advanced motion planning algorithms to enhance autonomous search capability for resource constrained SUAS; investigate, design, and develop multi-agent teaming algorithms and associated user interfaces to enable collaboration between Platoon and Squad level autonomous systems; validate functionality of algorithms on open architecture SUAS platforms in laboratory and simulated environment to reduce risk and improve system design. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding realigned to PE 0602180, Project CL7 (ATR using Multiple Cooperative Sensors Tech)			
Accomplishments/Planned Programs Subtotals	1.077	1.084	0.513

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BD8 / *Soldier & Sm Unit Tactical Energy Tech*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BD8: *Soldier & Sm Unit Tactical Energy Tech*	-	8.769	9.043	4.467	-	4.467	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project conducts applied research and development on materials and component level power and energy technologies in the areas of energy storage, power generation, alternative energy, and intelligent power distribution and thermal management designs that support Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) and Soldier power needs to include next generation squad weapons and advanced optical devices and sensors. Enables future Soldier lethality and mobility for longer mission durations at lighter weights to provide enhanced lethality and tactical overmatch of adversaries, and to reduce the burden on the Soldier.

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 2020	FY 2021	FY 2022
Title: Tactical Power for Soldier Lethality	3.692	3.695	3.557
Description: This effort investigates, designs, and develops innovative materials and component level power generation and energy storage technologies that support next generation weapons, sensors, radios, and human augmentation devices enabling Soldiers and Small Units to maximize probability of target hits, improve collective situational awareness, ensure multiple communication streams, and assist with tactical tasks in order to decrease Soldier load and power burden, and increase power capabilities by providing more energy to prolong mission run-time.			
FY 2021 Plans: Develop Si-Anode based buttstock batteries (BSBs) for the Next Gen Squad Weapon that minimize weight and maximize energy; conduct component level Technology Readiness Level 5 verification and validation of these high capacity batteries in a laboratory environment; investigate advanced energy storage and power generation materials and components specifically targeted at increasing runtimes of digital Soldier devices; investigate energy storage, weight distribution, power distribution, and safety for the next generation squad weapons power/data rail and native battery; investigate advanced cathode materials and pairings to determine increase on the runtime of Soldier borne devices in small, lightweight, flexible form factors; mature components of small, power generation devices powered by logistically available fuels to enable integrated Soldier borne/operated sensors and radios for critical applications.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BD8 / *Soldier & Sm Unit Tactical Energy Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Research High Voltage Electrolyte (HiVE) and innovative high power density cathode materials; investigate pairing these research materials with Silicon and Li-Metal anode technologies to validate the functionality of the Technology Readiness Level 4 material developments in a laboratory environment, which will enable greater material energy densities from 400-600 WH/Kg for longer runtimes, in distributed operations, with limited resupply; conduct experiments to quantify power trade space and requirements analysis that will enable development of high energy density materials for longer runtime durations for Soldier Tactical Power, Robotics, and Swarming UAS or other priorities identified by the Soldier Lethality Cross Functional Team (CFT); investigate power generation technologies to provide autonomous, on-the-move recharging through power management and distribution for critical Soldier Lethality applications and enable extended duration missions. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Materials & Component Technologies for Energy Independence ***Description:*** The effort develops technologies to substantially reduce the number of batteries required to accomplish dismounted Soldier/Squad mission objectives by developing more efficient power and thermal management for small systems and harvesting energy and alternative energy technologies thereby significantly reducing Soldier-borne load and logistics requirements for Soldier/Squad power and energy. ***FY 2021 Plans:*** Investigate optimized coupling between multifuel-fired heat sources and thermophotovoltaic converters for portable multifuel-fired power generators; research and develop multiplexed micro reactors and investigate at different scales for wearable or portable multifuel-fired power generator heat sources; develop flexible and safe aqueous/gel batteries and validate use in diversified application platforms for follow-on robustness studies; investigate the solvation, transport, liquid structure, and interface/interphase of multivalent cation electrolytes; further extend the new halide-graphite intercalation chemistry to multivalent cations; investigate devices based on a series of new materials and chemistries in both aqueous, non-aqueous, and hybrid systems; investigate reversible Martensitic phase transformations in solid-state cooling materials such as nickel-titanium alloys and new architectures, and conduct experiments with advanced characterization techniques to enable future high-performance and silent operation for applications related to directed energy, pulse power, and Soldier wearable cooling; fund research on blue whirl combustion technology for harvesting energy from a broad range of liquid fuels at a much higher efficiency than currently possible; determine new catalytic materials and pyrolysis reactor process in one-step to produce useful chemicals/fuels as energy scavenger for compact energy power sources for robotic autonomous systems. ***FY 2022 Plans:*** Will design, develop, and validate conceptual device that couples multifuel, excess enthalpy reactors with solid state thermal energy conversion for portable power generation; explore microchannel and porous media surface composition and thermal	5.077	5.348	0.910

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BD8 / *Soldier & Sm Unit Tactical Energy Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
designs to vaporize liquid fuels while minimizing carbon deposits on microchannel walls and pressure drop; investigate fabrication and integration methods that enhance cavity design flexibility including packaging for vacuum or thermally insulating sealed cavities between microreactors, spectral control elements, and photovoltaic cells to enable high view factors, providing lower energy losses across the small gaps in the cavity, and low thermal loss when scaling for compact, thin profiles for wearable power sources ***FY 2021 to FY 2022 Increase/Decrease Statement:*** A significant portion of the funding in FY 2022 is being realigned to PE 0602184A Project CO1 (Soldier Power And Energy Concepts and Technologies).			
Accomplishments/Planned Programs Subtotals	8.769	9.043	4.467

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BE1 / *Support Technology to Mission Command*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BE1: *Support Technology to Mission Command*	-	0.696	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates and designs technologies that support Soldier/Small Unit survivability, mobility, and combat effectiveness during mission command operations at operational and tactical levels in lethal and contested environments, enabling decentralized and dispersed operations in the future operating environment. This Project designs innovative mission command node platforms with enhanced mobility and agility, increased protection and survivability against electro-magnetic interference (EMI) and other threats, and rapid movement and emplacement, resulting in increased lethality and coordination of dispersed formations during operations and supporting resilient formations in multi-domain operations. Component technologies designed under this Project will transition to Advanced Technology Development efforts in the Soldier Lethality Modernization priority in support of decentralized and dispersed mission command operations in future operating environments and expeditionary maneuver in the Multi-Domain Operations Environment.

Work in this Project supports key Army needs and leverages/complements the technical research of several PEs to include PE 0601102A (Defense Research Sciences), and the following Projects within PE 0602143A (Soldier Lethality Technology): Project BB4 (Dismounted Soldier Survivability Materials), Project BD8 (Soldier & Sm Unit Tactical Energy Tech), Project AZ9 (Soldier Protection Advanced Tech - Detectability), PE 0603118A Soldier Lethality Advanced Technology / Project AZ8 (Soldier - Small Unit Detectability Adv Technology) and PE 0602712A (Countermine Systems) / Project H35 Camouflage and Counter-Recon Tech).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Small Unit Expeditionary Mission Command Research	0.696	-	-
Description: This effort investigates and designs components of agile, modular, non-traditional Command Post platforms designed to enable the mission command network, supporting decentralized and distributed mission command operations in the future operating environment. Investigates material node platforms and other component concepts supporting rapid emplacement and displacement with enhanced survivability, mobility, signature management protection, and secured/non-degraded communication capabilities. Investigates and conducts experiments to validate component performance in a multi-domain battle operations. The large-footprint and logistics-intensive nature of current mission command systems compromise Soldier Lethality and mission effectiveness and do not provide the enhanced mobility and protection necessary to effectively execute mission command operations in the extremely expeditionary, multi-domain environment of the future. This research effort will enable tactical leaders to make timely decisions, integrate more seamlessly into the battlefield through a decrease in size,			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BE1 / *Support Technology to Mission Command*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
signature, and logistics burden, and will increase both maneuverability and survivability by enabling the development of agile Command Posts that support Multi-Domain Operations.			
Accomplishments/Planned Programs Subtotals	0.696	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BE3 / *Joint Service Combat Feeding Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BE3: *Joint Service Combat Feeding Technology*	-	3.832	4.109	4.024	-	4.024	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project investigates and develops nutrient compositions and stabilization techniques to maximize the Warfighter's physical and cognitive performance on the battlefield, investigates technologies to enhance detection and identification capabilities of chemical and biological threats in foods, and develops innovative ration and field feeding technologies to reduce resupply requirements for the multi-domain battlefield. The Army serves as the Executive Agent for this Department of Defense (DoD) program, with oversight and coordination provided by the DoD Combat Feeding Research and Engineering Board.

Work in this PE is related to and fully coordinated with PE 0602787A (Medical Technology) / Project 869 (Warfighter Health Prot & Perf Stnds) to develop technologies and concepts; Army Additive Manufacturing Community of Practice to enable customization, increase readiness, and improve sustainment due to fabrication of end-use items at point of need; Office of the Assistant Secretary of Defense (OASD) Applied Research for Army Priorities (ARAP) to transition and develop materiel solutions in the synthetic biology and microbiome technical areas; Defense Health Agency (DHA) Joint Program Committee-5, which seeks to develop effective nutritional countermeasures against stressors and to maximize health, performance, and well-being; and Office of Navy Research (ONR) PE 0601153N Defense Research Sciences Biosciences program to evaluate nutritional countermeasures to physiological environmental extremes.

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 2020	FY 2021	FY 2022
Title: Joint Service Combat Feeding Technology	3.832	4.109	4.024
Description: This effort investigates, designs, and develops nutrient compositions and stabilization techniques to maximize the Warfighter's physical and cognitive performance on the battlefield. The effort investigates technologies to enhance detection and identification capabilities of chemical and biological threats in foods and develops innovative ration and field feeding technologies to reduce resupply requirements. Work in this area results in increased performance, less food-borne illness, and overall increased readiness of the Warfighter.			
FY 2021 Plans: Continue investigation of nutritional factors affecting immune function and muscle recovery, and perform ex-vivo experimentation to identify gut microbiome effects on immune, gastrointestinal, and neurological health for preventing performance decrements in deployed troops; validate lipid oxidation analysis techniques to improve monitoring ability in ration components and ensure optimized nutrition; identify effects of high fat intake on physical performance to ensure optimal nutrient profiles in weight reduced			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BE3 / *Joint Service Combat Feeding Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
rations; investigate microbial response to vacuum microwave drying and antimicrobials effects on Salmonella to maintain food safety; mature component technologies for reagent-less biosensors to decrease logistical burdens in multi-domain operations; continue investigation of food product production with additive manufacturing; and design and develop ration packaging system to improve cost and efficiency. ***FY 2022 Plans:*** Will validate effects of high fat intake on physical performance to ensure optimal nutrient profiles in weight reduced rations; determine effects of nutritional factors on intestinal function, investigate feasibility of developing a 3D intestinal tissue model to identify effects of nutritional interventions and bioactives on immune function and gastrointestinal health and investigate effect of nutrient compounds on circulating biomarkers and immune function to prevent performance decrements in deployed troops;determine correlations between lipid oxidation analysis techniques and sensory results to improve monitoring ability in ration components and ensure optimized nutrition; investigate individual warfighter hydration methods to decrease logistical burdens in multi-domain operations and investigate augmented reality technologies to enable food safety inspections in austere environments ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	3.832	4.109	4.024

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army											Date: May 2021	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*				Project (Number/Name) BE6 / *Reactive/Resp Surfaces & Matls-Soldiers & Sys*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
BE6: *Reactive/Resp Surfaces & Matls-Soldiers & Sys*	-	2.632	6.215	2.955	-	2.955	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project designs, fabricates, and assesses a variety of bio-based materials through the application of biotechnology advances to develop material capabilities that respond and adapt to a wide range of external stimuli and biological processes for protection, situational awareness, and sustainment. Innovative materials will be sought that are capable of sensing and responding, as well as adapting response, to a broad spectrum of environmental variables. Research will develop materials that are able to self-monitor, self-heal, and self-sustain. Research will explore new biology-based methods for controlled synthesis and assembly to create materials with precise chemistries, microstructures, properties, and responsive functionalities through controlled molecular placement, spatial architectures, and interfacial structures. These materials have potential to enable more survivable, situationally aware, lighter weight Soldier systems and electronics. Research conducted focuses on unique and/or novel material properties, developing models, materials characterization techniques, non-destructive testing methods and advanced fabrication/processing methodologies.

Work in this PE complements PE 0601102A (Defense Research Sciences) / Project AA3 (Single Investigator Basic Research), Project AA3 (Single Investigator Basic Research), Project AA7 (Mechanics and Ballistics), and Project AA5 (Biotechnology and Systems Biology) and informs PE 0603118A (Soldier Lethality Advanced Technology) / BB3 (Dismounted Soldier Survivability Equip/Tech Integ).

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 2020**	**FY 2021**	**FY 2022**
Title: Bio-enabled Materials and Processes	2.632	2.882	2.955
Description: This effort conducts applied research through the application of biotechnology advances to develop materials with capabilities to respond and adapt to a wide range of external stimuli and biological processes. Investment in bio-enabled materials research allows for the design of materials that are capable of sensing and responding, as well as adapting to a broad spectrum of environmental variables with the ability to self-monitor, self-heal, and self-sustain. Investments in this area could lead to future applications in Soldier performance, situational awareness, protection and sustainment. Research from this effort has potential to transition to multiple end items and applications.			
FY 2021 Plans: Investigate chemically and structurally diverse biological building blocks (peptide-based) for advanced sensing applications, protection, and interface/assembly of hierarchical materials; investigate advanced coatings and materials assembly utilizing bio-			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BE6 / *Reactive/Resp Surfaces & Matls-Soldiers & Sys*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
derived and bio-composite materials for advanced sensing and protection (e.g. situational awareness, counter-biocorrosion, and biological inhibitors) and electro-magnetic applications such as antennas, lenses, and optically triggered skins/coatings; identify targets and design strategy for accelerated degradation of high value assets (electronic components, protective coatings), logistics reduction (e.g., accelerated repair and reclamation of rare-earth elements), and next generation anti-tamper technologies. ***FY 2022 Plans:*** Will design strategies to integrate biological building blocks with sensor platforms; mature peptide-based building blocks for strength and selectivity of target interactions, and down select candidate peptide materials; validate models and use computational and experimental tools to investigate properties of novel molecules for improved adhesion and structural stability of composites; build characterization and computation tools for rapid prototyping of biomaterials; down-select targets and use computational and analytical tools to validate models of accelerated degradation of high value targets; explore biological engineering strategy to counter material degradation. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Scalable and On-Demand Production of Novel Molecules ***Description:*** This effort conducts applied research through the investigation of new methods to produce novel biological molecules. Typical customized molecule production is extremely expensive and difficult to achieve. Investment in synthetic biomanufacturing techniques will further the applicability and widespread use of novel molecules to further Warfighter performance. ***FY 2021 Plans:*** Investigate computational and experimental tools facilitating the use of molecular biology to produce novel molecules of interest. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Effort ends in FY 2021.	-	3.333	-
Accomplishments/Planned Programs Subtotals	2.632	6.215	2.955

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BE8 / *Synthetic Training Environment (STE) Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BE8: *Synthetic Training Environment (STE) Technology*	-	14.802	13.649	14.741	-	14.741	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project designs and develops technologies supporting the Army's Synthetic Training Environment (STE). The Synthetic Training Environment (STE) is the next generation holistic collective training capability that will train units where they will fight, with whom they will fight with, and in complex operational environments to include dense urban and sub-terrain; within the entire range of combined arms maneuver tasks in support of Multi- Domain Operations. STE Information Systems (STE-IS) delivers the Common Synthetic Environment consisting of Global Terrain/One World Terrain (OWT), Training Simulation Software (TSS), and Training Management Tools (TMT). The STE will be available where training occurs (home station, combat training centers, armories, institutions, shipboard, deployed) and will include Air and Ground Reconfigurable Virtual Collective Trainers (RVCTs), a Soldier/Squad Virtual Training (S/SVT), and a live training capability. The STE will be cloud-enabled, compatible with the Army Enterprise Network, and service-based through the Common Operating Environment, including Live and Constructive. The STE will provide the realistic repetitions necessary to fight 25 bloodless battles before the first battle; a Secretary of Defense priority.

This effort is coordinated with work done in PE 0603118A (Soldier Lethality Advanced Technology) / Project BE9 (Synthetic Training Environment (STE) Advanced Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy and supports the STE Cross Functional Team efforts.

Work in this Project is performed by the United States Army Futures Command (AFC) and at the Institute for Creative Technologies (ICT) University Affiliated Research Center (UARC) at the University of Southern California

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Innovative Synthetic Training Technology	7.910	-	-
Description: This effort investigates and designs methods of applying Artificial Intelligence (AI) into the STE to simulate a fully immersive environment in large urban settings with a population of adaptable, noncombatant virtual human agents for increasing the realism and complexity of training scenarios. In addition, develops tools, techniques and technologies for improving the immersion of human senses within simulation environments with the goal of creating enhanced realism within the simulated environment.			
Title: STE One World Terrain	1.934	5.832	5.554

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BE8 / *Synthetic Training Environment (STE) Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Description: This effort investigates and designs tools and methods to improve the speed and fidelity of a terrain capability that provides a representation of the globe, fully accessible through the Army network and usable by all simulation trainers; develops complex representations (including megacities and subterranean) of the operational environment and the Multi-Domain battlefield in synthetic training environments. ***FY 2021 Plans:*** Develop a whole world terrain at low to medium resolution using available data; evaluate alternative data sources to fill gaps; develop tools to rapidly process source data into a single representation that serves all application needs; develop and investigate a processes for generating fully attributed hi-resolution terrain insets such as underground geometry, key civilian infrastructure components, complex road networks, hydrological features, and complex structures. ***FY 2022 Plans:*** Will investigate tools, algorithms and communities of practice to develop automated complex terrain features for Dense Urban Environments and determine level of attribution required to extend OWT data model support for dynamic and cascading effects (e.g., transportation tunnels, civilian infrastructure); investigate and determine OWT data model compliant metadata (e.g., geometry, attributes) towards enriching OWT 3D terrain mesh generation; design terrain correlated material maps with textures to advance simulation sensor implementations and enable physics-based calculation for terrain modification. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: STE Training Management Tool ***Description:*** This effort investigates Adaptive Training (AT) methods to facilitate authoring, distribution, management, and evaluation of tailored instruction for both individuals and teams; and evaluates the impact of training and education tools/ methods on comprehension, reasoning, learning, performance, retention, and transfer of knowledge and acquired skills to assess Training Effectiveness (TE) in Synthetic Training Environments. ***FY 2021 Plans:*** Design and develop natural language artificial intelligence (AI) processing techniques for small team verbal communications during task execution; develop proof of principle for automating team performance assessments and for actionable automated after action review (AAR) feedback to teams, leaders, and instructors; develop a robust intelligent team adaptive training capability to maximize training outcomes at point of need; develop AI methods grounded in learning science to support self-optimizing systems that produce skill retention and transfer into the operational environment; conduct experiments to validate team performance measures; assess the effectiveness of different machine learning approaches to facilitate automated authoring of scenario based training for individuals and teams; develop models for assessing competencies of individuals and teams using	4.958	5.269	4.999

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BE8 / *Synthetic Training Environment (STE) Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
a combination of live, virtual, and constructive training events in militarily relevant domains; investigate the use of physiological measures as a means of improving automated adaptation of training and for assessing training outcomes, predicting training transfer, and providing real-time feedback to instructors and students during the execution of individual and collective training. ***FY 2022 Plans:*** Will validate techniques for automating team performance assessments and actionable automated after action review (AAR) feedback to teams, leaders, and instructors; continue design of adaptive, intelligent tutor for teaming to maximize training outcomes at the point of need; investigate team tutor technologies to assess team training measures and effectiveness; determine reinforcement learning-based planning models to deliver run-time feedback to teams during simulation-based training; investigate team intelligent tutoring based on roles and functions within the team to assess the overall team readiness level; design team communication analysis toolkit using natural language processing and deep learning neural networks to analyze and assess team communications during simulated training exercises; investigate team performance assessments for the instructors using artificial intelligence models to determine an evaluation of a team?s performance and recommendations to optimize training toward an acceptable readiness level; investigate the association between squad level performance measures for individuals and teams and determine how to best deliver data to assess their performance. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects minor change in planned project scope.			
Title: STE Training Simulation Software	-	2.548	4.188
Description: This effort designs and develops Modeling and Simulation (M&S) technologies to enable the Army?s Synthetic Training Environment (STE) Training Simulation Software (TSS). This includes technologies that enable the representation of the development of synthetic military forces and noncombatants leveraging emerging Artificial Intelligence (AI) methods and techniques. This application of AI to simulation use is focused on enabling more complex modeling of the Operational Environment and the representation of Multi-Domain Operations. This effort also investigates methods and means to enable a pipeline of modeling development and reuse from authoritative sources to simulation environments considering the complexities of simulating various echelons of warfare (e.g. squad to ASCC) and their application in support of multiple collective training use cases and user interfaces to access the Training Simulation Software (TSS). ***FY 2021 Plans:*** Investigate autonomous, artificially intelligent agents that adapt to changing battlefield conditions, friendly forces, non-combatants, and enemy threats in a military relevant virtual training environment; investigate multi-resolution modeling applications such as Live, Virtual, and Constructive (LVC) experimentation utilizing AI enabled attributes; and design and develop cutting-edge M&S methods to enable the reuse and development of new Army and Department of Defense (DoD) STE-ready models for			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BE8 / *Synthetic Training Environment (STE) Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Multi-Domain Operations in support of System of Systems (SoS) analysis, experimentation, technology tradeoffs, capability assessments, concept development, and training. ***FY 2022 Plans:*** Will investigate application of Artificial Intelligence (AI) techniques to enable autonomous squad-level interactions between friendly forces, non-combatants, and enemy threats in support of squad battle drills; will design methods to connect Operational Environment (OE) models, data and algorithms with emerging AI techniques in order to automate generation of representative OE simulation for collective training; will investigate cross-cutting modeling capabilities required to enable Multi-Domain Operations and their effect on model interactions, such as the introduction of complex weather modeling, that could impact the ability to deliver collective training. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increased to further research into AI techniques in support of developing OE models to support MDO training.			
Accomplishments/Planned Programs Subtotals	14.802	13.649	14.741

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army										Date: May 2021		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*				Project (Number/Name) BP9 / *Soldier Lethality Technologies (CA)*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
BP9: *Soldier Lethality Technologies (CA)*	-	30.626	79.000	-	-	-	-	-	-	-	-	-

Note

Congressional Interest Item funding provided for Soldier Lethality Technologies.

A. Mission Description and Budget Item Justification

This project is for congressional increases that support applied research in support of Soldier Lethality, where the Soldier and Squad are treated as an integrated combat platform. The fundamental challenge is to overcome an erosion in close combat overmatch relative to the pacing threats identified in the National Defense Strategy. This program increase leverages science, technology, and human potential to achieve the overmatch necessary to maneuver, isolate, and defeat our adversaries in any environment.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
Congressional Add: Medical simulation and training ***FY 2020 Accomplishments:*** Congressional Increase. Applied research in support of Soldier Lethality Medical Simulation and Training Work executed by Army Futures Command.	3.626	-
Congressional Add: Active and passive camouflage concealment and deception ***FY 2020 Accomplishments:*** Congressional Increase. Applied research in support of Soldier Lethality Active and Passive Camoflage, Concealment and Deception. Work executed by Army Futures Command.	3.000	-
Congressional Add: Human systems integration ***FY 2020 Accomplishments:*** Congressional Increase. Applied research in support of Soldier Lethality Human Systems Integration Work executed by Army Futures Command.	10.000	-
Congressional Add: Expeditionary mobile base camp technology ***FY 2020 Accomplishments:*** Congressional Increase. Applied research in support of Soldier Lethality Expeditionary Mobile Base Camp Technology	2.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BP9 / *Soldier Lethality Technologies (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
Work executed by Army Futures Command.		
Congressional Add: SOCOM communications capability ***FY 2020 Accomplishments:*** Congressional Increase. Applied research in support of Soldier Lethality Communications Capability Work executed jointly by Army Futures Command. and SOCOM.	2.500	-
Congressional Add: Soldier Lethality Technologies Program Increase ***FY 2020 Accomplishments:*** Congressional Increase. Applied research in support of Soldier Lethality fundamental challenges to overcome is an erosion in close combat overmatch relative to the pacing threats identified in the NDS. This program increase leverages science, technology, and human potential to achieve the overmatch necessary to maneuver, isolate, and defeat our adversaries in any environment. Work executed by Army Futures Command.	5.000	-
Congressional Add: Harnessing Emerging Soldier Lethality Technology Research ***FY 2020 Accomplishments:*** Congressional Increase. Applied research in support of Soldier Lethality fundamental challenges to overcome is an erosion in close combat overmatch relative to the pacing threats identified in the NDS. This program increase leverages science, technology, and human potential to achieve the overmatch necessary to maneuver, isolate, and defeat our adversaries in any environment. Work executed by Army Futures Command.	4.500	-
Congressional Add: Program increase - pathfinder airborne ***FY 2021 Plans:*** Conduct applied research in Pathfinder Airborne. Work executed by Army Futures Command.	-	8.000
Congressional Add: Program Increase - Pathfinder Air Assault ***FY 2021 Plans:*** Conduct applied research in Pathfinder Air Assault. Work executed by Army Futures Command.	-	10.000
Congressional Add: Program increase - Rapidly deployable shelters	-	3.000

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
FY 2021 Plans: Conduct applied research in Rapidly Deployable Shelters. Work executed by Army Futures Command.		
Congressional Add: Program increase - UTDD catalyst ***FY 2021 Plans:*** Conduct applied research in UTDD Catalyst. Work executed by Army Futures Command.	-	5.000
Congressional Add: Program increase - lightweight body armor mechanisms and materials ***FY 2021 Plans:*** Conduct applied research in Lightweight Body Armor Mechanisms and Materials. Work executed by Army Futures Command.	-	10.000
Congressional Add: Program increase - advanced textile-based products ***FY 2021 Plans:*** Conduct applied research in Advanced Textile-Based Products. Work executed by Army Futures Command.	-	6.000
Congressional Add: Program increase - HEROES program ***FY 2021 Plans:*** Conduct applied research in HEROES Program. Work executed by Army Futures Command.	-	5.000
Congressional Add: Program increase - soldier ballistic technologies ***FY 2021 Plans:*** Conduct applied research in Soldier Ballistic Technologies. Work executed by Army Futures Command.	-	5.000
Congressional Add: Program increase - medical simulation and training ***FY 2021 Plans:*** Conduct applied research in Medical Simulation and Training. Work executed by Army Futures Command.	-	4.000
Congressional Add: Program increase - body armor study ***FY 2021 Plans:*** Conduct applied research in Body Armor Study.	-	4.000

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
Work executed by Army Futures Command.		
Congressional Add: Program increase - academic accelerator pilot program ***FY 2021 Plans:*** Conduct applied research in Academic Accelerator Pilot Program. Work executed by Army Futures Command.	-	15.000
Congressional Add: Program increase - Advanced ballistics technology for personal protective systems ***FY 2021 Plans:*** Conduct applied research in Advanced Ballistics Technology for Personal Protective Systems. Work executed by Army Futures Command.	-	4.000
Congressional Adds Subtotals	30.626	79.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BR9 / *Personnel & Airdrop Safety Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BR9: *Personnel & Airdrop Safety Technology*	-	3.929	3.601	3.476	-	3.476	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project funds the research and investigation of component technologies to enhance cargo and personnel airdrop capabilities for global precision delivery, rapid deployment, and insertion for force projection into hostile regions. Areas of emphasis include parachute technologies, parachutist injury reduction, precision offset aerial delivery, soft landing technologies, and airdrop simulation. Technologies support the Soldier Lethality Army Modernization Priority. New operational concepts call for increased precision of personnel and cargo in austere environments in which small units are dispersed and logistical supply is limited. The Army requires enhanced payload extraction and other increased capabilities to support the airdrop requirement for current and future vehicles exceeding aircraft payload weight capacity. TheU.S. Army Airborne Board (Chaired by the XVIII Airborne Corps Commanding General) identified increased payload capabilities as a critical requirement to support the mission readiness profile for the Global Response Force (GRF), and will support Joint Forcible Entry requirements while maximizing the capacity of a C-17 aircraft.

Work in this Project supports key Army needs and complements the technical research of several PEs to include PE 0601102A (Defense Research Sciences), PE 0602143A (Soldier Lethality Technology) / Project BD6 (Soldier Sys Interfaces/ Integration- Sensor Tech), and PE 0603118A (Soldier Lethality Advanced Technology) / Project BE5 (Personnel & Airdrop Safety 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 2020	FY 2021	FY 2022
Title: Personnel & Airdrop Safety Technology	3.929	3.601	3.476
Description: This effort investigates technologies that enhance payload extraction, which will allow current vehicles to be dropped with more armor and support equipment, and reduce the design constraint on future vehicles that have airdrop as an operational requirement, increase parachute gliding capabilities, and mature delivery accuracy of cargo aerial delivery systems that support varying payload weights. Research in the area of novel parachute materials will provide increased capabilities for cargo and personnel aerial delivery systems. This effort will support an investigation of new Modeling and Simulation (M&S) tools in order to develop validation methods for airdrop concepts. This effort also investigates technologies that advance airborne personnel insertion safety requirements to modernize the Airborne Soldier and provide the ability to effectively execute the airborne mission through reducing safety risk and increasing capabilities.			
FY 2021 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Conduct research into sensing technologies that augment personnel or autonomous cargo airdrop systems, enabling accurate, reliable insertion and resupply missions across a broad scope of operational conditions and non-traditional airdrop environments; examine new parachute designs and avionics necessary to facilitate maximum mission effectiveness conducted across an array of technologies and modalities using analytical, numerical, and experimental methods. ***FY 2022 Plans:*** Will mature high altitude personnel and cargo insertion technologies that facilitate extended offset insertions in GPS denied conditions; carry out research on high offset air insertion and resupply mission capability enhancements; perform research into sensor integration and fusion techniques to produce robust navigational datasets suitable for guidance, navigation and control of autonomous systems in contested and challenging mission environments; determine feasibility of materiel and non-materiel solutions focused on reduction of airdrop platform signature. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	3.929	3.601	3.476

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A