Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
Total Program Element	-	273.166	166.500	149.108	-	149.108	155.296	154.184	144.152	154.477	0.000	1,196.883
BF3: *Combat Vehicle Robotics Tech*	-	20.332	17.443	18.659	-	18.659	19.393	18.540	16.313	15.968	0.000	126.648
BF6: *Crew Augmentation and Optimization Tech*	-	10.761	11.664	10.890	-	10.890	9.820	10.128	10.237	10.339	0.000	73.839
BF8: *Artificial Intelligence & Machine Learning Tech*	-	19.573	20.329	15.007	-	15.007	15.027	16.642	16.835	17.212	0.000	120.625
BF9: *Sensors for Autonomous Operations and Surv Tech*	-	22.666	25.327	24.772	-	24.772	24.939	25.689	25.969	26.229	0.000	175.591
BG2: *Modeling and Simulation for MUMT Technology*	-	5.591	5.526	4.142	-	4.142	3.851	3.988	3.649	5.286	0.000	32.033
BG6: *Advanced Concepts for Active Defense Technology*	-	33.399	32.668	30.206	-	30.206	34.367	33.620	24.762	28.748	0.000	217.770
BG8: *Obscuration Technology*	-	2.722	-	-	-	-	-	-	-	-	0.000	2.722
BH5: *Platform Electrification and Mobility Tech*	-	14.206	13.763	15.160	-	15.160	18.885	15.544	14.426	14.570	0.000	106.554
BI2: *Sensor Protection Technology*	-	6.100	5.532	5.782	-	5.782	7.295	7.749	7.834	7.912	0.000	48.204
BI4: *Materials Application and Integration Tech*	-	7.651	7.505	-	-	-	-	-	-	-	0.000	15.156
BJ2: *Tactical and Navigation Lasers Sensors Technology*	-	5.596	5.790	5.863	-	5.863	5.865	5.868	5.933	5.992	0.000	40.907
BK2: *Virtual Prototyping Technology*	-	7.022	9.910	7.042	-	7.042	7.255	8.063	8.070	8.135	0.000	55.497
BK5: *Adv Direct In-Direct Armament Sys (ADIDAS) Tech*	-	13.054	11.043	11.585	-	11.585	8.599	8.353	10.124	14.086	0.000	76.844
BP5: *Ground Vehicle Technology (CA)*	-	103.500	-	-	-	-	-	-	-	-	0.000	103.500

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602145A *I Next Generation Combat Vehicle Technology*							
CU5: *Platform Agnostic Armaments Applied Technology*	-	0.993	-	-	-	-	-	-	-	-	0.000	0.993

A. Mission Description and Budget Item Justification

This Program element (PE) line is directly aligned to the Next Generation Combat Vehicle (NGCV) Army Modernization Priority. This PE researches, designs, and evaluates combat vehicle technologies that enable the Army to have a smarter, faster, more lethal, more precise, more protected, and more adaptable force. The focus is on building upon the foundational vehicle architectures to support the Next Generation of Combat Vehicles, to include autonomy architecture, power architecture, vehicle electronic architecture, physical architecture, lethality architecture and vehicle protection architecture. The research conducted will provide technologies to enable leap ahead capabilities for manned, optionally manned and unmanned vehicles that deliver decisive lethality.

Work in this PE complements PE 0602141A (Lethality Technology), PE 0602144A (Ground Technology), PE 0602146A (Network C3I Technology), PE 0603116A (Lethality Advanced Technology), PE 0603119A (Ground Advanced Technology), PE 0603462A (Next Generation Combat Vehicle Advanced Technology), and PE 0603463A (Network C3I Advanced Technology).

Work in this PE will transition to PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Priority focus areas.

Work is performed by the Ground Vehicle System Center (GVSC); the Army Research Laboratory (ARL); the Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center; the Geotechnical and Structures Laboratory; the Data and Analysis Center (DAC); and the Armaments Center (AC).

Overseas Operations Costs (OOC) funds this requirement in the amount of $1,041 thousand for FY 2025 Budget Estimate. Overseas Operations Costs (OOC) are those financed with former Overseas Contingency Operations (OCO) funding.

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army	Date: March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	277.445	166.500	166.523	-	166.523
Current President's Budget	273.166	166.500	149.108	-	149.108
Total Adjustments	-4.279	0.000	-17.415	-	-17.415
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-2.598	-			
• SBIR/STTR Transfer	-1.681	-			
• Adjustments to Budget Years	-	-	-17.415	-	-17.415

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Project: BP5: *Ground Vehicle Technology (CA)*		
Congressional Add: *Program Increase - Silicon Carbide Electronics*	6.000	-
Congressional Add: *Program Increase - Highly Electrified Vehicles*	3.000	-
Congressional Add: *Program Increase - Prototyping Energy Smart Autonomous Ground Systems*	10.000	-
Congressional Add: *Advanced Materials Development for Survivability*	10.000	-
Congressional Add: *Program Increase - Digital Design and Simulated Testing*	5.000	-
Congressional Add: *Program Increase - Fast-Refueling Fuel Cell Engines*	7.000	-
Congressional Add: *Program Increase - Hydrogen Technologies*	15.000	-
Congressional Add: *Program Increase - Machine Learning Optimized Power Electronics*	3.000	-
Congressional Add: *Program Increase - Zero Emission Combat Vehicles*	3.000	-
Congressional Add: *Program Increase - ADVANCED MANUFACTURING FOR COMBAT LOGISTICS SUPPORT*	2.000	-
Congressional Add: *Program Increase - ENTERPRISE AND CROSS-FUNCTIONAL LVC FOR ACCELERATED DEVELOPMENT*	8.000	-
Congressional Add: *Program Increase - MOBILITY MATERIALS RESEARCH*	5.000	-
Congressional Add: *Program Increase - MODULAR ELECTRIC MOTORS*	5.500	-
Congressional Add: *Program Increase - SMALL UNIT TECHNOLOGY ADVANCEMENTS*	10.000	-
Congressional Add: *Program Increase - SOLID OXIDE FUEL CELL DEVELOPMENT*	5.000	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army	Date: March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Congressional Add: *Program Increase - STRUCTURAL THERMOPLASTICS*	6.000	-
Congressional Add Subtotals for Project: BP5	103.500	-
Congressional Add Totals for all Projects	103.500	-

Change Summary Explanation

Funding realigned to PE0602146A/ Network C3I Technology, Project AO4/Energy Efficient Devices and 0602150A/Air and Missile Defense Technology, Project SU1/Counter Small Unmanned Aircraft System.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*				Project (Number/Name) BF3 / *Combat Vehicle Robotics Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BF3: *Combat Vehicle Robotics Tech*	-	20.332	17.443	18.659	-	18.659	19.393	18.540	16.313	15.968	0.000	126.648

A. Mission Description and Budget Item Justification

This Project designs, develops, and evaluates a variety of innovative 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.). This Project focus areas include autonomous architecture, autonomous behaviors and perception, and soldier machine Interface. Autonomous Behaviors efforts focus on enhancing the performance of autonomy such as obstacle detection and avoidance. Soldier Machine interface efforts focus on design and development of technologies to become more efficient and effective for a robotic operator to complete missions on government owned Warfighter Machine Interface (WMI) software.

This work is done in coordination with Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BF4 (Combat Vehicle Robotics).

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

Work in this Project is performed by Ground Vehicle System Center (GVSC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Autonomous Behaviors and Perception	13.034	9.827	10.886
Description: This effort contributes to the NGCV Robotic Autonomous Strategy (RAS) to advance the mobility performance of autonomous systems within complex environments/ operations to allow for the completion of mission goals in separate and teaming configurations at varying levels of autonomy. ***FY 2024 Plans:*** Will develop and validate complex obstacle detection and obstacle avoidance at operationally relevant speeds and over rough terrain, enabling autonomous vehicles to successfully navigate in unstructured environments. Further develop, validate, and certify the object classification and scene understanding created in FY 2023, resulting in a matured framework for customized and trusted reactions to specific situations. Will investigate teaming and tactical behaviors for multi-vehicle goal negotiation, using the enhanced scene understanding from FY 2023 with a focus on human-understandable autonomy within the Army's Robotic Technology Kernel (RTK) autonomy stack (system). Will develop methods for using map data merged with current sensor data to increase situational awareness and conduct reconnaissance maneuvers with an emphasis on autonomous implementation and tools. Will continue to mature the Autonomous Ground Vehicle Reference Architecture (AGVRA) framework by building additional large and small team mission models and task decomposition within the operational reference models. Will mature ground vehicle			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF3 / *Combat Vehicle Robotics Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
robotics architecture and associated model profile, library, and views, advancing current technologies within a model-based systems engineering environment. Will continue to develop interface model definition and tools to facilitate model integration. Will continue to develop and mature the Robot Operating System - Military (ROS-M) to support the ability to register and distribute concepts, specifications, requirements, standards and architectures, in addition to autonomous software solutions and supporting tools. ***FY 2025 Plans:*** Will research adaptable motion control, enabling autonomous vehicles to respond to changes in the operating environment and mission context. Will research frameworks to enable behavior switching and mobility adjustment based on terrain awareness, sensing, and object classification. Will investigate passive perception techniques to supplement or replace light detection and ranging (LIDAR) as the perception capability for the RTK to reduce the detectability of the system during operations. Will research methods for a-priori map ingestion to enable better path planning in complex environments. Mature the commercial Robotic Operating System (ROS)-2 standard for components of RTK. Will continue to research and validate complex obstacle detection and avoidance at operationally relevant speeds and over rough terrain, started in FY 2024. Mature the Autonomous Ground Vehicle Reference Architecture (AGVRA) framework by developing mission models and associated test plan models to support engineering evaluation tests (EETs). Will mature and advance the robotics and autonomous architecture and associated digital engineering model profile, library and views advancing current technologies within a model-based systems engineering (MBSE) environment. Will develop interface model definition and tools to facilitate digital engineering model integration. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects the planned milestones for development of advanced manned-unmanned teaming and includes advancements in degraded environments.			
Title: Human Robotic Interaction	5.296	3.423	3.965
Description: This effort contributes to the Next Generation Combat Vehicle Robotic Autonomous Strategy (NGCV RAS) to implement a focused approach to deliver optimized unmanned system and manned-unmanned system performance through reduced cognitive burden for the Soldier while maintaining real-time unmanned system status/activity, overall mission effectiveness, and predictive capability of the system's intended activity. ***FY 2024 Plans:*** Will continue to design robotic warfighter machine interface (WMI) technologies to become more efficient and effective for a robotic operator to demonstrate the ability to complete mission in a combat scenario. Will continue to investigate improved language control with tactical commands for robotic operations to bring a more natural implementation of teaming within a command and control scenario, improving mission time and overall mission success. Will investigate improved methodologies			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF3 / *Combat Vehicle Robotics Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
to express autonomy systems' decision process and intent to the operator. Will investigate ways for the operator to influence autonomous decisions through the WMI tools. ***FY 2025 Plans:*** Will design more efficient and effective robotic warfighter machine interface (WMI) technologies for a robotic operator to demonstrate the ability to complete missions in a combat scenario. Will investigate improvements of data fusion across multi-asset formations with routes, multi-phase mission plans and natural language processing. Will investigate ways for the operator to influence autonomous decisions through the WMI tools. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding is increased in FY 2025 for Human Robotic Interaction to enable new technologies anticipated within industry, academia and other government agencies.			
Title: M&S for Autonomy Enabled Ground Systems ***Description:*** This effort contributes to the NGCV RAS program by designing and developing modeling and simulation (M&S) tools for the development and evaluation of autonomy technologies. The effort designs and develops tools necessary to virtually evaluate Combat Vehicle Robotics (CoVeR) program autonomy algorithms. . The capabilities and contents of the M&S tools will emulate the CoVeR Engineering Evaluation Test (EET) events conducted in PE 0603462A (Next Generation Ground Vehicle Advanced Technology) / Project BF4 (Combat Vehicle Robotics Adv Tech) and allowing these tools to scale on other Army and Department of Defense compute platforms. ***FY 2024 Plans:*** Will enhance and develop Robotic Technology Kernel (RTK), Robotic Vehicle Integration and Safety (RVIS) and Warfighter Machine Interface (WMI) M&S started in FY 2023. Will use M&S to ensure readiness of the various technologies to be incorporated in the FY 2025 EET. ***FY 2025 Plans:*** Will mature CoVeR M&S capability through targeted model developments in line with autonomous capability increments supporting CoVeR evaluations, specifically the FY 2026 virtual EET. Will enhance the architecture to maintain stable integration and interoperability with updated releases of CoVeR technologies to include the RTK, Robotic Vehicle Integration and Safety (RVIS) and Warfighter Machine Interface (WMI). Will develop M&S models focusing on real-time improved sensors, vehicle dynamics, and communications enabling autonomy development. Will develop simulations focusing on CoVeR platforms operating in off-road terrain and operational mission scenarios to stimulate robotic and autonomous capabilities in the FY 2026 EET. Will validate technologies through a virtual EET to assess technology readiness prior to participation in the EET. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	2.002	2.081	2.095

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF3 / *Combat Vehicle Robotics Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Funding increase is an economic adjustment.			
Title: Small Unmanned Ground Vehicle (UGV) as Deployable Sensor	-	2.112	1.713
Description: This effort advances teaming between autonomous small Unmanned Ground Vehicles (UGVs) and Next Generation Combat Vehicles (NGCV) to execute collaborative mission tasks in support of reconnaissance and clearing missions. ***FY 2024 Plans:*** Will continue to develop and further advance autonomous behaviors to enable small robot autonomy teaming with NGCV systems. Will update and expand the task-distribution architecture as well as autonomy behaviors to optimize small UGVs and NGCV teaming in support of mission tasks such as route and area reconnaissance, Listening Post/Observation Post (LP/OP), and clearing missions. In addition, the effort will advance Artificial Intelligence (AI) enabled sensing and communication Modular Mission Payloads (MMPs) to support the mission tasks. Will validate these enhancements through Engineering Evaluation Testing (EET) to ensure the autonomy teaming technology and integrated MMPs are fully evaluated for performance and safety. ***FY 2025 Plans:*** Will design and develop behaviors for unmanned systems with emphasis on quadruped (legged) robots for increased to evaluate reconnaissance applications in rough terrain. Will design and develop an optimized system control architecture to overcome size, weight, and power (SWaP) limitations of small unmanned platforms enabled with sensors to perform complex and long duration mission tasks. Will further research and develop supporting autonomous behaviors identified during previous EETs. Will validate newly developed enhancements to autonomous teaming, AI-enabled sensing, and Modular Mission Payloads (MMPs) through EETs to evaluate performance and system safety. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding is decreased in FY25 due to transition of mature technologies to PE 0603462A/BF4 Combat Vehicle Robotics Advanced Tech.			
Accomplishments/Planned Programs Subtotals	20.332	17.443	18.659

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*	Project (Number/Name) BF6 / *Crew Augmentation and Optimization Tech*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BF6: *Crew Augmentation and Optimization Tech*	-	10.761	11.664	10.890	-	10.890	9.820	10.128	10.237	10.339	0.000	73.839

A. Mission Description and Budget Item Justification

This Project designs capabilities for reduced vehicle crew sizes to successfully operate a larger number of closed-hatch manned and remote unmanned vehicles in a complex multi-domain operations environment. This Project will enable future crews to perform missions with increasingly sophisticated technologies, and in increasingly complex, dynamic socio-technical environments. The applied research will provide the fundamental technologies to enable integrated performance improved learning - Warfighter Machine Interfaces (WMIs) that are scalable to multiple crew hardware and functional configurations; reconfigurable frameworks and simulation for concept experimentation and exploration; and team-centered dynamic tasking by machine intelligence to effectively utilize full capabilities of crew and technologies. The research will generate Soldier-informed data, reports, and analysis to support operational use in future vehicles through Soldier experimentation and assessment of technical concepts in simulation and in-field WMIs. The capabilities created by this research will increase overall crew and team performance; improved Soldier safety due to fewer Soldier per vehicle, closed-hatch operations, and improved standoff from effective control; and vehicles that can effectively conduct multiple domain operations.

Work in this Project complements Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology) and PE 0602143A (Soldier Lethality Technology).

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

Work in this Project is performed by the Ground Vehicle System Center (GVSC) and Army Research Laboratory (ARL)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Crew Capability Enhancement	3.397	3.447	2.668
Description: This effort focuses on the dynamic interaction of Soldiers, responsible for both manned and unmanned ground vehicles, working together within a platoon formation. The project funds research on the simultaneous use of multiple technologies by Soldiers including transparent multi-modal user interfaces, commander's tools for maintaining and enhancing situation awareness, decision aids for enabling dynamic resource allocation and orchestration, and tools to interact with and adapt vehicle based autonomy. Products will include artificial intelligence algorithms, information display technologies, and team-centric design principles.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF6 / *Crew Augmentation and Optimization Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will design and implement a component-level Warfighter-Machine Interface-embedded capability allowing autonomous systems to learn from multiple forms of Soldier interaction; implement automatic team re-tasking components for dynamic task allocation based on operator workload, mission, or personalization. ***FY 2025 Plans:*** Will research autonomous systems capabilities to learn from in Soldier behavior observed during the conduct of a mission; develop algorithms to dynamically allocate tasks between Soldiers and autonomous systems during missions based on communication and sensing of Soldier behavior and workload. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Title: Characterize Soldier-Adaptive AI Interactions ***Description:*** This effort develops approaches for characterizing Soldier interactions and overall human-system performance of mixed Soldier and intelligent-agent teams to enable robust human system performance for manned and unmanned teams. This effort will focus on flexible, tailorable methodologies for laboratory-grade, high-resolution characterization of Soldier and Artificial Intelligence (AI) enabled intelligent-agent adaption in complex environments. ***FY 2024 Plans:*** Will develop and implement Next Generation Combat Vehicle (NGCV) Dashboard tool for subject matter experts to conduct performance assessments of Soldier-Autonomous System Teams using data collected during the mission; augment visualizations of dynamic systems-based measures of crew-autonomous system effectiveness with subject matter expert-derived labels to improve observer understanding of team states; conduct experiments on intelligent signal management techniques to improve predictive model accuracy. ***FY 2025 Plans:*** Will conduct experiments to determine the effectiveness of Next Generation Combat Vehicle (NGCV) Dashboard tool for assessing and improving Soldier-Autonomy team performance; investigate initial data management and evaluate autonomous system interventions associated with increased Soldier span of control. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.	2.569	2.608	2.626
Title: Human Augmentation for Collective Training ***Description:*** This effort investigates assessment techniques of crew performance to inform the development of individual and collective training for military vehicles. Assessment techniques will be applicable across a variety of vehicle platforms, training tasks and vehicle crew roles. This effort will support training and increased force readiness of vehicle crews in complex	1.890	1.918	1.932

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF6 / *Crew Augmentation and Optimization Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
environments by developing accurate and efficient performance assessment techniques evaluated in complex Operational Environments (OE) enabled by the latest advances in simulation and training technology. ***FY 2024 Plans:*** Will mature subcomponents of an embedded training architecture to facilitate crew-to-section training and conduct software validation experiments for whole system performance within applicable simulation or platform environments; conduct experiments to determine ground platform operator roles supported by the embedded training architecture, training modes for effective instruction within or outside the immersive training environment, and continued functional architecture development which will enable manned-unmanned platform teaming concepts; investigate digital terrain considerations pertinent to effective team training and operation of robotics or autonomous systems. ***FY 2025 Plans:*** Will design and develop embedded training architectural subcomponents for crew and collective operation of Next Generation Combat Vehicle (NGCV) platforms; conduct experiments to determine multi-modal interface considerations for task training, investigate adaptive training modes for effective machine learning and retention, explore simulated and simulation environment conditions required for embedded training to support full spectrum embedded training. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Platoon Teaming Capability ***Description:*** This effort focuses on the design, development and validation of intelligent, real-time, within-vehicle task management; data-driven allocation of situational awareness (SA) across platforms within the platoon; coordinated platoon-level manned-unmanned teaming (MUM-T) semi-autonomous maneuver with complex formations; and on-the-fly, platoon-level task optimization. This effort includes WMI modification to conduct experiments with these capabilities in application of intelligent task management and data-driven prediction of crew to support changing mission goals. ***FY 2024 Plans:*** Will further develop, integrate at system level, and validate intelligent technology aids and embedded training software to increase platoon-level crew situational awareness and enable soldier adaptation of autonomous systems; integrate software algorithms at system level and validate approaches to automatically re-task critical tasks based on workload, mission requirements and operator strengths/weaknesses, across a mixed manned-unmanned platoon-level formation. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned conclusion of this effort in FY24.	2.905	3.691	-
Title: Crew Interaction Interfaces and Technologies	-	-	3.664

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF6 / *Crew Augmentation and Optimization Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort focuses on the design and development of crew interaction interfaces and intelligent technologies. It includes Warfighter Machine Interface modification to improve cross-platform situational awareness and enables real-time, data-driven prediction of the crew to support changing mission goals. ***FY 2025 Plans:*** Will design and evaluate crew interaction interfaces, crew augmentation and embedded training technologies, and optimize these hardware and software interfaces based on warfighter feedback and performance data; improve Warfighter Machine Interface to refine cross-platform situational awareness and enable data-driven augmentation to optimize crew task loading during multiple mission scenarios. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase reflects the initiation of design and development of crew interaction interfaces and intelligent technologies efforts.			
Accomplishments/Planned Programs Subtotals	10.761	11.664	10.890

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*				Project (Number/Name) BF8 / *Artificial Intelligence & Machine Learning Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BF8: *Artificial Intelligence & Machine Learning Tech*	-	19.573	20.329	15.007	-	15.007	15.027	16.642	16.835	17.212	0.000	120.625

A. Mission Description and Budget Item Justification

This Project develops and characterizes artificial intelligence and machine learning software and algorithms to team with soldiers in support of fully autonomous maneuver of the Next Generation Combat Vehicle (NGCV) and other autonomous systems, both physical and non-embodied. Efforts develop capabilities for NGCV and other autonomous agents that increase autonomy, unburdening the soldier operator, with a high degree of survivability and lethality in a highly contested environment. This work also investigates power distribution and conversion technologies to provide compact, efficient, and high-power capabilities for electrical and electro-mechanical loads supporting both mobile and stationary unmanned platforms. Research enables combat vehicles to rapidly learn, adapt, and reason faster than the adversary; accomplish missions in contested, austere and congested environments, characterized by lack of structure, adversarial actions, and minimal a priori knowledge; and provide force reduction through self-learning vehicles that can operate in complex militarily relevant environments. This Project also matures emerging research leading to potential technology development in areas of strategic importance to the Army by bringing competitively selected Universities with research teams into Technical Alliances.

Work in this Project is done in coordination with PE 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BF7 (Crew Augmentation and Optimization Advanced Technology).

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

Work in this Project is performed by the Army Research Laboratory (ARL)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Scalable, Adaptive, and Resilient Autonomous Systems	8.066	8.484	5.590
Description: This effort develops emerging research in Autonomous Vehicle intelligence and decision making, human agent teaming, scalable and collaborative behaviors, embodied and embedded intelligence, and autonomous operations for next generation Army platforms in dynamic Army relevant environments, architectures, and missions. Specific focus will be on the application of Artificial Intelligence/Machine Learning (AI/ML) to autonomous systems and human-intelligent agent teaming; scalable and collaborative behaviors in support of heterogeneous air and ground manned-unmanned teaming (MUM-T) operations; methods for embodied and embedded intelligence for increased understanding, manipulation, and reflexive maneuver through and interaction with dynamic environments; techniques for improved perception, decision making, and adaptive behaviors in contested environments for MUM-T; and new methods for testing and evaluating emerging technologies for intelligent and autonomous systems under Army relevant constraints and environments and in Army relevant architectures.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF8 / *Artificial Intelligence & Machine Learning Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2024 Plans: Will design and develop methods to rapidly identify and adapt on the fly to changing ground vehicle terrain; create methods and techniques that allow for longer-duration ground vehicle autonomy, measured by time between human interventions; conduct experiments to increase operational speed and mission distances in complex terrain; continue to identify methods to integrate terrain awareness and platform capability into tactical decision-making process; validate methods to advance cooperation with multiple air and/or ground autonomous systems for improved vehicle perception, learning, reasoning, navigation and physical maneuver in complex terrain. ***FY 2025 Plans:*** Will explore methods to incorporate human-guided input and learning methods into real-time task adaptation and shifts in autonomous behaviors; investigate approaches for scaling and increasing mission complexity for heterogenous air and ground robot teaming; develop methods and applications to increase small unmanned systems ability to traverse complex and varying terrains. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects the support of a higher priority artificial intelligence effort being executed by the Army Futures Command Artificial Intelligence Integration Center (AI2C).			
Title: Context-Based Information Dynamics ***Description:*** This effort investigates techniques that integrate on-board and external information sources, and it applies ML analytic approaches to support automated intelligence analysis and decision making. The goal is to enable tactical agents to cooperatively share relevant and timely tactical information within a distributed environment. ***FY 2024 Plans:*** Will develop computer vision algorithms that can provide enhanced estimates of objects of relevance when operating with limited or missing information; investigate rule-based and machine learning approaches for intelligent systems that interpret multisource information to infer meaning, create shared understanding, and support decision-making; define inferencing algorithms to derive context from multi-modal multi-source information for automated decision-making and course of action generation. ***FY 2025 Plans:*** Will validate enhanced object estimation algorithms and automated autonomous maneuver reasoning tools; investigate algorithms and machine learning approaches to enable autonomous systems to collaborate through context-informed dialogue; investigate limited set of computational linguistics-based semantic approaches to augment deep learning language models. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	2.561	2.640	1.056

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF8 / *Artificial Intelligence & Machine Learning Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Funding decrease reflects partial realignment to Program Element (PE) 0602146A (Network C3I Technology) / Project AO4 (Energy Efficient Devices Technology) to develop machine processing capabilities for AI-enabled systems.			
Title: Heterogeneous Computing and Computational Sciences ***Description:*** This effort funds research to develop algorithms and architectures that allow adaptable, energy efficient information processing across different computing hardware platforms. The goal of this research is to provide high performance computing and processing capabilities to the Soldier on the battlefield. ***FY 2024 Plans:*** Will explore automated data and model optimization and reduction methods for advanced intelligence, surveillance, reconnaissance (ISR) algorithms to be executed on low size, weight, and power (SWaP) computing devices; investigate combined optimization of heterogeneous datasets and measure performance and increase efficiency through implementing scalable task scheduling methods on networked edge devices; develop methods that are applied in centralized, distributed, and decentralized agent environments and schedule routines to enable processing in tactical environments and under associated constraints. ***FY 2025 Plans:*** Will investigate scalable computing methods for complex inference tasks and methods for model partitioning; explore novel strategies for adaptive and efficient execution of analytic models in extremely resource constrained, heterogenous environments; investigate methods to optimize analytic performance and accuracy. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.	1.888	1.943	1.055
Title: Machine Learning with Constrained Resources ***Description:*** This effort will research new ML and reinforcement learning methods to address issues of statistically mismatched and incomplete information which must be annotated, collected, classified, and used for rapid decisions by joint intelligent agent-Human teams. In addition, multi-modal human interaction approaches will be investigated to ensure effective Soldier interactions and understanding of intent. The goal of this research is to enable joint human-intelligent agent decision making, optimizing the strengths of each in the decision process and creating an adaptive, agile team. This work applies research conducted in PE 0611102A (Defense Research Sciences) / AA6 (Robotics and Mobile Energy) and AA9 (Information and Networking). ***FY 2024 Plans:*** Will conduct experiments to assess the ability of novel navigation techniques to effectively plan routes in environments that include partially observable elements, such as obscured terrain features; investigate rule-based algorithms and data-driven machine learning methods for interpreting multi-source information to capture meaning, support cross-domain event detection, and enable effective automated text generation for knowledge and information management tasks; investigate computer vision	4.434	4.570	4.602

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF8 / *Artificial Intelligence & Machine Learning Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
algorithm and machine learning methods that can quantify uncertainty, rank, and prioritize visual information in ways that are consistent with human judgment; develop computational models of human behavior to predict soldier attention and biases in different contexts, detect camouflaged, obscured, or non-obvious objects, and detect rare and novel cases using contextual information. ***FY 2025 Plans:*** Will assess ground vehicle autonomy performance using modular navigation, perception, and state estimation; mature autonomous navigation components to sustain performance while adapting to environmental features optimize and assess route planning capability for autonomous systems in partially obscured complex environments; validate simulation-based coordination techniques for multiple autonomous systems using research platforms; investigate automated extraction of full scene information based on autonomous system sensor data; experiment with automated optimization methods for perception algorithms under constraints including network bandwidth, computer memory, and compute capacity; develop inference algorithms for artificial reasoning systems for automated decision making and course of action recommendations for autonomous maneuver; develop fundamental methods for enhanced deep learning language models to create intelligent systems with increased effectiveness; investigate computational models to detect camouflaged, obscured, or non-obvious objects, and detect rare and novel conditions using contextual information from sensor fusion. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Intelligence for High Operational Tempo Maneuver ***Description:*** Applied research on intelligence for cognitive learning and control architectures to enable efficient and full use of embodied physical capabilities and create the machine intelligence required of autonomous systems to understand physical limitations. Investigates the means through which robotic physical performance attributes (e.g. speed, agility) will be coupled with artificial intelligence to enable resilient maneuver in high operational tempo missions in complex environments. ***FY 2024 Plans:*** Will continue to explore how novel models and algorithms function with design features of biologically inspired robotics to advance the efficiency of maneuver over or through complex terrain at high operational tempos; mature architectures and models that provide predictable performance appropriate for tactical multi-agent teaming. ***FY 2025 Plans:*** Will continue to investigate novel models, artificial intelligence algorithms, and architectures that enable autonomous systems to operate at operationally relevant speeds and agility; conduct research focused on increasing complexity for autonomous	1.603	1.652	1.663

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF8 / *Artificial Intelligence & Machine Learning Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
navigation and planning related to natural environmental conditions such as dust, snow, and rain; develop performance prediction models for autonomous systems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Operational Assessment of Artificial Intelligence Developmental Systems ***Description:*** This effort supports the Combatant Commander's needs by performing operational assessments of AI-intense developmental weapon systems. ***FY 2024 Plans:*** Will continue to optimize results from ongoing studies to support Combatant Commander identified needs. ***FY 2025 Plans:*** Will continue to optimize results from ongoing studies to support Combatant Commander identified needs. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.	1.021	1.040	1.041
Accomplishments/Planned Programs Subtotals	19.573	20.329	15.007

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*				Project (Number/Name) BF9 / *Sensors for Autonomous Operations and Surv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BF9: *Sensors for Autonomous Operations and Surv Tech*	-	22.666	25.327	24.772	-	24.772	24.939	25.689	25.969	26.229	0.000	175.591

A. Mission Description and Budget Item Justification

This Project designs and develops modular and adaptive sensor components, novel embedded processing approaches, innovative threat cueing solutions and novel multi-function sensor payloads integrated with novel signal image processing techniques tools to provide improved manned and unmanned ground vehicle situational understanding that enables aided target recognition (AiTR) and autonomous navigation in all environments.

This research is coordinated with PE 0603462A (Next Generation Combat Vehicle Advanced Technology), 0603118A (Soldier Lethality Advanced Technology), 0602143A (Soldier Lethality Technology), 0602148A (Future Vertical Lift Technology) and 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Sensors with Embedded Processing	17.991	16.339	16.325
Description: Designs and develops advanced, automated multi-spectral and multi-function sensor components, and image processing techniques with improved performance in all environments and against all threats to include low-contrast targets in camouflage or in degraded conditions to enable combined arms maneuvers in complex environments for NGCV via manned, optionally manned, and robotic platform applications. ***FY 2024 Plans:*** Will validate feasibility of on-chip compression capabilities on digital readout integrate circuits (DROICs) to enable lower data rates for high-resolution sensing, enabling more information content for down-stream processors; design and develop DROIC architectures for uncooled longwave infrared (LWIR) microbolometer detectors at new, smaller pixel pitches to enable size, weight, power, and cost (SWAP-C) and resolution improvements; continue developing cooled DROICs for integration with avalanche photodiode (APD) detectors at smaller pixel pitches for increased resolution to enable covert threat and target ranging; begin development of an extensible core software module, using a selected reasoning approach, to fuse contextual scene information or additional metadata to reduce false alarms of transitioned target detection algorithms; mature targeting and navigation sensors capable of operating on-the-move while providing far-target location and target tracking; mature and demonstrate modular sensor assemblies optimized for use in detection of threats at increased ranges; begin design of at-sensor processing hardware components to improve performance and SWAP-C of image processing and inferencing; investigate whether emerging			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF9 / *Sensors for Autonomous Operations and Surv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
neuromorphic processing architectures could be utilized to enable more complex processing at the sensor; determine how on-sensor processing can best conform with Modular Open System Approaches (MOSA) to reduce lifecycle costs. ***FY 2025 Plans:*** Will develop dual-band, high dynamic range digital readout integrate circuits (DROICs) with enhanced sensitivity at smaller semiconductor foundry processing nodes that contain standardized control and output formats for all-digital sensor system solutions; continue to develop full resolution cooled DROICs for integration with avalanche photodiode (APD) detectors at smaller pixel pitches (size), capable of enhanced sensitivity at faster frame rates to enable covert target geo-location capabilities. Will validate preliminary design and mature a detailed design of at-sensor processing hardware components to improve performance and size, weight, power, and cost (SWAP-C) of image processing for Army sensor applications. Will investigate board-level Modular Open System Approaches (MOSA) configurations for the advanced processing components to enable more complex processing at the sensor. Will investigate suitability of other emerging commercial processing technologies for low-SWAP-C sensors. Will validate a reasoning software module using scene information and meta-data to reduce high-confidence false alarms. Will mature the reasoning software module framework and hardware components, ensuring compliance with a transitioning Aided Target Detection and Recognition (AiTDR) Interface Control Document (ICD). Will develop additional capabilities for the reasoning software module that enhance target confidence and battlefield context using external sources of data or meta-data (e.g., blue force tracking). Will design and develop mid-wavelength infrared (MWIR) capable microbolometer sensor hardware through semiconductor processes for hostile fire detection. Will investigate pixel size, resolution, noise parameters, and thermal time constant specifications in MWIR and long-wavelength infrared (LWIR) microbolometer sensors for counter-unmanned aircraft systems (C-UAS) applications. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Title: Multi-Mission Payload ***Description:*** Description: Investigates, designs and develops sensor payloads for ground vehicle based unmanned aerial system to detect line of sight, and beyond line of sight threats and complex obstacles such as personnel and vehicles in all environments.	2.403	-	-
Title: Automated Threat Cueing ***Description:*** Investigates, matures and validates novel image processing and threat recognition and detection methods to enable automated search and detection of open and concealed threats for cueing and target hand-off to maintain overmatch via speed in cluttered environments.	2.272	-	-
Title: Sensors, Electronics and Processing Approaches for Threat Overmatch	-	8.988	8.447

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF9 / *Sensors for Autonomous Operations and Surv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort design, develops, matures and validates novel electro-optic/infrared (EO/IR), radar and other sensor components, sensor payloads and image processing approaches to enable enhanced detection of line of sight and beyond line-of-sight threats and complex obstacles in all environments via manned, optionally manned and robotic platforms. It will enable cueing and target hand-off to maintain overmatch while on-the-move, at speed, in cluttered environments. ***FY 2024 Plans:*** Will complete validation of sensor performance and exploitable target signatures to improve target detection performance in adverse conditions; complete experiments and validate the use of polarized electro-optic/infrared (EO/IR) sensors to suppress clutter and improve detection performance across environments, times-of-day/night, weather conditions, and targets; investigate and mature small form-factor multispectral sensors and assess performance improvements for targets obscured by vegetation or camouflage; complete data collections and an assessment of the effectiveness of using high resolution polarized sensor components for dismounted soldier and unmanned aerial system (UAS) applications to reduce the effects of clutter while providing a wider field of view, improved ability to detect smaller targets, and at greater range; investigate and mature approaches and processing techniques to exploit scene features and target signatures to enable improved detection of targets in varying environmental conditions using concealment penetrating radar; validate processing approaches and methods using additional data from multispectral and high definition polarized EO/IR sensor components and position sensing information to improve target detection and tracking from a moving platform; validate image formation and processing techniques to help assess target detection performance using compact ground and concealment radar antennas mounted on a small UAS. ***FY 2025 Plans:*** Will conduct experiments using multiple sensor modalities to support the development and training of algorithms to improve automated threat detection. Will investigate and develop new processing approaches and methods using location and position data from multi-spectral and high definition polarized EO/IR sensor components to improve target detection and location accuracy from an unmanned aerial system (UAS). Will develop new image formation and processing techniques to improve target detection performance using radar antennas mounted on a small UAS. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	22.666	25.327	24.772

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF9 / *Sensors for Autonomous Operations and Surv Tech*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*				Project (Number/Name) BG2 / *Modeling and Simulation for MUMT Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BG2: *Modeling and Simulation for MUMT Technology*	-	5.591	5.526	4.142	-	4.142	3.851	3.988	3.649	5.286	0.000	32.033

A. Mission Description and Budget Item Justification

This Project develops Modeling and Simulation (M&S) tools and technologies to assess and improve freedom of movement for ground forces and supports vehicle developers by addressing challenges for robotic and ground vehicles. Through investigation and design, this project develops obstacle detection and classification algorithms for dynamic mobility hazards in urban and complex environments. This project develops tools to evaluate system performance reducing the need for physical testing including: real-time mobility decision support tools, vehicle-terrain interactive 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 in a wide variety of weather and terrain conditions. These M&S technologies can be integrated across Army vehicle platforms as required.

Work in this Project complements Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BG3 (Modeling and Simulation for MUMT Advanced Tech).

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

Work in this Project is performed by the Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Simulation Tools for Combat Vehicle Robotics (CoVeR) ***Description:*** This effort develops M&S capabilities to evaluate hardware and software technologies enabling battlefield autonomy in complex environments and adaptive learning algorithms for predicting mobility performance in challenging environments.	3.345	-	-
Title: Autonomous Vehicle/Terrain Interactions ***Description:*** This effort develops Modeling and Simulation (M&S) capabilities to evaluate autonomous vehicle formation performance on mission-relevant terrain and environments (i.e., soft soil, gap crossing, obstacle override, cold regions, low-light, etc.). This effort develops algorithms for improved manned/unmanned and air/ground teaming for off-road tactical behaviors. ***FY 2024 Plans:*** Will develop advanced vehicle terrain interface for vehicle platforms operating in highly altered terrain and enhance Virtual Autonomous Navigation Environment (VANE) M&S tool for evaluating ground vehicle formations in various operational	2.246	5.526	4.142

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BG2 / *Modeling and Simulation for MUMT Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
environments, such as degraded sensor performance environments. Will develop methods to support the identification of vulnerabilities directly related to vehicle maneuver in various operational environments. ***FY 2025 Plans:*** Will develop physics-based environment modeling capabilities to support autonomy performance evaluations and predictions in low-light emission and nighttime environments. Will mature advanced M&S tools for evaluating ground vehicle formations and human / machine interactions in complex operational environments. Will mature advanced vehicle-terrain interface algorithms to support mobility performance evaluations and predictions of ground vehicle systems operating in cold weather environments. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects the planned completion of work for this effort as technologies are transitioned for maturation and demonstration.			
Accomplishments/Planned Programs Subtotals	5.591	5.526	4.142

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*	Project (Number/Name) BG6 / *Advanced Concepts for Active Defense Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BG6: *Advanced Concepts for Active Defense Technology*	-	33.399	32.668	30.206	-	30.206	34.367	33.620	24.762	28.748	0.000	217.770

A. Mission Description and Budget Item Justification

This Project funds research for advanced materials and mechanisms to defeat the most common and most dangerous threats that are expected to be encountered by our ground forces in the near, mid and far term. Work conducted in this Project will result in concepts for Adaptive and Cooperative Protection of ground combat vehicles. Additionally, research will focus on subcomponent/component models to predict performance of early concepts and the means to evaluate effectiveness on ground platforms. The Project will balance developments of active threat defeat measures with the necessary advanced passive and active components to provide solutions which will help meet the requirements of current and next generation ground tactical and combat vehicles.

This Project is coordinated with and transitions to Projects in PE 0603462A (Next Generation Combat Vehicle Advanced Technology) and builds upon weapon target interaction research in PE 0602144A (Ground Technology) and PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics).

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

Work in this Project is performed by the Army Research Laboratory (ARL), Command, Control, Communication, Computers, Cyber, Intelligence, Surveillance and Reconnaissance Center (C5ISR), Data and Analysis Center (DAC), Ground Vehicle Systems Center (GVSC)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Multi-Threat Armor Technologies	8.413	8.245	6.754
Description: This effort develops multi-threat hybrid armor technologies incorporating both active and passive mechanisms for ground vehicle systems that are effective against future conventional weapons and evolving improvised threats including kinetic and chemical energy as well as blast threats.			
FY 2024 Plans: Will validate armor protection mechanism for Medium Caliber (Med-Cal), Explosively Formed Projectiles (EFP), and Shaped Charged Jet (SCJ) threats, as well as Active Protection System (APS) residual effects; design and develop lab-scale solutions for more efficient, cost-effective tools and methodologies to provide data to improve vehicle protection technologies; conduct virtual experiments to assess complex warhead-penetrator orientations; finalize the development of vehicle spall protection requirements for shaped charge threats for both manned and unmanned systems.			
FY 2025 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BG6 / *Advanced Concepts for Active Defense Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will develop vulnerability mapping of threats to emerging and proliferated chemical energy weapons; enhance armor protection mechanisms for medium caliber KE threats utilizing novel armor mechanisms including multi-threat and multi-hit armor mechanisms to improve vehicle protection technologies; develop and validate protection capability for future threats. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Title: Adaptive and Cooperative Protection ***Description:*** This effort pursues a holistic approach toward achieving significant weight reduction and protection from future threats by utilizing real-time information, combined with threat knowledge, to provide ever-increasing protection. This approach includes integrating individual vehicle capabilities of armor, underbody blast protection, active protection systems, and advanced soft kill methods into one layered solution to maximize survivability and minimize weight for combat and tactical vehicles. This effort will investigate modern protective technologies that implement complex kinematic mechanisms in order to bend, break and disperse threat projectiles before they can injure crew or disable vehicles. ***FY 2024 Plans:*** Will validate a collaborative multi-platform defense mechanism; explore the use of novel armor mechanisms to provide hemispherical protection against a variety of rocket propelled grenade (RPG) and Anti-Tank Guided Munitions (ATGM) threats; mature a statistical computational model for adaptive protection systems; explore alternate lasers for ATGM soft-kill active protection system. ***FY 2025 Plans:*** Will enhance statistically based computational models for adaptive technologies to include hemispherical protection concepts; conduct experiments on advanced adaptive concepts to counter emerging threats; enhance numerical models to explore the kinematics of multiple adaptive protective technologies and establish optimal defeat range of incoming threats with increased protection. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.	6.520	6.793	6.163
Title: Emerging Overmatch Technologies ***Description:*** This effort designs, develops, and conduct experiments to validate the lethality and protection concepts that re-establish overmatch for the next generation of manned and unmanned combat platforms. It will tightly couple scientific research within a campaign of learning to form technology concepts for battlefield domination against current and future threats. This research will heavily leverage other efforts within PE 0602145A (Next Generation Combat Vehicle Advanced Technology) and PE 0603462A (Next Generation Combat Vehicle Advanced Technology).	2.405	2.459	2.475

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BG6 / *Advanced Concepts for Active Defense Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2024 Plans: Will continue to develop technology to enable concepts of cooperative protection and collaborative lethality, emphasizing autonomous distributed task assignment across a team of robotic and autonomous systems acting in opposition to numerous surrogate threat systems; perform experiments on both simulation and physical systems in pseudo-tactical scenarios. ***FY 2025 Plans:*** Will validate collaborative protection technologies against real threats in field experiments; document proof-of-concept for cooperative protection and collaborative lethality and evaluate preliminary performance based on a limited set of simulation runs; assess residual technology risk and document recommendations for transition partners. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Survivability/Lethality/Vulnerability Analysis Tools and Methodology	5.440	5.734	5.488
Description: This effort devises state-of-the-art survivability/lethality/vulnerability methodologies to dynamically model the interaction of conventional ballistic threats against future weapon systems. ***FY 2024 Plans:*** Will research and conduct analysis of autonomous unmanned ground vehicle systems and teamed manned and unmanned systems against multi-domain threats in a common framework while applying time-dependent failures from consumables like fuel/electric; complete development of communications linkage map between vehicle system, assistive automation, artificial intelligence, and the Soldier; expand survivability/lethality/vulnerability methodologies and proof-of-concept analyses of vehicle protection system technologies against multi-discipline threats and attacks in a common framework; conduct experiments to inform improved methodology, analytical techniques, and modeling capability to assess lethality of next generation combat vehicle fragmenting and high explosive munitions. ***FY 2025 Plans:*** Will research human machine teaming methodology and develop vulnerability analysis capability with combined voice and data communication focusing on cognitive burden and network traffic impact over time; develop vulnerability analysis capability of Aided Target Recognition to small Unmanned Aerial Systems (UAS) obscuration of target; develop direct fire analysis capability for advanced medium caliber munitions against moving vehicle targets; continue development of UAS target vulnerability to advanced medium caliber munitions and active protection technologies; improve methodology for assessing capabilities of advanced active, reactive, passive, and roof armors; improve methodology for collaborative protection of multiple vehicles			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BG6 / *Advanced Concepts for Active Defense Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
in a formation and sensor assessment, as well as improve intercepted munition residual characterizations in support of next generation combat vehicle protection. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Title: Ground Systems Active Defense Technology Research ***Description:*** This effort contributes to the Army's ground vehicle survivability by developing technologies which electronically or physically defeat an incoming threat before it contacts the vehicle. These technologies involve sensors and effectors interacting with an incoming threat to disrupt or destroy in while it is in flight or before it is even fired at a vehicle. This effort designs and develops modern armors that directly complement and are optimized to work with active defense technologies in order to implement sophisticated mass efficient mechanisms and leverage investments in materials to act as a system for the defeat of advanced threats and active protection system residuals. This effort designs and develops active blast mitigation technologies to counter the effects of underbody attacks to ground vehicles. This effort will also design and develop the required advanced structures required to accommodate active blast mitigation technologies into vehicles. The design of the structure and active defense technology is critical to an effective blast survivability solution.	6.631	-	-
Title: Advanced Threat APS Radar Technology ***Description:*** This effort develops ground combat vehicle survivability technologies including radar techniques to support hard-kill countermeasures as a part of an integrated survivability suite for ground combat platforms in all-weather, day or night conditions with 360 degree situational awareness and Kinetic Energy threat defeat. ***FY 2024 Plans:*** Will finalize studies to provide signature management improvements and optimization; develop resource management techniques to counter threats while maintaining radar search modes; assess sensor resource management techniques and algorithm performance via experiments. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned completion of this effort in FY 2024.	3.374	2.209	-
Title: Detection Avoidance Applique Technology Research ***FY 2024 Plans:*** Will build upon FY 2023 effort by down-selecting component technologies based on experimental results; design and develop a technology concept for ground vehicles that integrates multiple signature management component technologies into a system in	0.616	0.728	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BG6 / *Advanced Concepts for Active Defense Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
order to create a holistic solution to avoid detection across spectrums of interest; conduct system-level modeling and simulation to refine the concept. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects work being shifted to Project Element 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BG7 (Ground Systems Active Defense (GSAD) Advanced Tech) to focus on maturing the technology.			
Title: Collaborative Defense ***Description:*** This effort expands the capability of the US Army to protect ground vehicles. This is done by conducting research into technologies that can enable the sharing of protection resources across multiple platforms in real time, allowing for the expansion of the zone of protection on the battlefield beyond a single vehicle and its protection system. These technologies include components such as sensors which can be used to identify and track incoming threats, radios/networks which will allow local sharing of threat detection and tracking information, and effectors which can disrupt or destroy threats before terminal engagement with the platform. In order to enable collaboration across multiple platforms, including integration factors such as size, weight, power consumption, and cost impacts to the platform, this effort will study various system-level approaches to integrating these aforementioned technologies. Additionally, this effort will validate performance of the system in the laboratory environment. ***FY 2024 Plans:*** Will research technology approaches for the application of a distributed, autonomous countermeasure for ground vehicle formations; conduct component and system-level modeling of collaborative countermeasure concepts to explore feasibility; conduct experiments into vehicle-to-vehicle threat sensing and response; investigate feasibility of system-level concepts for integration with the Army's modular active protection system architecture. ***FY 2025 Plans:*** Will continue investigation of collaborative countermeasure concepts through advanced modeling and simulation tools and system-level trade studies. Will down-select and mature the most-promising technology concept through computational analysis and physical experiments. Will develop system-level model for selected approach and develop hardware components. Will begin detailed design of countermeasure system architecture for Modular Active Protection Framework compliance. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** This funding increase reflects the cost of developing hardware components in accordance with project plans.	-	6.500	9.326
Accomplishments/Planned Programs Subtotals	33.399	32.668	30.206

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BG6 / *Advanced Concepts for Active Defense Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*	Project (Number/Name) BG8 / *Obscuration Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BG8: *Obscuration Technology*	-	2.722	-	-	-	-	-	-	-	-	0.000	2.722

A. Mission Description and Budget Item Justification

This Project investigates and evaluates obscurant technologies that degrade threat force surveillance sensors and defeat the enemy's target acquisition devices, missile guidance, and directed energy weapons. This Project focuses on advanced infra-red and multi-spectral obscurant materials that provide effective, affordable, and efficient screening of deployed forces, while being safe and environmentally acceptable.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Priority focus areas.

Research in this Project is related to and fully coordinated with PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Obscuration Enabling Technologies	2.722	-	-
Description: This effort investigates new materials and compounds to enable safe, effective screening of personnel and equipment across the electromagnetic spectrum. This effort also provides vulnerability assessments against enemy threat systems.			
Accomplishments/Planned Programs Subtotals	2.722	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*				Project (Number/Name) BH5 / *Platform Electrification and Mobility Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BH5: *Platform Electrification and Mobility Tech*	-	14.206	13.763	15.160	-	15.160	18.885	15.544	14.426	14.570	0.000	106.554

A. Mission Description and Budget Item Justification

This Project researches and develops advanced power and energy technologies for tactical and combat ground vehicles that are necessary for parallel or series hybrid-electric drive. Research energy storage, distribution and battlefield charging technologies to enable future plug-in hybrid-electric drive and all electric tactical vehicle systems.

This Project researches and develops advanced power and energy technologies for combat ground vehicles that are necessary for parallel hybrid, series hybrid and all-electric vehicle systems.

Work in this Project complements PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

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

Work in this Project is performed by the Ground Vehicle System Center (GVSC)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Scalable Electrification & Control Architecture	1.977	1.999	-
Description: This effort designs and develops the power distribution and control components to implement a common, scalable, electrified vehicle power architecture to enable advanced lethality and protection capabilities, fast vehicle charging from the grid, and silent mobility on combat platforms across light to heavy weight classes. This power architecture enables the hybrid electric, fuel cell electric, and all-electric powertrains. ***FY 2024 Plans:*** Will validate the high voltage power converter developed in FY 2023, allowing integration of high voltage batteries and range extending technologies. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned conclusion of this effort in FY 2024.			
Title: Platform Electrification Research	10.519	6.374	0.963

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BH5 / *Platform Electrification and Mobility Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort designs and develops the electric power generation, energy storage and electrified components and sub-systems required to electrify combat vehicles across light to heavy weight classes. ***FY 2024 Plans:*** Will mature design of the high-power density in-hub electric sprocket module; mature designs for electrified cooling components; mature battery cell concept for extreme high-energy storage system; perform component optimization and maturation for multi-cell module for high voltage energy storage system. ***FY 2025 Plans:*** Will validate the electric motor/power generation system for mobility power and power generation for future warfighter electrical loads. Validate the integration of the motor/generator and inverter sub-system. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort with only motor/generator work continuing in FY 2025			
Title: Robotic Combat Vehicle Silent Watch and Mobility Range Extension ***Description:*** This effort designs and develops the Jet Propellant 8 (JP8) reformer based silent watch and mobility extension subsystem required to electrify 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 2024 Plans:*** Will validate the component level performance of JP8 fuel reformer based silent watch and mobility extension subsystem; explore higher power density technologies for range extension subsystem. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned conclusion of this effort in FY 2024.	1.710	3.340	-
Title: Battlefield Electric Vehicle Recharge Technology ***Description:*** This effort develops technologies to enable highly mobile Electric Vehicle (EV) rechargers that are essential to allow highly electrified tactical and combat platforms to be fielded by the Army to enable capabilities such as persistent silent mobility.? Effort includes highly mobile power generation and wireless power transfer to the tactical and combat platforms. ***FY 2024 Plans:*** Will design components of a wireless recharge system. ***FY 2025 Plans:***	-	2.050	2.204

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BH5 / *Platform Electrification and Mobility Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will design and build components for mobile power generation and battlefield recharge technology. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** This increase is an economic adjustment.			
Title: Advanced Running Gear and Suspension Research ***Description:*** This effort develops an advanced track and suspension system for heavy combat vehicle applications and will offer significantly reduced system weight, maintenance, noise and vibration over conventional systems, as well as increased operational effectiveness on- and off-road and lower platform fuel consumption. ***FY 2025 Plans:*** Will design and conduct experiments on critical suspension height management and adjustable damping components and critical track components, materials and joints to validate performance. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase reflects initiation of Advanced Running Gear and Suspension Research efforts.	-	-	1.786
Title: Electric Propulsion System Research ***Description:*** This effort designs and develops the propulsion system and sub-systems required to power heavy hybrid-electric drive combat vehicles. It also develops the support hardware and auxiliary systems to allow integration and thermal management of electrified components and energy storage for heavy hybrid-electric drive combat vehicles. ***FY 2025 Plans:*** Will design and develop the compact electrified combat transmission and electric machine required to power heavy combat vehicles. Will investigate supporting architecture and thermal management for electrified component and energy storage. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase reflects initiation of Electric Propulsion System Research efforts.	-	-	8.062
Title: Extreme Energy Density Energy Storage Research ***Description:*** Develop and validate Extreme Energy Density battery cell performance for fast recharge. Design battery components to enable militarized Extreme Energy Density battery packs. ***FY 2025 Plans:*** Develop and validate high energy cell technologies with improved safety for combat vehicle applications. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	-	-	2.145

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BH5 / *Platform Electrification and Mobility Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Increase reflects initiation of Extreme Energy Density Energy Storage Research efforts.			
Accomplishments/Planned Programs Subtotals	14.206	13.763	15.160

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*	Project (Number/Name) BI2 / *Sensor Protection Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BI2: *Sensor Protection Technology*	-	6.100	5.532	5.782	-	5.782	7.295	7.749	7.834	7.912	0.000	48.204

A. Mission Description and Budget Item Justification

This Project investigates, designs, and develops techniques for masking friendly force capabilities and intentions. The Project pursues technologies to reduce the susceptibility of sensor systems to detection and targeting by threat forces, as well as to inform the development of next generation signature reduction schemas. This Project also designs, investigates, fabricates, evaluates and characterizes advanced sensor protection technologies, components, and concepts that will enable the future soldier to see and operate through a laser directed energy weapon attack. Both active and passive protection technologies will be investigated to protect Army sensors that operate in the visible, short-wave infrared, mid-wave infrared, and long-wave infrared spectra from battlefield laser threats. Areas of research include passive optical limiters such as nonlinear organic dyes, semiconductors, and meta-materials, as well as fast active switches and tunable filters. Technologies investigated include novel optics designs combined with signal processing, spectral filtering, and threat sensing algorithms.

Work in this Project is coordinated with Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology), PE 0603118A (Soldier Lethality Advanced Technology), PE 0603465A (Future Vertical Lift Advanced Technology), and PE 0602143A (Soldier Lethality Technology)

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Sensor Protection Technology	6.100	5.532	5.782
Description: This effort will design and develop component technology to improve protection of sensors and sensor electronics from threats via techniques to harden optics, reduce sensor optical cross sections, novel coating approaches, filter improvements, and emerging signature reduction schemas.			
FY 2024 Plans: Will validate the interactions and effects of ultra-short pulsed lasers (USPL) on current higher performance sensors and optical materials; develop new USPL protection techniques for high performance cooled electro-optical / infrared sensorsystems; investigate enhanced laser identification techniques to improve the speed and accuracy of protective responses; investigate and report on emerging spectrally agile filter approaches for the visible and infrared (speed, transmission, and blocking ability) for protection.			
FY 2025 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BI2 / *Sensor Protection Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will conduct experiments on spectrally agile filters in the visible and infrared waveband to determine which filter device(s) are applicable to military applications. Will validate commercial spectrally agile filter performance. Will investigate the interactions and effects of out-of-band stressing laser threats on infrared optical materials. Will begin development of a filter, coating, or new material to provide out-of-band protection for high performance cooled infrared systems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects an economic adjustment.			
Accomplishments/Planned Programs Subtotals	6.100	5.532	5.782

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*				Project (Number/Name) BI4 / *Materials Application and Integration Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BI4: *Materials Application and Integration Tech*	-	7.651	7.505	-	-	-	-	-	-	-	0.000	15.156

A. Mission Description and Budget Item Justification

This Project designs, develops, fabricates and evaluates a variety of materials (e.g. metals, ceramics, polymers and composites) to enable more survivable, lighter weight vehicle armor, chemical and biological protection, armaments and electronics for the next generation combat vehicle. Research focuses on unique and /or novel materials properties, developing physics-based models, materials characterization techniques, non-destructive testing methods and advanced fabrication/processing methodologies to transition candidate solutions for maturity, scale-up, and integration into systems.

This Project also continues the Advanced Vehicle Power Technology Alliance between the Department of Energy and the Department of the Army with a focus on materials, providing an emphasis on developing advanced technologies that enable 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. This Project matures and integrates 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.

Work in this Project leverages research from Program Element (PE) 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics) and 0602144A (Ground Technology) / Project BL1 (Materials and Manufacturing Research Technology). This work is also coordinated with PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

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

Work in this Project is performed by the Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Novel Armor Materials and Processes for Vehicle Protection	7.651	7.505	-
Description: Develop novel metal alloys and associated processes through the scale-up and exploitation of revolutionary new metal alloys, which have demonstrated capabilities to overcome traditional engineering trade-offs (e.g., strength and ductility) with exceptional high temperature stability. ***FY 2024 Plans:*** Will develop lightweight, low cost transparent glass/polymer laminates with optical transmissivity at wavelengths suitable for personnel and sensor protection; conduct experiments to maximize the thickness for weldable high toughness, low cost, high hard steel armor alloy for structural and armor applications for vehicle assessment; develop service temperature-time-mechanical			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BI4 / *Materials Application and Integration Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
property map for aluminum alloys to understand service properties of platform alloys and inform selection and development of alternative materials; design and develop scalable extreme environmental coatings that provide enhanced camouflage reflectance and chemical agent resistivity; develop capabilities for characterizing and modeling performance of dissimilar material joints (welded, solid state joined, adhesively joined) under extreme loading conditions. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned conclusion of this effort in FY24.			
Accomplishments/Planned Programs Subtotals	7.651	7.505	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*	Project (Number/Name) BJ2 / *Tactical and Navigation Lasers Sensors Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BJ2: *Tactical and Navigation Lasers Sensors Technology*	-	5.596	5.790	5.863	-	5.863	5.865	5.868	5.933	5.992	0.000	40.907

A. Mission Description and Budget Item Justification

This Project designs and develops novel laser sensor technologies which provide improved maneuver, lethality, and survivability capabilities via manned and autonomous navigation, adversary sensor threat detection, and target detection and designation in all environments. It will deliver novel laser technologies which will provide low size, weight, and power (SWaP) laser sources and receivers for optical augmentation detection systems; and compact Laser Detection and Ranging (LADAR) sources for situational awareness and air and ground vehicle operations and navigation in all environments. This Project is a critical enabler for autonomous operations in environments where other imaging technologies are not sufficient.

This Project is coordinated with PE 0603462A (Next Generation Combat Vehicle Advanced Technology), 0603118A (Soldier Lethality Advanced Technology), 0603465A (Future Vertical Lift Advanced Technology), and 0602143A (Soldier Lethality Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Tactical and Navigation Lasers Sensors Technology	5.596	5.790	5.863
Description: This effort designs and develops novel low SWaP, compact, high peak power pulsed laser sources and receivers for optical augmentation detection systems; and compact LADAR sources for situational awareness and manned and unmanned air and ground vehicle operations and navigation in all environments. Effort delivers component technologies needed to support future Army autonomous, covert targeting approaches.			
FY 2024 Plans: Will investigate pixel pitch optimization of high-sensitivity laser detectors for enhanced resolution capabilities of the arrays; investigate dark current optimization of the high-sensitivity laser detectors through detector short loops to increase detection ranges when coupled with the short-pulse laser sources; begin development of a physics-based optical link error budget and laser detector model to guide development and predict future system performance.			
FY 2025 Plans: Will design high-sensitivity laser detectors with optimized pixel pitch (size) and dark current (sensitivity) and optimize advanced laser sources to increase array resolution and detection ranges. Will model laser detector components to predict performance			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BJ2 / *Tactical and Navigation Lasers Sensors Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
based on design specifications of high-sensitivity laser detectors. Will begin validation of laser detector model using laboratory test results of components and update models based on validation testing to guide development and predict future system performance. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	5.596	5.790	5.863

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*				Project (Number/Name) BK2 / *Virtual Prototyping Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BK2: *Virtual Prototyping Technology*	-	7.022	9.910	7.042	-	7.042	7.255	8.063	8.070	8.135	0.000	55.497

A. Mission Description and Budget Item Justification

novel ground vehicle design concepts that will be analyzed and evaluated through modeling, simulation, and virtual experimentation to provide engineering data and operational feedback to inform NGCV requirements to strengthen and accelerate acquisition decisions. This Project designs and analyzes novel NGCV system level ground vehicle concepts by integrating advanced mobility, survivability, lethality, sensing and electrical/electronic technologies to address emerging and future advanced threats. This Project provides system level ground vehicle design concepts and performance analysis, assesses cost and performance trades, and provides real-time soldier feedback on technology performance for the Army's NGCVs. Technologies to be evaluated include high efficiency advanced powertrains, power generation, vehicle electrification, active protection systems, active blast, advanced lethality and robotic control and autonomy technologies. The NGCV Virtual Prototypes include Virtual Soldier Operational Experiments (VSOE) with System Integration Labs (SILs) to give warfighters an understanding into how behaviors and tactics change given emerging Operation concepts based on new technologies and capabilities. Future integration of VSOEs with software and hardware SILs with realistic interfaces and utilizing mixed reality technology will provide higher fidelity Soldier evaluations, without the time and cost associated with physical prototypes. The Virtual Prototyping results provide critical inputs to the Army's NGCV program by providing independent technical and operational performance results for the Army's next generation of ground combat vehicles while reducing risk and accelerating transition to physical prototypes.

Work in this Project is coordinated with Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BF4 (Combat Vehicle Robotic

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

Work in this Project is performed by the Ground Vehicle System Center (GVSC)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Virtual Prototyping	7.022	9.910	7.042
Description: This effort utilizes virtual prototyping to address technical and integration challenges in the areas of mobility, survivability, lethality, vehicle architecture, and systems integration for the Army's next generation of ground combat vehicles. Specifically, this effort focuses on developing integrated design concepts, performance analysis, identifying and assessing trade space, and conducting virtual operational experiments for the NGCV. The combination of technical performance and operational feedback provides insights that will inform designs and reduce development and testing time.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BK2 / *Virtual Prototyping Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will continue modeling and simulation to virtually design, develop, and assess new Next Generation Combat Vehicle (NGCV) manned and unmanned systems that include projected lethality, mobility, sensing, protection, and autonomous vehicle technologies. Will integrate technologies into multiple combat vehicle concepts with a focus on Robotic Combat Vehicle (RCV) design approaches that are then analyzed for performance, cost, and traceability of NGCV requirements. Inform S&T and NGCV plans with knowledge and analyses. Will conduct Soldier-in-the-loop virtual experiments and build an initial virtual soldier operational exercise capability including system integration labs with realistic hardware/software interfaces and mixed reality technology to provide higher fidelity Soldier evaluations. Will assess ground vehicle concepts for military utility, mission performance, Soldier preference, and to explore Soldier derived Tactics, Techniques, and Procedures (TTPs). ***FY 2025 Plans:*** Will continue modeling and simulation to virtually design, develop, and assess new NGCV manned and unmanned systems that include projected lethality, mobility, sensing, protection, and autonomous vehicle technologies. Will integrate technologies into multiple combat vehicle concepts with a focus on robotic combat platform design approaches and integration of autonomous technologies into Virtual Soldier Operational Experiments (VSOE) to enable evaluation of human machine teaming (HMT) capabilities and requirements. Will continue to inform S&T and NGCV plans with knowledge, M&S analyses, and Soldier feedback. Will develop simulation environment to include system integration labs with realistic hardware/software interfaces and mixed reality technology to provide higher fidelity Soldier evaluations. Will assess ground vehicle concepts, autonomous technologies and HMT capabilities for military utility, mission performance, and Soldier preference to inform NGCV capabilities and requirements. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned completion of virtual designs.			
Accomplishments/Planned Programs Subtotals	7.022	9.910	7.042

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*				Project (Number/Name) BK5 / *Adv Direct In-Direct Armament Sys (ADIDAS) Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BK5: *Adv Direct In-Direct Armament Sys (ADIDAS) Tech*	-	13.054	11.043	11.585	-	11.585	8.599	8.353	10.124	14.086	0.000	76.844

A. Mission Description and Budget Item Justification

This Project matures and conducts experiments on component technologies for large caliber direct fire light-weight armament systems that will exceed the current capability of 120mm direct fire and be optimized for future operational environment with cross-domain engagement capability. This Project also researches large caliber direct fire munitions to project overwhelming lethality while ensuring maneuver forces remains mobile and sustainable during close-combat engagements at extended ranges.

Research in this Project is related to and fully integrated with the efforts funded in PE 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BK6 (Advanced Technology Direct In Direct Armament Sys (ADIDAS) Advanced Technology).

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

Research in this Project is performed by the Armaments Center (AC) and Army Research Laboratory (ARL)

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Advanced Lethality - Kinetic Energy (AL-KE) ***Description:*** This effort designs and develops component technologies for large caliber direct fire light-weight armament systems that will exceed the current 120mm direct fire cannon performance for future operational environments, including dense urban, with multi -domain engagement capability. The component technologies that support rapid fire on-the-move (direct & indirect) engagements include: compact ammunition design with advanced ignition, reduced gun impulse on platform through advanced recoil mitigation techniques, fire control and automated ammunition handling and reloading.	1.614	-	-
Title: NGCV Penetrator Technology for Decisive Lethality ***Description:*** This effort develops energy-efficient lethal mechanism technologies for next-generation warheads and projectiles for large-caliber ammunition launched from direct fire weapon systems that maximize the lethality against an array of targets and provide tactical advantage at extended ranges for next generation threats. The results of this research will provide the basis for the lethality required for the next generation of combat vehicles and enable the development of the next generation of ammunition to ensure lethal overmatch throughout the operational environment.	3.340	-	-
Title: Advanced Lethality Armament System- Large Caliber (ALAS-LC)	8.100	4.564	2.945

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BK5 / *Adv Direct In-Direct Armament Sys (ADIDAS) Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: Investigate increased lethality solutions for next generation large caliber direct fire armament systems that will ensure battlefield dominance of US ground forces. Design reduced recoil armament systems capable of increased rate of fire enabled by a compact autoloader with performance that exceeds current state of the art 120mm direct fire cannons for current and future Army platforms. ***FY 2024 Plans:*** Will develop modeling and simulation to assess armament system component technologies for future large caliber direct fire systems. Will validate models of large caliber system and component technologies to increase direct fire lethal overmatch. Will design and develop concepts for component hardware and software to reduce recoil and increase rate of fire of next generation large caliber direct fire armament systems. ***FY 2025 Plans:*** Will mature armament system component technologies that increase lethality for future large caliber direct fire systems. Will conduct experiments on armament system component technologies to inform future integration tasks. Will investigate technologies to reduce large caliber target defeat timeline via enhanced direct fire automation. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Title: Decisive Lethality ***Description:*** This effort develops energy-efficient lethal mechanism technologies for the next-generation of large-caliber ammunition launched from direct fire weapon systems to maximize the lethality against an array of targets and provide tactical advantage at extended ranges against current and future threats. This includes research and development to produce a compact, high energy density propelling charge, engineered aerodynamics for improved accuracy, a novel kinetic penetrator with next generation lethal mechanism, and the ability to defeat advanced and smart armors. ***FY 2024 Plans:*** Will investigate robust penetrators for greater lethality; explore the development of compact, high-energy propellant charges for direct fire which provide increased energy as well as advanced ignition technologies; conduct research into accuracy improvements needed for future large-caliber weapon systems; investigate approaches to survive, counter, and defeat smart armor technologies such as active protection system. ***FY 2025 Plans:*** Will evaluate concepts for robust large caliber penetrators for increased lethality; mature compact, high-energy propellant charges for direct fire which provide increased energy as well as advanced ignition safety or timelines?; explore the interaction between	-	6.479	8.640

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BK5 / *Adv Direct In-Direct Armament Sys (ADIDAS) Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
ignition and propellant to ensure controllable, repeatable combustion; evaluate technologies to improve accuracy necessary for future large-caliber weapon systems; evaluate system viability of counter-countermeasure technologies against projected threat systems for defeat of advanced protection technologies. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding realigned in FY 2025 from Advanced Armor and Protection Technologies in PE 0602144A Project CG7 Ground Protection Concepts and Technologies to support additional research in the area of the interaction between ignition and propellant for repeatable combustion.			
Accomplishments/Planned Programs Subtotals	13.054	11.043	11.585

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*				Project (Number/Name) BP5 / *Ground Vehicle Technology (CA)*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BP5: *Ground Vehicle Technology (CA)*	-	103.500	-	-	-	-	-	-	-	-	0.000	103.500

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Ground Vehicle Technology.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
Congressional Add: Program Increase - Silicon Carbide Electronics ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Silicon Carbide Electronics	6.000	-
Congressional Add: Program Increase - Highly Electrified Vehicles ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Highly Electrified Vehicles	3.000	-
Congressional Add: Program Increase - Prototyping Energy Smart Autonomous Ground Systems ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Prototyping Energy Smart Autonomous Ground Systems	10.000	-
Congressional Add: Advanced Materials Development for Survivability ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Materials Development for Survivability	10.000	-
Congressional Add: Program Increase - Digital Design and Simulated Testing ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Digital Design and Simulated Testing	5.000	-
Congressional Add: Program Increase - Fast-Refueling Fuel Cell Engines ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Fast-Refueling Fuel Cell Engines	7.000	-
Congressional Add: Program Increase - Hydrogen Technologies ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Hydrogen Technologies	15.000	-
Congressional Add: Program Increase - Machine Learning Optimized Power Electronics	3.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BP5 / *Ground Vehicle Technology (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Interest Item funding provided for Machine Learning Optimized Power Electronics		
Congressional Add: Program Increase - Zero Emission Combat Vehicles ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Zero Emission Combat Vehicles	3.000	-
Congressional Add: Program Increase - ADVANCED MANUFACTURING FOR COMBAT LOGISTICS SUPPORT ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for ADVANCED MANUFACTURING FOR COMBAT LOGISTICS SUPPORT	2.000	-
Congressional Add: Program Increase - ENTERPRISE AND CROSS-FUNCTIONAL LVC FOR ACCELERATED DEVELOPMENT ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for ENTERPRISE AND CROSS-FUNCTIONAL LVC FOR ACCELERATED DEVELOPMENT	8.000	-
Congressional Add: Program Increase - MOBILITY MATERIALS RESEARCH ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for MOBILITY MATERIALS RESEARCH	5.000	-
Congressional Add: Program Increase - MODULAR ELECTRIC MOTORS ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for MODULAR ELECTRIC MOTORS	5.500	-
Congressional Add: Program Increase - SMALL UNIT TECHNOLOGY ADVANCEMENTS ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for SMALL UNIT TECHNOLOGY ADVANCEMENTS	10.000	-
Congressional Add: Program Increase - SOLID OXIDE FUEL CELL DEVELOPMENT ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for SOLID OXIDE FUEL CELL DEVELOPMENT	5.000	-
Congressional Add: Program Increase - STRUCTURAL THERMOPLASTICS ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for STRUCTURAL THERMOPLASTICS	6.000	-
Congressional Adds Subtotals	103.500	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BP5 / *Ground Vehicle Technology (CA)*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*	Project (Number/Name) CU5 / *Platform Agnostic Armaments Applied Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CU5: *Platform Agnostic Armaments Applied Technology*	-	0.993	-	-	-	-	-	-	-	-	0.000	0.993

A. Mission Description and Budget Item Justification

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Platform Agnostic Armaments Technology	0.993	-	-
Description: This effort designs and develops technologies that enables platform performance by increasing range without degrading accuracy, reducing size, weight, and power and impact to lighter platforms, enhancing weapon, munitions, fire control, and agnostic remote weapon automation tech to reduce the kill chain timeline. This effort enables Army Modernization and Multi-Domain Operations (MDOs) in support of the Army's future and planned vehicles.			
Accomplishments/Planned Programs Subtotals	0.993	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A