Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army											Date: April 2022	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603462A *I Next Generation Combat Vehicle Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
Total Program Element	-	309.860	299.712	193.242	-	193.242	212.497	201.523	205.254	206.775	0.000	1,628.863
BF2: *Autonomous Ground Resupply (AGR) Adv Tech*	-	18.374	-	-	-	-	-	-	-	-	0.000	18.374
BF4: *Combat Vehicle Robotics Adv Tech*	-	10.104	26.765	29.463	-	29.463	34.550	36.226	45.407	45.104	0.000	227.619
BF7: *Crew Augmentation and Optimization Adv Tech*	-	4.211	3.768	4.326	-	4.326	3.795	4.334	4.386	4.385	0.000	29.205
BG1: *Sensors for Auto Oper and Survivability Adv Tech*	-	14.054	10.666	12.464	-	12.464	12.670	12.664	12.652	12.648	0.000	87.818
BG3: *Modeling and Simulation for MUMT Advanced Tech*	-	3.241	5.188	5.975	-	5.975	6.248	7.175	7.529	7.363	0.000	42.719
BG4: *Adv Mobility Experimental Prototype Adv Tech Demo*	-	3.760	2.819	-	-	-	-	-	-	-	0.000	6.579
BG5: *Extended Line of Sight (ELOS) Advanced Technology*	-	1.396	-	-	-	-	-	-	-	-	0.000	1.396
BG7: *Ground Systems Active Defense (GSAD) Advanced Tech*	-	36.496	52.172	60.371	-	60.371	57.781	49.425	52.255	55.800	0.000	364.300
BG9: *Obscuration Advanced Technology*	-	10.533	2.511	2.765	-	2.765	2.813	2.810	2.811	2.810	0.000	27.053
BH1: *Survivability Systems Controls Advanced Technology*	-	11.880	-	-	-	-	-	-	-	-	0.000	11.880
BH4: *Ground Vehicle Holistic Defense Adv Tech*	-	-	0.034	-	-	-	-	-	1.427	1.798	0.000	3.259
BH6: *Platform Electrification and Mobility Adv Tech*	-	20.698	24.891	46.679	-	46.679	63.174	45.417	45.419	40.181	0.000	286.459
BH8: *Enhanced VETRONICS Advanced Technology*	-	11.809	14.989	10.776	-	10.776	10.223	10.559	9.317	12.641	0.000	80.314
BI3: *Sensor Protection Advanced Technology*	-	1.752	1.645	1.708	-	1.708	1.738	1.738	1.734	1.734	0.000	12.049

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army											Date: April 2022	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603462A *I Next Generation Combat Vehicle Advanced Technology*							
BI5: *Materials Application and Integration Adv Tech*	-	5.286	4.825	5.279	-	5.279	5.478	4.580	4.736	4.734	0.000	34.918
BJ1: *Vehicle System Security Advanced Technology*	-	1.444	2.455	-	-	-	-	-	-	-	0.000	3.899
BK1: *Autonomous Mobility Adv Tech*	-	11.370	6.087	6.323	-	6.323	5.282	5.286	-	-	0.000	34.348
BK4: *Next Gen Intelligent Fire Control(NG-IFC) Adv Tech*	-	23.205	1.727	2.198	-	2.198	2.309	2.985	-	-	0.000	32.424
BK6: *Adv Direct InDirect Armament Sys (ADIDAS) Adv Tech*	-	0.224	-	1.534	-	1.534	2.053	9.850	12.613	12.622	0.000	38.896
BP6: *Ground Vehicle Advanced Technology(CA)*	-	116.200	135.250	-	-	-	-	-	-	-	0.000	251.450
BZ9: *Smart Targeting Environment for Lower Level Assets*	-	3.823	3.920	3.381	-	3.381	4.383	4.393	-	-	0.000	19.900
CU4: *Platform Agnostic Armaments Advanced Technology**	-	-	-	-	-	-	-	4.081	4.968	4.955	0.000	14.004

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2023

A. Mission Description and Budget Item Justification

This Program Element (PE) executes development, maturation, and demonstration for the Army's modernization priority for the Next Generation of Combat Vehicle (NCCV). This PE matures, integrates and demonstrates combat vehicle technologies that enable the Army to have a smarter, faster, more lethal, more precise, more protected, and more adaptable force. Technology development builds upon the foundational vehicle architectures to support the NGCV, to include autonomy architecture, power architecture, vehicle electronic architecture, physical architecture, lethality architecture and vehicle protection architecture. Technologies developed, matured, and demonstrated will enable leap ahead capabilities for manned, optionally manned and unmanned vehicles that deliver decisive lethality.

Research in this PE complements PE 0602141A (Lethality Technology), PE 0602144A (Ground Technology), PE 0602145A (Next Generation Combat Vehicle Technology), PE 0602146A (Network C3I Technology), PE 0603116A (Lethality Advanced Technology), PE 0603119A (Ground Advanced Technology), PE 0603463A (Network C3I Advanced Technology), PE 0604115A (Technology Maturation Initiatives), and PE 0708045A (End Item Industrial Preparedness Activities). Research in this PE also transitions to PE 0603645A (Armored Systems Modernization Adv Dev) and PE 0604017A (Robotics Development).

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army	Date: April 2022
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603462A *I Next Generation Combat Vehicle Advanced Technology*

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

This PE is directly aligned to the NGCV Army Modernization Priority.

Research is performed by the United States (U.S.) Army Futures Command and the U.S. Army Engineer Research and Development Center.

B. Program Change Summary ($ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	302.209	164.951	0.000	-	0.000
Current President's Budget	309.860	299.712	193.242	-	193.242
Total Adjustments	7.651	134.761	193.242	-	193.242
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	135.250			
• Congressional Directed Transfers	-	-			
• Reprogrammings	7.651	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	193.242	-	193.242
• FFRDC Transfer	-	-0.489	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2021	FY 2022
Project: BP6: *Ground Vehicle Advanced Technology(CA)*		
Congressional Add: *Additive Manufacturing for Jointless Hull*	10.000	15.000
Congressional Add: *Carbon Fiber and Graphite Foam Technology*	10.000	5.000
Congressional Add: *Hydrogen Fuel Cells*	10.000	-
Congressional Add: *ATE5.2 Engine Development*	10.000	5.000
Congressional Add: *Additive Manufacturing of Critical Components*	5.000	-
Congressional Add: *Combat Vehicle Weight Reduction Initiative*	10.000	5.000
Congressional Add: *Virtual and Physical Prototyping*	10.000	8.000
Congressional Add: *HMMWV Autonomy*	3.000	-
Congressional Add: *HMMWV Automotive Enhancements*	5.000	3.000
Congressional Add: *Program Increase - Combat Vehicle Blast Testing*	6.000	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army	Date: April 2022
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603462A *I Next Generation Combat Vehicle Advanced Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2021	FY 2022
Congressional Add: *Program Increase - Advanced Adhesives*	5.000	5.000
Congressional Add: *Program Increase - Combat Vehicle Lithium 6T Battery Development*	5.000	5.000
Congressional Add: *Program Increase - Vehicle Technology Readiness Levels*	2.000	-
Congressional Add: *Program Increase - 10X Technology Demonstration*	8.000	-
Congressional Add: *Program Increase - HMMWV Augmented Reality HUD*	5.000	-
Congressional Add: *Program Increase - Operator?In?The?Loop Virtual and Physical Prototyping*	4.000	-
Congressional Add: *Program Increase - Next Generation Electrified Transmission*	8.200	-
Congressional Add: *Advanced Materials Applications*	-	12.000
Congressional Add: *Augmented Reality for Denied Environments*	-	7.000
Congressional Add: *Autonomous Minefield Clearance*	-	7.000
Congressional Add: *Autonomous Vehicle Mobility*	-	10.000
Congressional Add: *Carbon Fiber Tires*	-	5.000
Congressional Add: *Force Protection Vehicle Kit*	-	5.000
Congressional Add: *Fuel Cell Technology*	-	5.000
Congressional Add: *Machine Learning for Advanced Lightweight Combat Vehicle Structures*	-	6.000
Congressional Add: *Maneuverable Lightweight Electric Weight Reducer*	-	5.000
Congressional Add: *Off-Road Maneuver*	-	5.000
Congressional Add: *Predictive Maintenance System*	-	2.000
Congressional Add: *RCV-L*	-	5.000
Congressional Add: *Short Fiber Thermoplastic Applications*	-	4.000
Congressional Add: *Unmanned Navigational Technology*	-	2.500
Congressional Add: *Virtual Autonomy Environment*	-	3.750
Congressional Add Subtotals for Project: BP6	116.200	135.250
Congressional Add Totals for all Projects	116.200	135.250

Change Summary Explanation

Fiscal Year 2023 (FY23) funding increase reflects the fact that the FY22 President's Budget request did not include out-year funding.

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BF2 / *Autonomous Ground Resupply (AGR) Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BF2: *Autonomous Ground Resupply (AGR) Adv Tech*	-	18.374	-	-	-	-	-	-	-	-	0.000	18.374
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project will mature and demonstrate an improved ground supply distribution system across multiple levels of strategic and tactical sustainment operations. The Project will equip existing military ground vehicles with scalable robotic technology through the integration of modular kits, common interfaces, and a common architecture to improve inter-node supply movement. Further, the system will modernize and optimize the operations within the supply nodes to improve accountability and throughput. The objective of this Project is to integrate new and emerging technologies into the Army's sustainment system to improve throughput, accountability, and safety and provide the Warfighter with the flexibility needed to meet future needs.

The research under this Project will transition to the Leader Follower Program of Record (PoR). The architecture and safety work under this Project also lays the groundwork for the Next Generation Combat Vehicle (NGCV) Army Modernization Priority .

This Project matures and demonstrates simulation tools that predict autonomous vehicle performance. This Project also matures and demonstrates a real-time simulator that provides the ability to design and assess ground vehicle autonomous behaviors in adverse environmental conditions, reducing the need for field testing. These simulation technologies can be integrated across Army vehicle platforms as required.

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

Research in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Research in this Project is performed by the United States (US) Army Futures Command and the US Army Engineer Research and Development Center.

Research in this Project is also coordinated with PE 0602145A (Next Generation Combat Vehicle Technology), and transitions to PE 0604017A (Robotics Development).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Architecture and Standards	7.035	-	-
Description: This effort matures and validates the government-owned autonomous architecture for an inclusive military library of behaviors that are non-proprietary and modular format to allow for design and development of payloads across the enterprise. This architecture allows the development and implementation of the same government owned software across multiple			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BF2 / *Autonomous Ground Resupply (AGR) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
robotic systems. This will enable interoperability and modularity within systems and will lay the foundation for an affordable and sustainable lifecycle management model.			
Title: Hardware and Hardware-in-the-loop/Software-in-the-loop (HIL/SIL) ***Description:*** The HIL/SIL is a test system that uses real-time, physics-based models of the vehicle (multi-body dynamics), sensor systems (optics/signal processing and positioning), platform mobility (vehicle-terrain interaction) and weather/environment to provide a "virtual proving ground" for the Autonomous Ground Resupply (AGR) system.	4.519	-	-
Title: Soldier Experimentation ***Description:*** In conjunction with the Army Training and Doctrine Command (TRADOC) and Army Test and Evaluation Command (ATEC), this effort will employ unmanned systems in an operational evaluation to test the system in real word applications and environments. After the lab testing is complete and a safety test performed by ATC, then the soldier will provide the final test to determine if AGR is useful and rugged enough to enable the soldiers to increase through put on actual missions.	6.338	-	-
Title: Simulation Tools for Autonomous Ground Resupply ***Description:*** This effort matures and demonstrates a real-time and high-fidelity, hardware and software-in-the-loop simulation environment for evaluation of autonomous systems, and algorithm design and development for the same; demonstrates novel analysis methods for modeling and simulation to provide enhanced demonstrations of autonomous ground vehicles to include adverse environmental conditions.	0.482	-	-
Accomplishments/Planned Programs Subtotals	18.374	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BF4 / *Combat Vehicle Robotics Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BF4: *Combat Vehicle Robotics Adv Tech*	-	10.104	26.765	29.463	-	29.463	34.550	36.226	45.407	45.104	0.000	227.619
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates innovative enabling technologies that enable scalable integration of multi-domain robotic and autonomous system capabilities teamed within Army formations supporting all combat warfighting functions (close combat, reconnaissance, targeting and acquisition, etc.). Project focus areas include Platform Electronic Control and Autonomy Safety Engineering.

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

Research in this Project supports the Next Generation Combat Vehicle (NGCV) Army Modernization Priority.

Research is performed by the United States (U.S.) Army Futures Command (AFC).

Research is also coordinated with Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology), and transitions to PE 0604017A (Robotics Development).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Platform Electronic Control	5.845	11.411	8.822
Description: This effort optimizes the electronic, closed loop control of by-wire vehicle systems to provide stable, reliable, and predictable control in the presence of potential malicious or unintended commands for both wheeled and tracked unmanned vehicles. ***FY 2022 Plans:*** Will develop an optimized solution to an expanded closed loop control of drive by-wire (DBW) systems for robotic ground vehicles to improve safe platform control. Will develop a stable interface, to control autonomous ground vehicle systems, for autonomy kits and/or user interfaces (UI) while maintaining safety critical aspects of the platform. Will demonstrate these enhancements through Engineering Evaluation Testing (EET) to ensure the autonomous technology has been fully evaluated for system safety, thereby demonstrating technical maturity. Will mature and demonstrate Robotic and Autonomy Systems (RAS) safety standards for unmanned ground vehicle systems. Will validate Ground Vehicle Robotics Safety Board published guidelines to show they meet best practices for development of safety critical software for unmanned ground vehicle systems. Validation of Ground Vehicle			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BF4 / *Combat Vehicle Robotics Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Robotics Safety Board processes will result in a useable safety confirmation to enable testing and reduced developmental time for testing of autonomous ground combat systems. ***FY 2023 Plans:*** Will mature and continue optimization of an expanded closed loop DBW system for robotic ground systems. Focus will be on optimization of a platform side vehicle control architecture which will be aligned to a known safety standard to mature the current safety pedigree of ground robotic systems this will enable more stable interface controls enabling ease of autonomy integration. Will demonstrate these enhancements through EET to show technical maturity. Will continue to mature and validate RAS safety standards for unmanned ground vehicle systems based on EET activities. Will update Ground Vehicle Robotics Safety Board published guidelines to show they meet best practices for development of safety critical software for unmanned ground vehicle systems while incorporating lessons learned. Validation of Ground Vehicle Robotics Safety Board processes will result in improved safety pedigree which will enable higher confidence in receipt safety confirmation to enable testing and reduced developmental time for testing of autonomous ground combat systems. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding decreased in Fiscal Year 2023 (FY23) reallocated to PE 0603462A / Project BH6 (Platform Electrification and Mobility Adv Tech).			
Title: Unmanned Maneuver ***Description:*** This effort matures and demonstrates the advanced mobility performance of autonomous systems within complex, combat scenarios to allow for the completion of mission goals in individual and teaming configurations at various levels of autonomy. ***FY 2022 Plans:*** Will improve and demonstrate autonomous vehicle maneuvering in rough terrain. Will demonstrate the ability to detect and avoid negative obstacles, such as large holes, bodies of water, and cliffs. Will mature and demonstrate the ability to detect the characteristics of the terrain the vehicle is driving over, and optimize the combat vehicle?s driving behaviors in response. Will demonstrate these enhancements through EET to ensure the autonomous technology has been fully evaluated for system safety, thereby demonstrating technical maturity. ***FY 2023 Plans:*** Will optimize and demonstrate autonomous vehicle maneuvering in hostile environments using government owned autonomy software, Robotic Technology Kernel (RTK). Will mature and demonstrate the ability to conduct Manned-Unmanned Teaming maneuvers including human team members. Will improve cybersecurity posture in development of autonomy. Will demonstrate advanced collaborative surveillance behaviors for unmanned ground vehicles. Will demonstrate all enhancements though EET to ensure the autonomous technology has been fully evaluated for system safety, thereby demonstrating technical maturity. Will	2.931	9.099	14.171

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BF4 / *Combat Vehicle Robotics Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
mature the Autonomous Ground Vehicle Reference Architecture (AGVRA) framework by developing conceptual, logical and physical data models while connecting them to exiting instantiated architectures and further develop safety and cyber models and associated libraries to support these evolving model viewpoints. Will develop and mature the Robot Operating System ? Military (ROS-M) to support the registration and distribution of Robotic and Autonomous System models. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding increased in FY23 to optimize autonomous forward surveillance and small unmanned ground vehicles (UGVs) as deployable sensors including support of on-going soldier evaluations of unmanned systems.			
Title: Soldier-Robotic Interface Integration ***Description:*** This effort is a focused approach to optimize control of the unmanned systems with improved performance incorporating Manned-Unmanned Teaming enabled formations and is measured against multiple phases of the combat scenario for improved operational effectiveness and overall system performance. ***FY 2022 Plans:*** Will develop an expanded operator span of control for robotic vehicles in defined mission to improve Manned /Unmanned Teaming to increase operator standoff and enable control of multiple platforms. Will demonstrate these enhancements through EET to ensure the autonomous technology has been fully evaluated for system safety, demonstrating technical maturity. ***FY 2023 Plans:*** Will mature and demonstrate an enhanced human robot interaction technology to improve the effectiveness of the robot as a tool for the human to complete the mission utilizing built in government owned Warfighter Machine Interface (WMI) software. Will exploit Manned /Unmanned Teaming technologies that will allow the operator to be at a longer standoff distance while enabling efficient control of robotic platforms. Will optimize novel control methods leveraging a wide range of hardware interfaces to improve robotic control across multiple control methods (mounted interface / dismounted-tablets/heads-up displays). Will demonstrate these technology enhancements through EET to validate the autonomous technology system safety and technical maturity. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding realigned to Small UGV as Deployable Sensor effort within this Project to better align with the research of artificial intelligence of multi-domain robotic and autonomous system capabilities.	1.328	5.278	4.138
Title: : Small UGV as Deployable Sensor ***Description:*** This effort improves the long range autonomy, mobility and sensing capabilities of small UGVs to expand reconnaissance in terrains and environments large systems cannot reach (i.e. culverts, underground, dense urban) and to serve	-	-	2.332

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BF4 / *Combat Vehicle Robotics Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
as unmanned listening & observation posts. The small UGVs will deploy out of NGCV systems to enhance battlespace awareness and reduce the risk to the systems. ***FY 2023 Plans:*** Will develop and optimize small robot autonomy built within the government owned RTK autonomy software to overcome size, weight and power (SWaP) limitations of small platforms. Will develop and implement enhanced functionality and task-distribution (swarming) to overcome mobility and functional limitations of small robots for effective reconnaissance. Will mature and demonstrate MMPs interoperable across multiple platforms that provide commanders with options to configure systems to the mission needs. Will demonstrate these enhancements through Engineering EET to ensure the autonomous technology and integrated MMPs have been fully evaluated for system safety, performance and technical maturity. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding realigned from the Soldier-Robotic Interface integration effort in this Project to mature and demonstrate small robot autonomy technologies that will enhance functionality and overcome mobility limitations for more effective reconnaissance with reduced operator direct control.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.977	-
Accomplishments/Planned Programs Subtotals	10.104	26.765	29.463

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BF7 / *Crew Augmentation and Optimization Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BF7: *Crew Augmentation and Optimization Adv Tech*	-	4.211	3.768	4.326	-	4.326	3.795	4.334	4.386	4.385	0.000	29.205
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced technologies to enable crew augmentation and optimization for closed hatch operations of ground vehicle platforms in a complex multi-domain operations environment. This includes integration of intelligent technologies to improve dynamic tasking and full crew interactions, machine learning to improve decision aids, early warnings, reduce response times and shorten task durations, and machine learning to optimize tasking and function. Mature technologies are incorporated onto existing or prototype Army-owned technology demonstrators so that performance of the enabling technologies can be evaluated.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

Research in this Project is conducted by the United States (US) Army Futures Command.

Work in this Project is also coordinated with work in Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology) and PE 0602143 (Soldier Lethality Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Crew Augmentation and Optimization Advanced Technology	4.211	3.630	4.326
Description: This effort focuses on optimizing crew station technologies while reducing crew sizes that will provide the same overall performance by exploiting human-machine interaction technologies, automation, machine intelligence and customization to permit soldiers to achieve performance beyond today's constrained ground vehicle environment			
FY 2022 Plans: Will mature and demonstrate vehicle and crew task management at the section level to enable sharing of critical tasks between crew and robotic operators during times of high workload. Will integrate and demonstrate interface advancements in novel display technologies (i.e. helmet mounted displays) to improve situational awareness. Will demonstrate section-level teaming of crew and robotic operator configuration to permit reconfiguration of mission roles. Will validate effectiveness in an operationally-relevant, field experiment.			
FY 2023 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BF7 / *Crew Augmentation and Optimization Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will integrate and demonstrate a threshold capability to adapt autonomous technologies by providing information regarding battlefield context inferred from Soldier behaviors. Will integrate and demonstrate technology aids with basic integrated decision support tools for automated play calling and task allocation. Will integrate and demonstrate after-action review (AAR) technology that enables Soldier-driven adaption of autonomy behavior from mission to mission. Will validate effectiveness in an operationally-relevant and motion-based Modeling & Simulation (M&S) virtual validation. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort to focus on platoon-level validation over a section-level formation.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.138	-
Accomplishments/Planned Programs Subtotals	4.211	3.768	4.326

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BG1 / *Sensors for Auto Oper and Survivability Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BG1: *Sensors for Auto Oper and Survivability Adv Tech*	-	14.054	10.666	12.464	-	12.464	12.670	12.664	12.652	12.648	0.000	87.818
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures, optimizes, and demonstrates automated, advanced multi-function sensors and integrates threat cueing capabilities for operations in full spectrum, complex environments, for next generation manned, optionally manned, and robotic platform applications. This Project will deliver sensor payloads which provide greatly increased situational awareness (e.g. pre-shot and hostile fire detection, threat classification) in all environments for manned and unmanned ground vehicle systems.

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

Research in this Project supports the Army Science and Technology Next Generation Combat Vehicle, Soldier Lethality, and Future Vertical Lift modernization priorities.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Advanced Sensors with Embedded Processing	8.680	5.539	8.787
Description: Matures and demonstrates advanced, multi-spectral and multi-function sensors, and image processing capabilities with improved performance in all environments and against all threats to include low-contrast targets in camouflage or in degraded conditions. Matures and demonstrates rapid detection of concealed enemy optical threat systems (visible, midwave infrared, longwave infrared) and real-time hostile fire detection (HFD) for anti-armor threats while on the move, exploiting multi-functional imaging components and embedded processing. Enables enhanced situational awareness and targeting capabilities in complex environments via manned, optionally manned, and robotic platform applications.			
FY 2022 Plans: Will mature low-power processing approaches for high definition (HD) sensor data to exploit imagery in degraded environments and detect threats. Will validate performance of novel uncooled infrared sensors to assess the impact of increased dynamic range, sensitivity, and higher data rates for passive HFD of anti-armor threats. Will exploit infrared digital read out integrated circuit (DROIC) technologies for 3rd Gen Forward Looking Infrared to improve multi-spectral, multifunction targeting and threat detection for greatly enhanced range performance and increased ability to detect targets and threats in degraded environments. Will mature advanced pulsed mid-wave infrared laser technology to enable maturation of on-the-move threat optics detection capabilities.			
FY 2023 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG1 / *Sensors for Auto Oper and Survivability Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will optimize novel uncooled infrared sensors, incorporating low power processing to minimize system size, weight, and power. Will optimize targeting and threat detection sensors with embedded multifunction processing against threats at increased range in complex environments. Will mature and provide advanced targeting and navigation laser technologies, novel image processing approaches and infrared sensors for on-the-move target detection, ranging and tracking. Will validate image processing approaches to enable optimized transmission from sensor to shooter systems. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding increase reflects investments required to develop advanced sensing capabilities with integrated targeting approaches for use in complex environments.			
Title: Multi-Mission Payload ***Description:*** Matures and demonstrates sensor payloads for ground vehicle based unmanned aerial systems to detect line of sight, and beyond line of sight threats and complex obstacles such as personnel and vehicles in all environments. ***FY 2022 Plans:*** Will improve performance of rotary and fixed wing unmanned aerial system (UAS) payloads to enable advanced detection of threats and targets in complex environments, day or night. Will exploit feature extraction and target detection techniques to enable advanced sensing capabilities inherent in the multi-modal sensor technologies to increase detection of near-pear threats and suppress clutter. Will demonstrate advanced sensor payloads in realistic open terrain environments to establish a baseline capability to augment maneuver and protection of small unit level formations. ***FY 2023 Plans:*** Will demonstrate rotary wing unmanned aerial system optionally tethered with a manned or unmanned ground vehicle (UGV) for detection of threats in complex environments, day or night. Will demonstrate real time feature extraction and target detection capabilities to increase detection of near-pear threats and suppress clutter. Will exploit fusion of polarization sensors and advanced lasers to enhance detection of a wider range of threats and improve target location accuracy. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Decrease represents completion of preliminary sensor improvement development efforts necessary to enable demonstrations of a rotary wing unmanned aerial system optionally tethered with a manned or unmanned ground vehicles.	5.374	4.736	3.677
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:***	-	0.391	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG1 / *Sensors for Auto Oper and Survivability Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	14.054	10.666	12.464

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BG3 / *Modeling and Simulation for MUMT Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BG3: *Modeling and Simulation for MUMT Advanced Tech*	-	3.241	5.188	5.975	-	5.975	6.248	7.175	7.529	7.363	0.000	42.719
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates modeling and simulation (M&S) tools/technologies to assess and improve freedom of movement for ground forces and supports vehicle developers by addressing challenges for robotic and ground vehicles. This Project matures and demonstrates obstacle detection capabilities for autonomous systems operating in complex environments. This Project also matures and demonstrates real-time mobility decision support tools, vehicle-terrain interaction models for autonomous convoy operations, simulation tools for vehicle mobility in highly altered terrain, and M&S tools for predicting the performance of autonomous vehicles. These M&S technologies can be integrated across Army vehicle platforms as required.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority .

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

Research in this Project is coordinated with Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology) / Project BG2 (Modeling and Simulation for MUMT Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Simulation Tools for Combat Vehicle Robotics (CoVeR) Demonstrations	3.241	4.999	5.975
Description: This effort matures and demonstrates M&S tools to support the development of autonomous ground vehicle platforms and components for successful maneuver in unstructured and mission relevant environments. This effort demonstrates M&S capabilities to evaluate hardware and software technologies enabling battlefield autonomy in complex and challenging environments.			
FY 2022 Plans: Mature and demonstrate analytical tools and adaptive learning models for predicting autonomous maneuver performance and determining alternative routes in unstructured environments; and mature advanced algorithms to detect obstacles that affect maneuver corridors in unstructured environments.			
FY 2023 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG3 / *Modeling and Simulation for MUMT Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will mature and demonstrate advanced algorithms to detect obstacles to maneuver in unstructured and operationally relevant environments. Will mature and demonstrate computational environment test bed to support development of autonomous vehicle platforms and components; will release of M&S tools with high-fidelity software-in-the-loop capability. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: FY 2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.189	-
Accomplishments/Planned Programs Subtotals	3.241	5.188	5.975

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BG4 / *Adv Mobility Experimental Prototype Adv Tech Demo*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BG4: *Adv Mobility Experimental Prototype Adv Tech Demo*	-	3.760	2.819	-	-	-	-	-	-	-	0.000	6.579
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced powertrain, power generation and running gear technologies into a combat vehicle that will reduce the percentage of no- go terrain for ground vehicles, increase the maneuver speeds across all traversable terrain, reduce fuel demands thus extending operation time between resupply, and provide onboard power generation to enable the integration of energy-based capabilities such as directed energy weapons and electromagnetic armor.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

Research in this Project is conducted by the United States (US) Army Futures Command.

Research in this Project is coordinated with Program Element (PE) 0604115A (Technology Maturation Initiatives).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Advanced Mobility Experimental Prototype (AMEP) Advanced Technology	3.760	2.716	-
Description: This effort develops and demonstrates the advanced powertrain, track and running gear, and unmanned robotic technologies for integration into a ground combat vehicle that will provide increased mobility, maneuver speeds, and optionally manned capabilities in order to validate performance and capability enhancements at increased vehicle weights to inform ground combat vehicle design. ***FY 2022 Plans:*** Will improve running gear performance for ground combat vehicles with gross vehicle weights up to 50 tons. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Project completes in Fiscal Year 2022 (FY22).			
Title: FY2022 SBIR/STTR Transfer	-	0.103	-
Description: Funding transferred in accordance with Title 15 USC ?638			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG4 / *Adv Mobility Experimental Prototype Adv Tech Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
FY 2022 Plans: Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	3.760	2.819	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army											Date: April 2022	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*				Project (Number/Name) BG5 / *Extended Line of Sight (ELOS) Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
BG5: *Extended Line of Sight (ELOS) Advanced Technology*	-	1.396	-	-	-	-	-	-	-	-	0.000	1.396
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project develops a precision guided tank fire and forget 120-mm munition to engage high-value targets including heavy armor, the growing Anti-Tank Guided Munition (ATGM) threat (dismounted and mounted), and light armor at extended ranges (2 to 8 km (T), 2 to 12 km (O)).

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Extended Line Of Sight (ELOS) Advanced Technology ***Description:*** This effort demonstrates a 120-mm Tank-fired ELOS Munition that counters the growing ATGM threat at extended line of sight ranges beyond current capability.	1.396	-	-
Accomplishments/Planned Programs Subtotals	1.396	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BG7 / *Ground Systems Active Defense (GSAD) Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BG7: *Ground Systems Active Defense (GSAD) Advanced Tech*	-	36.496	52.172	60.371	-	60.371	57.781	49.425	52.255	55.800	0.000	364.300
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates protection and survivability technologies to increase the survivability of ground vehicles and the protection of the Soldiers who depend on them. The tasks will focus on component maturation and demonstration and transfer products for demonstration as holistic (vehicle level) solutions. The Project will mature and demonstrate technologies to defeat threats throughout the timeline of a threat engagement; from obscuring a target, to actively defeat a threat and through mitigating its effects after engagement. These technologies include the active employment of smoke, physical and electronic active protection, advanced and adaptive armors, advanced and active blast mitigation systems and adaptive interior protection.

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

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

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

Research in this Project will be coordinated with Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology) and transitions to PE 0604852A (Suite of Vehicle Protection Systems - EMD).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Obscuration Technologies for Active Protection Systems ***Description:*** Research, develop, test, evaluate, and demonstrate obscurant soft-kill vehicle protection technologies to defeat the observer/gunner, anti-tank guided missiles (ATGMs), and other guided threats. Design and evaluate systems that are Modular Active Protection System (MAPS) and Survivability Subsystem Controls (SSC) compliant.	2.298	-	-
Title: Active Protection Technologies ***Description:*** This effort demonstrates protection for light armored combat vehicles from anti-armor threat weapons such as rocket-propelled grenades (RPG), ATGM, and recoilless rifle projectiles (RR).	6.898	-	-
Title: Advanced Radar and Soft-Kill (A-RASK) Suite	6.058	0.938	6.682

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG7 / *Ground Systems Active Defense (GSAD) Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: This effort matures and demonstrates next generation vehicle radar technologies and holistic electronic warning and soft-kill countermeasure techniques to support a layered modular active protection suite and ensure the survivability of ground combat platforms in all-weather day or night conditions with 360 degree situational awareness and threat defeat. ***FY 2022 Plans:*** Will continue to develop soft-kill countermeasure techniques and effects for additional ATGM threats. Will conduct demonstrations of system capabilities with integrated techniques to assess system performance against multiple ATGM threat classes, launch profiles and distances. ***FY 2023 Plans:*** Will begin development of universal threat detection sensor hardware and algorithms to detect priority ATGM threats. Will evaluate sensor system level requirements based upon the latest live fire demonstration results from Fiscal Year 2022 (FY22). Will conduct sensor sub-system derived requirements analysis with modeling and simulation. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** The funding increase reflects development of universal threat detection sensors in accordance with the project plan.			
Title: Long Range Hard Kill Countermeasure (LRHK-CM) ***Description:*** This effort matures and demonstrates a MAPS-compliant hard-kill countermeasure system able to defeat current threats such as RPG, ATGM and future threat munitions such as kinetic energy and artillery delivered sub-munitions. This effort will optimize a complete hard-kill active protection system including munitions, launcher, sensors, and fire-control, and demonstrate capabilities through modeling and simulation and live-fire demonstrations.	1.396	-	-
Title: Soft-Kill System Development ***Description:*** This effort focuses on maturing and demonstrating soft-kill system technologies to protect combat vehicles from current and emerging ATGM threats at stand-off distances with an unlimited magazine and low collateral hazard. This capability will also enhance situational awareness to vehicle occupants by detecting and alerting when threats have been fired. Technologies will be optimized and integrated on combat vehicles using the MAPS Framework and Controller. They will be demonstrated in a relevant environment. ***FY 2022 Plans:*** Will develop and mature soft-kill subsystems such as those developed in the Advanced Radar and Soft-Kill Suite effort in this Project by delivering soft-kill capabilities, environmentally hardening, upgrading to the latest revision of the MAPS Framework	9.140	9.827	15.310

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG7 / *Ground Systems Active Defense (GSAD) Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
(MAF), and optimizing space, weight, and power (SWAP) of the subsystems. Will begin virtual / lab demonstrations to assess subsystem performance and robustness in preparation for system integration. ***FY 2023 Plans:*** Will develop components and other hardware needed for FY23 demonstration and vehicle integration in FY24. Will integrate the soft-kill subsystems matured in FY22 utilizing the MAPS Framework and Controller. Will optimize ground vehicle system performance and continue lab and field demonstrations to assess system performance of integrated subsystems. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** The funding increase reflects maturation of subsystems and focus on system-level integration for demonstration in accordance with the project plan.			
Title: Advanced Threat Protection ***Description:*** This effort matures and provides armor and occupant protection technology to protect against emerging both top and bottom attacks threats increasing vehicle survivability and Soldier protection.	4.014	-	-
Title: Survivability Capability Characterization and Demonstration ***Description:*** This effort evaluates and demonstrates emerging protection technologies to characterize and assess their performance and maturity and potential for transition to Product Manager (PdM) Vehicle Protection System (VPS). ***FY 2022 Plans:*** Canvas industry, academia, and government for unverified high potential / high impact survivability technologies that have applicability to current ground vehicle platform requirements. Down-select promising technologies and work with industry, academia, or government partners to begin planning for the demonstration and assessment of the technologies. Identify the technology and any other necessary resources for future demonstration. ***FY 2023 Plans:*** Will demonstrate and validate the selected survivability subsystem. Will transition relevant information to our acquisition stakeholders and help determine the feasibility of further maturing the subsystem. Will analyze available survivability subsystems capability and applicability to current ground vehicle platforms, targeting threats. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	2.944	2.412	2.395
Title: Sensors for Adaptive Armor	2.714	1.629	1.502

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG7 / *Ground Systems Active Defense (GSAD) Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: This effort matures and demonstrates sensor technology to enable an adaptive armor system using the MAPS Framework and Controller on a combat vehicle platform. This effort matures real-time processing software, continuously refines the threat trajectory prediction algorithm and integrates sensors with an adaptive countermeasure for threat defeat to the MAPS Framework and Controller to ensure the activation of adaptive armor to protect against incoming threats. ***FY 2022 Plans:*** Will optimize real-time processing software and improve trajectory prediction algorithm of the sensor technology to enable adaptive armor systems. Will mature sensor subsystem and will perform environmental and hardening testing. ***FY 2023 Plans:*** Will improve trajectory prediction algorithm of the sensor technology to enable adaptive armor system. Will mature sensor subsystem integration and demonstrate capabilities against pacing applicable threats in a relevant environment. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Active Blast Mitigation Environmental and Durability Validation ***Description:*** This effort demonstrates mature sensor technology for an Active Blast Mitigation System (ABMS) into the MAPS Framework on a combat vehicle platform with improved countermeasure design for protection from blast events. ABMS will support a reduction of injuries caused from underbody blast events by providing a counterforce to the blast acceleration of the vehicle hull.	1.034	-	-
Title: APS Residuals Protection Maturation and Complex Threat Attack Protection (CTAP) ***Description:*** This effort contributes to the Army?s ground vehicle survivability by maturing, integrating, and demonstrating advanced technologies which physically defeat incoming threats. These technologies involve passive and reactive mechanisms that work seamlessly with active protection systems in order to increase the overall efficiency of the system. This effort will mature and demonstrate armor components that defeat residual blast and fragmentation from hard-kill active protection systems engagements with kinetic threats in order to protect vehicle occupants and critical subsystems. This effort also matures and demonstrates armor and occupant protection components that provide threat defeat for advanced and emerging threats with complex defeat mechanisms. ***FY 2022 Plans:*** Will mature and demonstrate component technologies developed under PE 0602145A (Next Generation Combat Vehicle Technology) / Project BG6 (Advanced Concepts for Active Defense Technology) for protection against degraded threats, ballistic shields for sensors, advanced mechanisms for moving armor to protect optics, and multi-functional modular seats to protect	-	9.714	7.441

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG7 / *Ground Systems Active Defense (GSAD) Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
occupants from injury. Will mature and package these component designs for durability. Will demonstrate hardened component threat defeat performance through exposure to environmental conditions. Will validate that packaged component physical parameters, such as size and weight, are able to meet vehicle system-level design constraints. ***FY 2023 Plans:*** Will build upon prior year work to integrate and demonstrate packaged component for protection against threat residuals at the system-level. Will mature and optimize components through integrated system-level environmental and automotive durability testing, followed by ballistic testing, to validate performance against system-level requirements. Will validate compliance with vehicle system architecture. Will provide capstone demonstrations of capabilities to protect from pacing threats in a relevant environment. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** The funding decreased as components for demonstrations have been developed in FY22 in accordance with the project plan.			
Title: Controls and Architecture ***Description:*** This effort provides the basis for holistic (vehicle level) active defense by ensuring compatibility of active defense subsystems and systems. This effort matures and demonstrates the effectiveness and efficiency of the controls and architecture for active defense systems. The focus will be to enable the integration of multiple emerging survivability technologies into safe and secure configurations. This effort will optimize size, weight, and power - cooling (SWaP-C) performance for the system components. ***FY 2022 Plans:*** Will build upon previous controls and architecture for APS efforts by advancing the intelligent decision management subsystem, cross domain management solution, active survivability safety measures, and vehicle user-interface subsystem for emerging survivability technologies. Will ensure that enhancements do not interfere with current compliant technology performance. ***FY 2023 Plans:*** Will optimize active survivability architecture for single platform protection. Will conduct build of base kit hardware and software products, to include enhancements, and will perform component level validation and verification. Will verify available components for coordinated efforts. Will validate software performance against new enhancements through regression testing to ensure backward compatibility. Will perform studies for collaborative active defense across multiple platforms. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	-	5.253	5.617
Title: Hard Kill Active Protection System (HK APS) Development, Integration, and Demonstration	-	20.494	21.424

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG7 / *Ground Systems Active Defense (GSAD) Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: This effort matures, integrates, and demonstrates a HK APS capable of defeating RPGs, Anti-Tank Guided Missiles, and Recoilless Rifles ensuring the platform?s ability to shoot, move and communicate after an engagement. The system will be compliant to the Modular APS Framework (MAF). This effort will optimize an HK APS that includes the following sub-systems; counter-measure, launcher, and sensors (active/passive). Will demonstrate HK APS capabilities in a virtual and live fire demonstration in a relevant operational environment. Counter-measure (CM): Matures and demonstrates CM designs that includes the following aspects: blast size, time of flight, velocity, engagement distance, accuracy, and SWaP-C. Analysis will be conducted for each counter-measure component as well as at the sub-system level. Demonstrations will be performed in the following environments: virtual, hardware in the loop, and live fire. Launcher: Matures and demonstrates launcher designs that considers the following aspects: SWaP-C, engagement speed and accuracy, number of launchers, material composition and reliability. The most mature and suitable launcher for the project will be demonstrated in the following environments: virtual, hardware in the loop, and live fire. Sensors: Matures and demonstrates overall sensor suite design (active/passive) that considers the following aspects; radar frequency, power, weight, volume, algorithms, accuracy, search range, tracking and identification time, and passive cueing integration and optimization. The most mature and suitable sensor suite (active/passive) for the project will be demonstrated in the following environments: virtual, hardware in the loop, and live fire. Integration: Demonstrate the matured HK APS sub-systems on a platform in the following environments: virtual, hardware in the loop, and live fire. This will also analyze subsystem and system performance characteristics against Integrated Product Team (IPT) stakeholder requirements. Develop a performance baseline for future hard kill system evaluations.			
FY 2022 Plans: Will conduct individual Initial Design Reviews for the CM, Launcher and Sensor sub-systems, using previous efforts as a baseline, with industry and government experts. Will integrate CM, Launcher and sensor suite sub-systems based on the Initial Design Reviews including long lead components for future sub-system demonstration and validation. Will begin planning and develop sub-system models to demonstrate the sub-systems in a virtual environment. Will conduct planning for the integration of the CM, Launcher, and Sensor sub-systems into a unified HK APS onto the demonstration platform. Will execute a system level Initial Design Review including the CM, Launder and Sensor sub-system baselines established in the sub-system Initial Design			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG7 / *Ground Systems Active Defense (GSAD) Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Reviews. Will begin planning and integrate an HK APS simulation to represent the system in a relevant environment using previous efforts to demonstrate the HK APS in a virtual environment. ***FY 2023 Plans:*** Will improve and optimize the sub-system requirements and design through analysis. Will conduct a down-selection of the countermeasure (CM) warhead, guidance, and other sub-system components. Will mature design of the sensor sub-system, with industry partners, to tailor the performance to meet the requirements of the CM sub-system. Will optimize the system architecture within the established APS framework to ensure components are designed for system compliance and compatibility. Will begin planning virtual tests and demonstrations of the sub-systems. Will continue planning integration of the sub-systems to develop the system-level design. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	1.905	-
Accomplishments/Planned Programs Subtotals	36.496	52.172	60.371

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BG9 / *Obscuration Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BG9: *Obscuration Advanced Technology*	-	10.533	2.511	2.765	-	2.765	2.813	2.810	2.811	2.810	0.000	27.053
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Project matures and demonstrates obscurant technologies with potential to enhance personnel and platform survivability by degrading threat force surveillance sensors and defeating the enemy's target acquisition devices, missile guidance, and directed energy weapons. Dissemination systems for new and improved obscurants are developed with the goal of providing efficient and safe screening of deployed forces. Synthetic Biology Manufacturing technologies in this project will provide Department of Defense (DoD) with the ability to manufacture products such as explosive alternatives and defense-only critical chemicals & materials.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

Research is performed by the United States (U.S.) Army Futures Command.

Research in this Project is related to and fully coordinated with Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Advanced Obscuration	2.533	2.416	2.765
Description: This effort matures and demonstrates the dissemination of new and advanced obscurants. ***FY 2022 Plans:*** Will examine packing and dissemination methods of advanced obscuration materials. Will ensure that materials can be safely and efficiently disseminated, and material packing methods geared towards use in obscuration programs . ***FY 2023 Plans:*** Will conduct field demonstration of a bi-spectral screening obscuration module and transition to Program Manager. Will down-select material coating and conduct flammability testing. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Synthetic Biology Bioprocessing Facility	8.000	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG9 / *Obscuration Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: This effort supports the modernization of the Army's Synthetic Biology Bioprocessing Technology to manufacture pilot scale products such as explosives, obscurants and defense-only critical chemicals & materials. This effort will expedite transitioning products from the new Synthetic Biology Manufacturing Innovation Institute into technology development efforts to support the Department of Defense.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.095	-
Accomplishments/Planned Programs Subtotals	10.533	2.511	2.765

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army											Date: April 2022	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*				Project (Number/Name) BH1 / *Survivability Systems Controls Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
BH1: *Survivability Systems Controls Advanced Technology*	-	11.880	-	-	-	-	-	-	-	-	0.000	11.880
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project advances the design and capability of the Modular Active Protection System (MAPS) framework and controller to enable integrating emerging survivability technologies into safe and secure configurations and demonstrating them in a representative operational environment. The Project will verify compliance of component sensors and effectors with the modular active protection architecture. This Project ultimately feeds demonstrations of active defense subsystems for demonstration as holistic (vehicle level) solutions. This Project is also a key enabler for insertion of current and future active survivability technologies onto ground platforms in order to combat current and emerging threats.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

This research is performed by the United States (US) Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Survivability System Control	11.880	-	-
Description: This effort focuses on maturing and demonstrating a common and open survivability architecture and core implementation to ensure its operational effectiveness. Specifically, this effort includes extending the MAPS architecture across a broader set of active survivability capabilities and increasing the portfolio of MAPS Framework (MAF) compliant technologies. In addition, this project will enhance the government-developed controller subsystem for performance and integration effectiveness with high speed digital signal processing and embedded systems/firmware/software which will be required due to the expanded active defense suite of sensors (e.g., electro-optic, infrared, radio frequency, magnetic, acoustic), sensor fusion, and explore synthesizing sensor data beyond situational awareness to situational understanding with context that can greatly enhance operational effectiveness and vehicle survivability. The activities under this effort provide incremental growth for broader threat spectrum defeat relevant to vehicle protection systems and will be aligned to capability gaps for transition to the acquisition community.			
Accomplishments/Planned Programs Subtotals	11.880	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH1 / *Survivability Systems Controls Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BH4 / *Ground Vehicle Holistic Defense Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BH4: *Ground Vehicle Holistic Defense Adv Tech*	-	-	0.034	-	-	-	-	-	1.427	1.798	0.000	3.259
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project will be the basis for a holistic survivability design framework utilizing virtual design models in a Modeling and Simulation (M&S) environment as well as conducting hardware in the loop and live fire demonstration. This Project will inform multiple system level demonstrations to validate that layered survivability technologies are optimized to defeat emerging near-peer threats. Data collected will be used to further validate and verify M&S tools. This Project also provides a design approach available to analyze and adjust the family of protection technologies for combat vehicles in relevant operational theaters.

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

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

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

Research in this Project is coordinated with Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BG7 (Ground Systems Active Defense (GSAD) Advanced Tech) and transitions to PE 0604852A (Suite of Vehicle Protection Systems - EMD).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Layered Survivability Demonstration	-	0.033	-
Description: This effort will utilize virtual models in a M&S environment to analyze layered survivability technologies for integration to a demonstration platform. Selected technologies will be demonstrated in a relevant environment to include, virtual, hardware/software in the loop, and live fire environments. This effort will validate that layered Survivability technologies are optimized to defeat threats consistent with the threat defeat capabilities of the selected technologies. ***FY 2022 Plans:*** Will conduct very limited holistic vehicle defense analysis in support of larger vehicle systems security activities. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Change reflects planned lifecycle of this effort.			
Title: FY2022 SBIR/STTR Transfer	-	0.001	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH4 / *Ground Vehicle Holistic Defense Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	-	0.034	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BH6 / *Platform Electrification and Mobility Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BH6: *Platform Electrification and Mobility Adv Tech*	-	20.698	24.891	46.679	-	46.679	63.174	45.417	45.419	40.181	0.000	286.459
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures, integrates and demonstrates technologies to electrify both manned and unmanned Next Generation Combat Vehicle platforms. Electrification of these platforms will enable advanced onboard electrified payloads such as directed energy weapons, reduce battlefield fuel consumption, and provide new capabilities such as burst acceleration, extended silent mobility and silent watch. This Project will also mature, integrate and demonstrate technologies to increase electric power such as a high voltage/temperature generator and high power/ temperature power electronics as well as technologies to reduce power demands including composite rubber band track and adaptive hydro-strut suspension.

This Project also continues the Advanced Vehicle Power Technology Alliance (AVPTA) between the Department of Energy and the Department of the Army with a focus on electrification technology that enables military ground vehicles to become significantly more energy efficient. The Alliance is chartered to accelerate the conceptualization and transition into deployment of inventive and creative energy-saving concepts that the Nation needs to achieve energy security.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

Research is performed by the United States (U.S.) Army Futures Command.

This work complements Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Platform Electrification Technologies	11.069	10.613	11.871
Description: This effort matures and integrates components and sub-systems in order to demonstrate a modular electrification architecture that scales across light to heavy weight classes of combat vehicles.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH6 / *Platform Electrification and Mobility Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will mature the electric sprocket drive system and develop integration software. Will mature thermal management system for a modular high voltage energy storage system. Will mature the diesel-electric power system and thermal management system and develop integration software. Will develop high power electrical components to enable the tactical battlefield recharging capability. ***FY 2023 Plans:*** Will validate subsystems for the electric sprocket drive, diesel-electric power system and thermal management system, and demonstrate all sub-systems in a system integration validation laboratory. Will validate supervisory controls for the subsystem controls and integrated system operation. Will perform subsystem integration and laboratory evaluation of a modular high voltage energy storage system. Will mature and improve performance of tactical battlefield recharging technologies. Will continue to improve electric sprocket drive and electric cooling to support Heavy Combat Vehicle electrification requirements. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding increased to support application of electric sprocket drive and electric cooling for heavy combat vehicle electrification.			
Title: Advanced Mobility Technologies ***Description:*** This effort matures and demonstrates a reduced weight composite running gear system for medium combat vehicle applications which increases operational effectiveness and reduces fuel consumption. ***FY 2022 Plans:*** Will exploit composite materials and component designs to significantly reduce running gear system weights. Will reduce integration and supportability concerns with external suspension systems. ***FY 2023 Plans:*** Will improve performance of composite track system technology with longer lasting compounds at higher weight carrying capacities. Will optimize external suspension system design to increase mobility performance. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	3.744	5.606	6.061
Title: Advanced Vehicle Power Technology Alliance - Electrification Technology ***Description:*** This effort matures and develops advanced energy storage technologies to improve power and energy performance and safety for vehicles. Higher energy stored with less space and weight increases vehicle efficiency and range. Ensures electrified ground vehicles have enough power for mobility, silent watch, and enables capabilities such as advanced protection, lethality and network capabilities. This effort is a partnership with the Department of Energy. ***FY 2022 Plans:***	2.841	1.992	2.207

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH6 / *Platform Electrification and Mobility Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will mature and optimize commercial based energy storage systems to meet military environmental conditions at a module level. ***FY 2023 Plans:*** Will improve energy storage module performance and validates performance at the energy pack level. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.			
Title: System/Vehicle Integration and Test ***Description:*** This effort integrates advanced mobility, platform electrification components and electrification architecture technologies into surrogate platforms and demonstrates the performance, scalability and modularity of the system approach which will provide the capabilities of silent mobility, improved mobility performance, improved operational duration without re-supply, and provides power to enable integration of advanced protection, lethality and network capabilities. ***FY 2022 Plans:*** Will demonstrate sub-system packaging into the surrogate hulls for significantly improved under-armor power density while maximizing system integration for ease of assembly, maintenance, and supportability. ***FY 2023 Plans:*** Will demonstrate the electrified system control, performance, and operational energy efficiency through system-level integration and laboratory testing. Will integrate the modular/ scalable electrified system into surrogate platforms for future demonstration. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding increase reflects development of systems integration lab for early integration of component technologies.	3.044	2.502	3.983
Title: Scalable Electrification & Control Architecture Technology ***Description:*** This effort validates component-level performance and integrates the power distribution and control components to implement a common, scalable, electrified vehicle power architecture to enable analyze layered survivability technologies, high voltage batteries, fast vehicle charging from the grid, and silent mobility on combat platforms from 15 to 50 tons. ***FY 2022 Plans:*** Will demonstrate component-level performance of the high voltage power converter and import/export power converter. Will integrate those components into the power subsystem to validate subsystem-level performance. ***FY 2023 Plans:***	-	1.860	3.536

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH6 / *Platform Electrification and Mobility Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will demonstrate component-level performance of high voltage power distribution component that enables electrified powertrains, and integrate that component into the power subsystem to validate subsystem-level performance. Will provide power subsystem software that will take advantage of the new capabilities and use-cases they enable. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort, moving from component-level demonstration to subsystem integration in a laboratory environment.			
Title: Robotic Combat Vehicle Silent Watch and Mobility Range Extension Advanced Technology ***Description:*** This effort matures and demonstrates JP8 reformer components and sub-systems that provide extended silent watch and mobility as part of a modular electrification architecture supporting robotic combat vehicles. The Army's robotic combat vehicles are expected to have increased silent watch and silent mobility requirements that are not met by current technologies. ***FY 2022 Plans:*** Will optimize the lightweight anode supported solid oxide fuel cell integration with JP8 reformer and mature from test stand to stand alone operation on a light robotic combat vehicle to increase silent watch and mobility. ***FY 2023 Plans:*** Will demonstrate initial JP8 reformer and anode supported solid oxide fuel cell system for a light robotic combat vehicle for increased silent watch and mobility. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding Increase reflects planned lifecycle of this effort.	-	1.409	2.021
Title: Parallel Hybrid Electric Combat System ***Description:*** This effort is focused on developing and demonstrating a parallel hybrid electric capability for tracked combat veicles that will enable silent mobility and improved fuel efficiency. ***FY 2023 Plans:*** Will develop architecture and controls to enable a clutch with position sensor necessary for a parallel hybrid tracked combat systems. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding increase reflects the development of parallel hybrid electric capabilities for tracked combat vehicles that will improve fuel efficiency and reduce impacts on the climate.	-	-	1.800
Title: Tactical and Wheeled Vehicles Hybrid Electric System	-	-	6.400

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH6 / *Platform Electrification and Mobility Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: This effort is part of the climate change initiative to reduce vehicle platform carbon emissions through development of hybrid electric, anti-idle and multi-vehicle power networking capabilities for tactical and wheeled platforms. ***FY 2023 Plans:*** Will mature hybrid electric technologies and multi-vehicle power networking node. Will develop integration software for anti-idle, high voltage energy storage, and hybrid functions of regenerative braking, electric launch assist, and mobility optimization. Will develop the supervisory control system that integrates the subsystems into a cohesive propulsion system including motoring and generating. Will develop and integrate a multi-vehicle microgrid dashboard. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding increase reflects the development of hybrid electric capabilities for tactical wheeled vehicles that will improve fuel efficiency and reduce impacts on the climate.			
Title: Battery Technologies for Supply Chain Security ***Description:*** This effort researches technologies that mitigate battery supply chain security issues as it relates to common military form factors that are critical to military ground vehicle electrification and other Army battery applications. This effort is part of a coordinated effort to conduct assessments of technologies across the Defense Advanced Battery Supply Chain along with DoD battery technology projects in PEs 0603342D8Z, 0605798D8Z, 0603680D8Z, 0607210D8Z, 0605805Z, 0603724N, and 0901212N. ***FY 2023 Plans:*** Will provide an assessment of industrial base risk in battery component technologies, quantifying the battery designs and common form factors needed to support future capability, and the current risk of exposure of those battery components to foreign supply influence. This assessment will inform follow on research into batteries and battery chemistries and materials that can be domestically sourced. Will begin to mature, integrate, and demonstrate small battery types (such as BB2590 and Small Tactical Universal Battery (STUBS)) in vehicle and other communications-electronics applications to develop a pathway for the adoption of these standard form factor batteries. Will exploit mature 6T common form factor Li-ion (Lithium ion) battery technology to demonstrate alternative uses to accelerate the electrification of other Army and DOD platforms. Will validate capabilities to evaluate commercial energy storage technologies in military vehicle and other conditions. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** This increase is to address defense-wide critical battery supply chain security issues that would prevent the Army from fielding electrified vehicle systems.	-	-	8.800
Title: FY2022 SBIR/STTR Transfer	-	0.909	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH6 / *Platform Electrification and Mobility Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	20.698	24.891	46.679

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BH8 / *Enhanced VETRONICS Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BH8: *Enhanced VETRONICS Advanced Technology*	-	11.809	14.989	10.776	-	10.776	10.223	10.559	9.317	12.641	0.000	80.314
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures, integrates, and demonstrates vehicle electronics hardware such as computers, sensors, communications systems, displays, and vehicle command/control/driving mechanisms as well as vehicle software to enhance crew performance, increase vehicle fuel efficiency, reduce Size, Weight, and Power (SWaP) burdens and reduce vehicle maintenance costs. This Project also exploits open system architectures (power and data) for military ground vehicles to enable common interfaces, standards and hardware implementations. The overall vehicle system architecture approach provides an open architecture such as the Vehicle Integration for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance / Electronic Warfare (C4ISR/EW) Interoperability (VICTORY), to allow platforms to accept future technologies without the need for significant re-design as new technologies are developed and integrated. Additionally, this project improves infrastructure that enables the ease of integration of autonomous subsystem technologies into future and existing tactical and combat vehicle architectures. Technical challenges include software and algorithm development for increased levels of automation for both manned and unmanned systems, secure vehicle data networks, interoperability of intra-vehicle and inter-vehicle systems, and implementation of advanced user interfaces. Overcoming these technical challenges enables improved and increased span of collaborative vehicle operations, efficient workload management, commander's decision aids, embedded simulation for battlefield visualization and fully integrated virtual test/evaluation.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

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

Research in this Project is coordinated with Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Enhanced - Vehicle Electronics (E-Vetronics)	11.809	14.442	10.776
Description: This effort addresses technical and integration challenges in the areas of vehicle architecture and systems integration. Specifically, this effort focuses on maturing and demonstrating a common ground vehicle open architecture with distributed display processing architecture, computing hardware capable of being re-configured to adapt to changes in Input / Output (I/O) needs, advanced network video distribution, advancements in slip ring technology, tactical situational awareness (SA), cooperative engagement and mission package integration through open architecture components and software. These			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH8 / *Enhanced VETRONICS Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
efforts will enable future vehicle capabilities, reduce dependencies on proprietary solutions, and support increased market competition through open architecture components and software. This effort will create the electronics architecture for future ground combat vehicles to enable software and hardware commonality and reduce system integration timing and cost. ***FY 2022 Plans:*** Will continue development of architecture, tactical situational awareness, digital containerization, flexible computing I/O and advanced slip sing. Will conduct final demonstration of advanced slip ring and flexible computing I/O technologies, as well as a second bench level demonstration of all available components in an open system architecture. Will develop scalable, modular hybrid electric system architecture for tactical vehicles as well as interfaces to high voltage energy storage modules, power management systems to improve fuel efficiency for military vehicles. ***FY 2023 Plans:*** Will improve the ground vehicle common architecture, tactical situational awareness, and digital containerization lines of efforts. Will integrate mission packages for key network functions within the common network architecture. Will demonstrate open system architecture to include objective hardware available to conduct bench level demonstration. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding realigned to Parallel Hybrid Electric Combat System in project BH6 Platform Electrification and Mobility Adv Tech for tactical vehicle hybrid electrification architecture.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.547	-
Accomplishments/Planned Programs Subtotals	11.809	14.989	10.776

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BI3 / *Sensor Protection Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BI3: *Sensor Protection Advanced Technology*	-	1.752	1.645	1.708	-	1.708	1.738	1.738	1.734	1.734	0.000	12.049
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates novel sensor protection capabilities which dramatically reduce the susceptibility of our thermal electro-optic/infrared (EO/IR) sensors to ever increasing threats on the battlefield. This Project enables continuation of the mission despite potential threat laser engagements. Low cost modular solutions will be demonstrated that can be applied across current and planned EO/IR targeting, surveillance, and situational awareness sensor systems against existing and emerging threats in support of combined arms maneuver.

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

Research in this Project supports the Next Generation Combat Vehicle, Soldier Lethality, and Future Vertical Lift Army Modernization Priorities.

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

Research in this Project is coordinated with Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology), 0602143A (Soldier Lethality Technology), 0603465A (Future Vertical Lift Advanced Technology) and 0603118A (Soldier Lethality Advanced Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Sensor Protection Advanced Technology	1.752	1.585	1.708
Description: This effort will mature and demonstrate sensor protection and signature reduction capabilities which better ensure sensors are difficult to detect, dazzle, and damage by current and future laser threats.			
FY 2022 Plans: Will mature super window optical coating or material solution with environmental hardening. Will validate protected uncooled microbolometer camera in a relevant environment.			
FY 2023 Plans: Will optimize longwave infrared (LWIR) filter coatings for newly available high sensitivity uncooled bolometer cameras. Will demonstrate effectiveness of visible filter materials against relevant commercially available visible laser threats.			
FY 2022 to FY 2023 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BI3 / *Sensor Protection Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Funding change reflects planned lifecycle of this effort			
Title: FY2022 SBIR/STTR Transfer	-	0.060	-
Description: Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	1.752	1.645	1.708

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BI5 / *Materials Application and Integration Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BI5: *Materials Application and Integration Adv Tech*	-	5.286	4.825	5.279	-	5.279	5.478	4.580	4.736	4.734	0.000	34.918
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures, integrates, and demonstrates lightweight novel materials, and new manufacturing processes and methodologies. These materials and technologies enable the Army to address critical areas of survivability, mobility, and transportability within the Next Generation Combat Vehicle (NGCV).

This Project also continues the Advanced Vehicle Power Technology Alliance (AVPTA) between the Department of Energy and the Department of the Army with a focus on developing advanced materials technologies that enable military ground vehicles to become significantly more energy efficient. The Alliance is chartered to accelerate the conceptualization and transition to deployment of inventive and creative energy-saving concepts that the Nation needs to achieve energy security. This Project matures and integrates lightweight materials and joining technologies in support of lighter military vehicles which are more fuel-efficient and capable in expeditionary scenarios, yet, with superior mobility and protection of both vehicles and occupants.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

Research is performed by the United States (US) Army Futures Command.

Research in this Project is coordinated with Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: System Design Optimization for Lightweighting	4.588	3.992	4.544
Description: This effort improves technologies, tools, and advanced manufacturing techniques in support of the Army?s mission to increase mobility, protection, and transportability while reducing weight. This effort focuses on maturing and demonstrating technologies to decrease ground vehicle weight while optimizing performances and enabling the Army trade space for enhanced capabilities. The technologies being demonstrated are in the fields of material maturation, design optimization, operational metrics, joining technologies, and additive manufacturing.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will mature and demonstrate advanced/lightweight materials technologies including materials for armor applications, and novel materials for high temperature and high wear surfaces. Will apply integrated computational materials engineering (ICME) tools for improved Modeling & Simulation for virtual prototyping. Will mature and demonstrate advanced manufacturing technologies such as additive manufacturing for design optimization to improve component and sub-system performance, reduce part complexity, and reduce weight. Will validate and demonstrate integration of solid-state materials joining to include joint designs for advanced armor materials. ***FY 2023 Plans:*** Will continue to improve the Fiscal Year 2022 (FY22) plan for advanced lightweight armor and high-temperature / high-friction surface materials utilizing improvements made to virtual prototyping, additive manufacturing, and integration / joining techniques. Will mature and demonstrate lightweight, topology optimized ballistic casting for combat weapon systems. Will continue to mature and demonstrate advanced additive manufacturing feedstocks and processes for design optimization to achieve component and sub-system performance metrics, simplify complexity for reduced material waste, and reduce overall weight. Will determine target integration processes for materials joining to include designs for advanced armor materials. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Advanced Vehicle Power Technology Alliance ? Materials ***Description:*** This effort matures and demonstrates lightweight materials and joining technologies in support of lighter military vehicles which are more fuel-efficient and expeditionary with superior mobility and protection of both vehicles and occupants. Lighter materials/constructions and advances in joining technologies such as multi-material and dissimilar material joining will lead to lightweight military vehicle structures. ***FY 2022 Plans:*** Will mature and demonstrate advanced/lightweight materials for weight optimization, energy storage/transfer, and protection such as FeMnAl (Iron, Manganese and Aluminum alloy) for high hard armor applications, high strength alloy for structural applications, and conductive materials for energy transfer; validate manufacturing, machining, blast/ballistic, dissimilar materials joining/ weldability and corrosion performance for these materials. Will mature and demonstrate wire arc additive manufacturing for design optimization of large ground system components. ***FY 2023 Plans:***	0.698	0.653	0.735

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BI5 / *Materials Application and Integration Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will mature and demonstrate advanced/lightweight materials for weight optimization, energy storage/transfer, and protection such as Copper,Tantalum (CuTa) for conductive materials for energy transfer and high temperature alloys for critical engine components. Will also validate manufacturing, machining, and corrosion performance for these materials. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.180	-
Accomplishments/Planned Programs Subtotals	5.286	4.825	5.279

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BJ1 / *Vehicle System Security Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BJ1: *Vehicle System Security Advanced Technology*	-	1.444	2.455	-	-	-	-	-	-	-	0.000	3.899
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates ground vehicle cyber protection and resilience technologies to increase the cybersecurity of ground vehicles and ensure their continued operation in near-peer cyber contested environments. This Project will mature cybersecurity technologies at the platform level to defeat cybersecurity threats and maintain assured vehicle functionality and freedom of maneuver in the cyber warfighting domain.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

Research is performed by the United States (US) Army Futures Command.

Research in this Project is coordinated with Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Vehicle System Security Advanced Technology	1.444	2.365	-
Description: This effort matures and demonstrates technologies required to maintain operating tempo and overmatch capability during offensive digital attacks to military ground vehicle systems. Additionally, the effort will maintain critical vehicle functionality in peer and near-peer cyber-contested environments. The effort will also mature and demonstrate technologies to mitigate risk of future and emerging cyber vulnerabilities by designing highly assured systems with cybersecurity designed from the beginning. ***FY 2022 Plans:*** Mature and demonstrate vehicle cybersecurity technologies which verify and validate the functionality of the hardware, software or firmware operation of vehicular microelectronics by identification, logging and notification of any instances of compromised hardware, software or firmware and the corresponding threat mitigation strategies without degrading the vehicle's designed functionality. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** This project completes in Fiscal Year 2022 (FY22).			
Title: FY2022 SBIR/STTR Transfer	-	0.090	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BJ1 / *Vehicle System Security Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	1.444	2.455	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BK1 / *Autonomous Mobility Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BK1: *Autonomous Mobility Adv Tech*	-	11.370	6.087	6.323	-	6.323	5.282	5.286	-	-	0.000	34.348
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates Artificial Intelligence and Machine Learning (AI/ML) technologies to increase autonomy and mobility to perform teamed operations with manned and unmanned air and ground vehicles in a military relevant environment through data collection on relevant platforms. Data collection will involve both simulation and live collection. Simulation will provide a baseline to correctly collect, clean, and analyze data that meets the need for improving algorithms for both formation control and unmanned aerial vehicle map input for unmanned ground vehicle mobility. Live data will start with Surrogate platforms in local areas. This will allow proper collection techniques, tools, and data to maximize embedded autonomy using Machine Learning and other Artificial Intelligent methods before utilizing live data collection. The Project will use AI/ML techniques to mature and demonstrate intelligent formation control to be used on maintained roads and in complex terrain without the need for a global positioning system (GPS). Data will be collected from mounted platforms utilizing special internal and external sensors to improve algorithms for exact positioning, undistributed formation control, and increased speeds of unmanned platforms. Also, the Project will use AI/ML techniques to optimize intelligent autonomous ground platform planning through the use of Unmanned Aerial Systems (UAS) mapped areas. Data collected from air vehicle will be converted to maneuverable information for unmanned ground platform with the identification of enemy positions, go/no-go areas, terrain classification, and optimal suggested paths.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

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

Research in this Project is coordinated with Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Machine Learning Data Collection	5.195	3.261	1.760
Description: This effort matures and demonstrates techniques and technologies for mass unmanned ground vehicle data collection to be used towards Army research in autonomy and mobility with machine learning efforts. ***FY 2022 Plans:*** Will optimize the data infrastructure for storage of large amounts of robotic ground vehicle data (petabytes) and access by many concurrent users. Will demonstrate the ground robotic data collection process with sensor kits installed on Army ground vehicles.			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BK1 / *Autonomous Mobility Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will mature and expand the AI/ML data for robotic ground data vehicles to include new environments and new types of robotic ground vehicle data ***FY 2023 Plans:*** Will collect data from sensor and robotic ground vehicles at multiple sites to provide a database of diverse environments and scenarios. Will process the data and ingest it into the project data environment to make it available for visualization, searching, sharing and ML development. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding decrease in Fiscal Year 2023 (FY23) reflects planned lifecycle progression of effort to focus on development of the formation control data-driven techniques in the Formation Control task in this project.			
Title: UAS Mapping ***Description:*** This effort matures and demonstrates the use of combined UAS and ground system (UGV) data with ML techniques to develop intelligent unmanned ground system path planning. Data collected from UAS will be converted to maneuverable information for unmanned ground platform to help with the identification of enemy positions, go/no-go areas, terrain classification, and optimal suggested paths. ***FY 2022 Plans:*** Will mature the ability to map the terrain, identify obstacles, and characterize the soil from a UAS and share that information with an UGV to better inform its planned maneuver(s). Will demonstrate these capabilities with Army platforms at a relevant Army test site. ***FY 2023 Plans:*** Will mature and demonstrate teaming of unmanned air and ground vehicles in challenging environments such as mapping under canopies and in complex terrains with limited line-of-sight to validate the robustness and utility of teamed UAS/UGS to improve mobility in varying scenarios. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY23 funding decrease reflects planned lifecycle progression and maturation of effort as demonstrated in live testing events.	3.275	2.598	1.615
Title: Formation Control ***Description:*** This effort uses ML techniques to develop intelligent formation control for manned and unmanned ground vehicles to be used on maintained roads and in contested environments under electronic warfare (EW) and GPS-denied conditions. Data will be collected from mounted platforms utilizing special internal and external sensors to develop and demonstrate algorithms for exact positioning, undistributed formation control, and increased speed.	-	-	2.948

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BK1 / *Autonomous Mobility Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
FY 2023 Plans: Will perform simulation and data collection and analysis of ML models and algorithms; will collect experimental data while conducting a live demonstration of ML models and algorithms for formation control tactical maneuvers of robotic ground vehicles. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding increase in FY23 reflects planned completion of effort in PE 0602145A (Next Generation Combat Vehicle Technology) / Project BJ9 (Autonomous Mobility Tech) and the planned focus on data-driven development of formation control techniques as ground vehicle data is collected and ingested in the Project?s data environment to enable more reliable and robust machine learning models and algorithms for robotic ground vehicle formation control.			
Title: Aided Target Recognition - Multiple Cooperative Auto Sensors ***Description:*** This effort will mature and demonstrate an AI-enabled scalable team of autonomous air and ground vehicles that will cooperatively conduct a zone recon to identify, geolocate, and track threats using on-board electronic intelligence (ELINT) and electro optical-infrared (EO-IR) sensors.	2.900	-	-
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.228	-
Accomplishments/Planned Programs Subtotals	11.370	6.087	6.323

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BK4 / *Next Gen Intelligent Fire Control(NG-IFC) Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BK4: *Next Gen Intelligent Fire Control(NG-IFC) Adv Tech*	-	23.205	1.727	2.198	-	2.198	2.309	2.985	-	-	0.000	32.424
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project will mature and demonstrate armament specific hardware, algorithms and architectures to support the Next Generation Combat Vehicle with the necessary fire control on future manned and unmanned platforms.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority .

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

Research in this Project is related to and fully integrated with the efforts funded in Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Next Generation Intelligent Fire Control	8.903	1.664	2.198
Description: This effort will deliver armament specific hardware, algorithms and architectures to support the Next Generation Combat Vehicle with the necessary fire control on future manned and unmanned platforms.			
FY 2022 Plans: Will demonstrate reduction of engagement timeline by leveraging advances of fire control technologies for extended range engagements through an improved user interface. Will mature hardware to demonstrate a tailored modular architecture framework.			
FY 2023 Plans: Will optimize fire control and modeling characteristics to improve performance of target prioritization models for current and future direct fire platforms. Will mature and demonstrate the model characteristics by assessing performance against specified targets and scenarios.			
FY 2022 to FY 2023 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BK4 / *Next Gen Intelligent Fire Control(NG-IFC) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Funding increase reflects project plan.			
Title: FIRESTORM Advanced Research ***Description:*** Designs and demonstrates networked lethality role-based architecture to support automated decision aids and target handoff capability for combined arms operations. Designs and demonstrates a hybrid distributed architecture that will ingest real-time, prioritized data for decision agents to support scalable operations with reduced processing time.	14.302	-	-
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.063	-
Accomplishments/Planned Programs Subtotals	23.205	1.727	2.198

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BK6 / *Adv Direct InDirect Armament Sys (ADIDAS) Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BK6: *Adv Direct InDirect Armament Sys (ADIDAS) Adv Tech*	-	0.224	-	1.534	-	1.534	2.053	9.850	12.613	12.622	0.000	38.896
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies for large caliber direct fire light-weight armament systems that will exceed the current capability of 120 millimeter (mm) direct fire cannons and be optimized for future operational environment with cross-domain engagement capability. Specifically, this Project integrates and demonstrates technologies for rapid fire on-the-move at all elevations (direct & indirect), compact ammunition design with advanced ignition, advanced recoil mitigation to reduce impulse and allow integration onto lighter platforms, automated ammunition handling and reloading. This Project also supports open architecture to enable supervised autonomy and remote operation and integrates intelligent fire control to address multi-domain targets from manned and unmanned platforms.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

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

Research in this Project is related to and fully integrated with the efforts funded in Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology) and PE 0604115A (Technology Maturation Initiatives).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Large Caliber Armament System (LCAS)	0.224	-	1.534
Description: This effort matures and demonstrates a next generation, automated, lightweight 120-mm armament system design for Next Generation Combat Vehicle, providing tank-like lethality for light medium-weight optionally manned platforms.			
FY 2023 Plans: Will demonstrate integrated technologies for improving lethal performance of direct fire projectiles. Will mature armament tracking algorithms, and enhanced targeting and engagement techniques for direct fire projectiles.			
FY 2022 to FY 2023 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BK6 / *Adv Direct InDirect Armament Sys (ADIDAS) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Funding resumes in Fiscal Year 2023 (FY23) to demonstrate emerging large caliber direct fire technology from PE 0602145A (Next Generation Combat Vehicle Technology) / Project BK5 (Adv Direct In-Direct Armament Sys (ADIDAS) Tech).			
Accomplishments/Planned Programs Subtotals	0.224	-	1.534

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BP6 / *Ground Vehicle Advanced Technology(CA)*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BP6: *Ground Vehicle Advanced Technology(CA)*	-	116.200	135.250	-	-	-	-	-	-	-	0.000	251.450
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Congressional Interest Item funding provided for Ground Vehicle Advanced Technology.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Ground Vehicle Advanced Technology.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
Congressional Add: Additive Manufacturing for Jointless Hull ***FY 2021 Accomplishments:*** Conduct advanced research in Additive Manufacturing for Jointless Hull. Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for Additive Manufacturing for Jointless Hull	10.000	15.000
Congressional Add: Carbon Fiber and Graphite Foam Technology ***FY 2021 Accomplishments:*** Conduct advanced research in Carbon Fiber and Graphite Foam Technology. Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for Carbon Fiber and Graphite Foam	10.000	5.000
Congressional Add: Hydrogen Fuel Cells ***FY 2021 Accomplishments:*** Conduct advanced research in Hydrogen Fuel Cells. Work executed by Army Futures Command.	10.000	-
Congressional Add: ATE5.2 Engine Development ***FY 2021 Accomplishments:*** Conduct advanced research in ATE5.2 Engine Development.	10.000	5.000

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BP6 / *Ground Vehicle Advanced Technology(CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for ATE5.2 Engine Development		
Congressional Add: Additive Manufacturing of Critical Components ***FY 2021 Accomplishments:*** Conduct advanced research in Additive Manufacturing of Critical Components. Work executed by Army Futures Command.	5.000	-
Congressional Add: Combat Vehicle Weight Reduction Initiative ***FY 2021 Accomplishments:*** Conduct advanced research in Combat Vehicle Weight Reduction Initiative. Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for Combat Vehicle Weight Reduction Initiative	10.000	5.000
Congressional Add: Virtual and Physical Prototyping ***FY 2021 Accomplishments:*** Conduct advanced research in Virtual and Physical Prototyping. Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for Virtual and Physical Prototyping	10.000	8.000
Congressional Add: HMMWV Autonomy ***FY 2021 Accomplishments:*** Conduct advanced research in HMMWV Autonomy. Work executed by Army Futures Command.	3.000	-
Congressional Add: HMMWV Automotive Enhancements ***FY 2021 Accomplishments:*** Conduct advanced research in HMMWV Automotive Enhancements. Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for HMMWV Automotive Enhancements	5.000	3.000
Congressional Add: Program Increase - Combat Vehicle Blast Testing ***FY 2021 Accomplishments:*** Conduct advanced research in Combat Vehicle Blast Testing.	6.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
Work executed by Army Futures Command.		
Congressional Add: Program Increase - Advanced Adhesives ***FY 2021 Accomplishments:*** Conduct advanced research in Advanced Adhesives. Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for Advanced Adhesives	5.000	5.000
Congressional Add: Program Increase - Combat Vehicle Lithium 6T Battery Development ***FY 2021 Accomplishments:*** Conduct advanced research in Combat Vehicle Lithium 6T Battery Development. Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for Combat Vehicle Lithium 6T Battery Development	5.000	5.000
Congressional Add: Program Increase - Vehicle Technology Readiness Levels ***FY 2021 Accomplishments:*** Conduct advanced research in Vehicle Technology Readiness Levels. Work executed by Army Futures Command.	2.000	-
Congressional Add: Program Increase - 10X Technology Demonstration ***FY 2021 Accomplishments:*** Conduct advanced research in 10x Technology Demonstration. Work executed by Army Futures Command.	8.000	-
Congressional Add: Program Increase - HMMWV Augmented Reality HUD ***FY 2021 Accomplishments:*** Conduct advanced research in HMMWV Augmented Reality HUD. Work executed by Army Futures Command.	5.000	-
Congressional Add: Program Increase - Operator?In?The?Loop Virtual and Physical Prototyping ***FY 2021 Accomplishments:*** Conduct advanced research in Operator-in-the-Loop Virtual and Physical Prototyping.	4.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BP6 / *Ground Vehicle Advanced Technology(CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
Work executed by Army Futures Command.		
Congressional Add: Program Increase - Next Generation Electrified Transmission ***FY 2021 Accomplishments:*** Conduct advanced research in Next Generation Electrified Transmission. Work executed by Army Futures Command.	8.200	-
Congressional Add: Advanced Materials Applications ***FY 2022 Plans:*** Congressional Interest Item funding provided for Advanced Materials Applications	-	12.000
Congressional Add: Augmented Reality for Denied Environments ***FY 2022 Plans:*** Congressional Interest Item funding provided for Augmented Reality for Denied Environments	-	7.000
Congressional Add: Autonomous Minefield Clearance ***FY 2022 Plans:*** Congressional Interest Item funding provided for Autonomous Minefield Clearance	-	7.000
Congressional Add: Autonomous Vehicle Mobility ***FY 2022 Plans:*** Congressional Interest Item funding provided for Autonomous Vehicle Mobility	-	10.000
Congressional Add: Carbon Fiber Tires ***FY 2022 Plans:*** Congressional Interest Item funding provided for Carbon Fiber Tires	-	5.000
Congressional Add: Force Protection Vehicle Kit ***FY 2022 Plans:*** Congressional Interest Item funding provided for Force Protection Vehicle Kit	-	5.000
Congressional Add: Fuel Cell Technology ***FY 2022 Plans:*** Congressional Interest Item funding provided for Fuel Cell Technology	-	5.000
Congressional Add: Machine Learning for Advanced Lightweight Combat Vehicle Structures ***FY 2022 Plans:*** Congressional Interest Item funding provided for Machine Learning for Advanced Lightweight Combat Vehicle Structures	-	6.000
Congressional Add: Maneuverable Lightweight Electric Weight Reducer	-	5.000

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BP6 / *Ground Vehicle Advanced Technology(CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
FY 2022 Plans: Congressional Interest Item funding provided for Maneuverable Lightweight Electric Weight Reducer		
Congressional Add: Off-Road Maneuver ***FY 2022 Plans:*** Congressional Interest Item funding provided for Off-Road Maneuver	-	5.000
Congressional Add: Predictive Maintenance System ***FY 2022 Plans:*** Congressional Interest Item funding provided for Predictive Maintenance System	-	2.000
Congressional Add: RCV-L ***FY 2022 Plans:*** Congressional Interest Item funding provided for RCV-L	-	5.000
Congressional Add: Short Fiber Thermoplastic Applications ***FY 2022 Plans:*** Congressional Interest Item funding provided for Short Fiber Thermoplastic Applications	-	4.000
Congressional Add: Unmanned Navigational Technology ***FY 2022 Plans:*** Congressional Interest Item funding provided for Unmanned Navigational Technology	-	2.500
Congressional Add: Virtual Autonomy Environment ***FY 2022 Plans:*** Congressional Interest Item funding provided for Virtual Autonomy Environment	-	3.750
Congressional Adds Subtotals	116.200	135.250

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BZ9 / *Smart Targeting Environment for Lower Level Assets*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BZ9: *Smart Targeting Environment for Lower Level Assets*	-	3.823	3.920	3.381	-	3.381	4.383	4.393	-	-	0.000	19.900
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates mission targeting support software and algorithms, to include Electronic Warfare capabilities, leveraged from the Defense Advanced Research Project Agency (DARPA) System-of-System Enhanced Small Unit (SESU), current force, and Science and Technology (S&T) in order to enable small units to continuously build and share targeting data and access strike assets in multi-domain operations.

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

Research in this Project supports the Next Generation Combat Vehicle Army Modernization Priority.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Small Targeting Environment for Lower Level Assets (STELLA)	3.823	3.775	3.381
Description: This effort matures and demonstrates integrated target search and electronic warfare data dissemination algorithms to speed the overall targeting process. This improved process will utilize automated target search algorithms based on mission parameters to reduce processing time and interface with systems for detecting concealed targets and setting target priority. It will fuse local data processing and payload data to increase accuracy for target engagement, optimize data dissemination algorithms based on local network conditions, and streamline interfaces for small units to access joint strike assets.			
FY 2022 Plans: Will incorporate development of improved alignment of non-kinetic strike assets and plan for integration into the common operational picture (COP). Will implement tactical procedure software into Mounted Computing Environment/Mounted Mission Command software baselines. Will continue maturing small unit common operating picture procedural software for strike asset planning and tasking alignment both prior to and during missions. Will conduct Soldier touch points and lab/field based demonstrations to assure project is meeting threshold metrics.			
FY 2023 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BZ9 / *Smart Targeting Environment for Lower Level Assets*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will implement pairing of electronic warfare target effects in coordination with kinetic effects. Will evaluate additional electronic warfare system use cases and develop end-to-end system demonstrations. Will conduct Soldier evaluations and laboratory and field-based demonstrations to ensure project meets threshold metrics. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.145	-
Accomplishments/Planned Programs Subtotals	3.823	3.920	3.381

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A