Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 1: *Basic Research*					R-1 Program Element (Number/Name) PE 0601104A / *University and Industry Research Centers*							
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	-	119.270	108.946	109.726	-	109.726	118.252	124.376	127.705	136.060	0.000	844.335
AB4: *Army Research Centers*	-	23.477	25.443	25.699	-	25.699	26.148	26.165	26.449	26.714	0.000	180.095
AB7: *Army Collaborative Research and Tech Alliances*	-	57.079	63.445	63.400	-	63.400	71.452	77.545	80.364	88.244	0.000	501.529
AB8: *Army Educational Outreach Program*	-	10.834	12.485	12.756	-	12.756	12.771	12.780	12.920	13.049	0.000	87.595
AC6: *International Science and Technology*	-	7.180	7.573	7.871	-	7.871	7.881	7.886	7.972	8.053	0.000	54.416
J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*	-	20.700	-	-	-	-	-	-	-	-	0.000	20.700

A. Mission Description and Budget Item Justification

This Program Element (PE) fosters university and industry based research to provide a scientific foundation for enabling technologies for future force capabilities. Broadly, the work in this PE falls into the categories of Collaborative Technology Alliances / Collaborative Research Alliances (CTAs/CRAs), University Centers of Excellence (COE), University Affiliated Research Centers (UARCs), Army-sponsored educational outreach, and Army investments at international academic and industrial partners. The Army formed CTAs to leverage large investments by the commercial sector in basic research areas that are of great interest to the Army. CTAs are industry-led partnerships between industry, academia, and the Army Futures Command to incorporate the practicality of industry, the expansion of the boundaries of knowledge from universities, and Army scientists to shape, mature, and transition technology relevant to the Army mission. CRAs are academia-led partnerships, which leverage the cutting-edge innovation found in the academic environment. The COEs focus on expanding the frontiers of knowledge in research areas where the Army has enduring needs, and couples state-of-the-art research programs at academic institutions with broad-based graduate education programs to increase the supply of scientists and engineers in automotive and rotary wing technology. Also included are Army Educational Outreach Program (AEOP) and activities to stimulate interest in science, math, and technology among middle and high school students. This PE includes support for basic research at three Army UARCs, which have been created to exploit opportunities to advance new capabilities through a sustained long- term multidisciplinary effort. The Institute for Soldier Nanotechnologies focuses on Soldier protection by emphasizing revolutionary materials research for advanced Soldier protection and survivability. The Institute for Collaborative Biotechnologies focuses on enabling network centric-technologies, and broadening the Army's use of biotechnology for the development of bio-inspired materials, sensors, and information processing. The Institute for Creative Technologies is a partnership with academia and the entertainment and gaming industries to leverage innovative research and concepts for training and simulation. Examples of specific research of mutual interest to the entertainment industry and the Army are technologies for realistic immersion in synthetic environments, networked simulation, standards for interoperability, and tools for creating simulated environments. This PE also includes the Historically Black Colleges and Universities and Minority Institutions (HBCU/MI) Centers of Excellence that address critical research areas for Army Transformation.

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

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army	Date: March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 1: *Basic Research*	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	121.160	108.946	109.506	-	109.506
Current President's Budget	119.270	108.946	109.726	-	109.726
Total Adjustments	-1.890	0.000	0.220	-	0.220
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.726	-			
• SBIR/STTR Transfer	-3.616	-			
• Adjustments to Budget Years	-	-	0.220	-	0.220

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Project: J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*		
Congressional Add: *Program Increase - MATERIALS IN EXTREME DYNAMIC ENVIRONMENTS*	5.000	-
Congressional Add: *Program increase - BIOTECHNOLOGY ADVANCEMENTS*	4.000	-
Congressional Add: *Program Increase - INFUSION OF CYBERSECURITY CONCEPTS INTO NONTECHNICAL HIGH SCHOOL COURSES*	2.000	-
Congressional Add: *Program Increase - NEXT GENERATION SURVIVAL RADIO*	3.800	-
Congressional Add: *Program Increase - QUANTUM COMPUTING TECHNOLOGIES*	1.400	-
Congressional Add: *Program Increase - HYPERSONIC TECHNOLOGY RESEARCH AND TESTING INITIATIVE*	4.500	-
Congressional Add Subtotals for Project: J13	20.700	-
Congressional Add Totals for all Projects	20.700	-

Change Summary Explanation

Minor increase in FY25 funding from the previous PB to the current PB due to economic assumptions.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 1	R-1 Program Element (Number/Name) PE 0601104A / *University and Industry Research Centers*	Project (Number/Name) AB4 / *Army Research Centers*	

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
AB4: *Army Research Centers*	-	23.477	25.443	25.699	-	25.699	26.148	26.165	26.449	26.714	0.000	180.095

A. Mission Description and Budget Item Justification

This Project encompasses three types of Centers. The first is the Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) Research Centers of Excellence which support the Army's research partnerships with HBCUs/MIs. The HBCU/MI Research Centers of Excellence were established as the next phase of what was previously known as the Partnered Research Initiative (PRI) Program that ended in Fiscal Year 2020. The focus of the HBCU/MI Research Centers of Excellence Program is to advance innovative basic research leading to potential technology development in areas of strategic importance to the Army by competitively selecting HBCU and MI research teams for grants or cooperative agreements. Awards have five-year periods of performance, with all supporting the Army's goal of broadening the performer base and diversifying the research ecosystem in the areas of information sciences, engineering, and physical sciences.

The second is the University Affiliated Research Centers (UARCs). Army UARCs have been created to exploit opportunities to advance new capabilities through a sustained long-term multidisciplinary effort. The Institute for Soldier Nanotechnologies focuses on Soldier protection by emphasizing revolutionary materials research for advanced Soldier protection and survivability. The Institute for Collaborative Biotechnologies focuses on enabling network centric-technologies and broadening the Army's use of biotechnology for the development of bio-inspired materials, sensors, and information processing. The Institute for Creative Technologies is a partnership with academia and the entertainment and gaming industries to leverage innovative research and concepts for training and simulation. Examples of specific research of mutual interest to the entertainment industry and the Army are technologies for realistic immersion in synthetic environments, networked simulation, standards for interoperability, and tools for creating simulated environments.

The third is the Army Centers of Excellence (COEs). The COEs focus on expanding the frontiers of knowledge in research areas where the Army has enduring needs and couples state-of-the-art research programs at academic institutions with broad-based graduate education programs to increase the supply of scientists and engineers in automotive and rotary wing technology.

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

Work in this Project is completed by the Army Research Laboratory (ARL), Aviation and Missile Center (AvMC), and Ground Vehicle Systems Center (GVSC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Centers of Excellence for Battlefield Capability Enhancements (BCE)	1.674	1.803	-
Description: The focus of the HBCU/MI Research Centers of Excellence Program is to advance innovative basic research leading to potential technology development in areas of strategic importance to the Army by competitively selecting HBCU and MI research teams for grants or cooperative agreements. Awards have five-year periods of performance, with one each awarded in			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB4 / *Army Research Centers*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
the areas of information, engineering, and physical science in order to support Army goals and broaden the performer base and diversify the research ecosystem. ***FY 2024 Plans:*** Will foster the advancement of remote sensing technologies by focusing on acoustic and seismic sensing capabilities for military movement and maneuver in urban environments while advancing education and training of minority and underrepresented students in research targeted towards Army modernization needs. Acoustic and seismic sensing have promising potentials for passive, non-line-of-sight, detection, localization, and monitoring of natural and human activities. There will be a strong emphasis on undergraduate involvement in addressing this unique-to-Army challenge of sensing in the Dense Urban Environment. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding realigned in FY 2025 to Historically Black Colleges and Universities/Minority Serving Institutions (HBCU/MI) Research Centers of Excellence (RCE) Program effort within this Project.			
Title: Institute for Collaborative Biotechnologies ***Description:*** This effort performs sustained multidisciplinary discovery-based research that combines state-of-the-art methods in synthetic biology with novel techniques for biologically-enabled material synthesis and characterization. This fundamental research program provides a firm foundation of biotechnological knowledge that serves as a robust platform for design and development of biologically-enabled materials and technologies for Army-relevant applications and priorities. ***FY 2024 Plans:*** Will develop enzymatic systems where activation of diazirines yield highly-strained ring systems and design and implement multi-component synthetic cells for biofilm formation; create and assess ultrasound-actuated multifunctional synthetic biology circuits; combine experimental and computational species translation modeling tests for animal-human study relevance to bridge the biotic-abiotic gap through electrical switching and control of reflectin and other proteins, that if successful will enable the use of synergy between synthetic biology and synthetic chemistry for the scalable synthesis of bioactive natural products. ***FY 2025 Plans:*** Will investigate the molecular basis of enzyme-substrate reactions in anaerobic fungi that, if successful, will enable tunable binding affinity and substrate specificity of synthetic enzyme complexes for environmental sensing; examine the snake infrared (IR) sensing pathway using molecular genetic techniques to inform new designs for efficient, uncooled detectors for IR wavelengths; explore new synthetic routes based on biocatalysis to create functionalized molecular structures with high efficiency and control of stereochemistry to enable cost-effective and sustainable synthesis of military relevant materials for energy storage, remediation, and protection. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	4.791	5.053	5.087

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB4 / *Army Research Centers*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Funding increase is an economic adjustment.			
Title: Institute for Creative Technologies	4.810	5.127	5.161
Description: This effort focuses on basic research of Immersive Environments and spans a number of key areas to include virtual humans, three-dimensional (3D) sound and visual media to achieve more efficient and affordable training, modeling, simulation, and application solutions and tools. Research includes: investigation of techniques and methods to address the rapid development of synthetic environments and the study of perception and cognition to help direct the development of new technologies and techniques that evoke more realistic responses from users; auditory aspects of immersion to provide the sound stimulus for increasing the realism for military training and simulation devices; new computational techniques in graphics for achieving real-time photo-realistic rendering of physical and synthetic environments for training and simulations; innovative methods for automatically generating animations and gestures for virtual humans based on what is being communicated; new technologies for scanning real people and rapidly generating virtual humans which look like these people significantly reducing the time, expense, and effort required to develop virtual humans and virtual environments; methods and techniques for creating autonomous virtual human computer-generated characters that look, communicate, and behave like real people, use verbal and non-verbal communication, exhibit emotions, model their own beliefs, desires, and intentions as well as those of others, and reason using advanced artificial intelligence; and methods and techniques for improving the perception, communication, understanding, and responsiveness of virtual humans when interacting with live humans and explore how people relate to virtual humans. ***FY 2024 Plans:*** Will research dynamics of emotional expression to obtain fine-grained understanding of emotion and human intent during person to person, or person to agent interactions; investigate how individual's information can be used during training and inference time for software agents to effectively communicate with humans without agents being able to personally identify the individual (differential privacy); explore fast three-dimensional (3D) scene generation to aid in synthetic data-generation and in Augmented Reality/Virtual Reality as part of synthetic training environments. ***FY 2025 Plans:*** Will investigate neuroscience-based models of attention to develop design aids for virtual reality environments that, if successful, will build the foundations of a framework for immersive content creation capable of better engaging individuals in synthetic environments; conduct research with an artificial neural network trained with deep learning to enable more realistic versions of real-world objects for Augmented Reality/Virtual Reality; will examine the combination of new optical arrays and deep learning to create hardware capable of real-time measurement and rendering. ***FY 2024 to FY 2025 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB4 / *Army Research Centers*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Funding increase is an economic adjustment.			
Title: Institute for Soldier Nanotechnologies ***Description:*** This effort investigates Nanomaterials and Nanotechnologies for Soldier applications focused on light-weight, multifunctional nanostructured fibers and materials. ***FY 2024 Plans:*** Will explore fundamental questions in the exploitation, understanding, and ultimate capabilities of nanophotonics including imaging metastructures in conjunction with computational imaging, and novel light sources for stable large area lasers, efficient THz sources, and free-electron lasers; develop computational, data science, and experimental methods to explore the field of superelastic ceramics that exhibits a martensitic transformation that permits large shape change; explore fundamental aspects of radiative thermal emission, in the far field and in the near field regimes, using the unique ability of photonic crystals and metamaterials to tailor the photon densities of states in these systems by developing mesoscale objects with nanoscale feature sizes that if successful, will enable new functional materials, portable power generation, and flexible electronics. ***FY 2025 Plans:*** Will study the topological physics of electrons and photons in a variety of materials (e.g., Weyl semimetals niobium phosphide and Cobalt monosilicide) that, if successful, may lead to very sensitive detection of far infrared (IR) and terahertz (THz) radiation; examine fundamental process-structure-property relationships of long, crystalline, nanofiber reinforced heterogeneous ceramic matrix materials to inform the development and manufacture of lightweight materials with beyond the state of the art strength and toughness; explore versatile synthesis and processing path to generate different mesoporous materials that if successful will enable rationally designed hierarchically organized material properties for use in lithium based energy storage applications. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease is an economic adjustment.	4.949	5.753	5.680
Title: Vertical Lift Research Center of Excellence (VLRCOE) ***Description:*** VLRCOE agreements with Pennsylvania State University, University of Maryland, and Georgia Institute of Technology to supplement a robust experimental and analytic basic research program in rotorcraft technologies including: Aeromechanics, Structures, Flight Dynamics and Control, Rotorcraft Design and Concepts, Vibration and Noise Control, Propulsion, Affordability, Safety and Survivability, and Naval Operations. ***FY 2024 Plans:*** Will conduct the second annual review followed by executing the third year of the VLRCOE program. The research conducted will focus on human-intuitable collision avoidance for semi/autonomous aircraft and adaptive pilot modeling for complex environments such as shipboard operations; explore new technologies such as electrified variable speed rotorcraft drivetrain and electric	3.363	3.578	3.602

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB4 / *Army Research Centers*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
actuators for vibration control; continue research collaborations with a team of multi-agency (Army, Navy, and NASA) government subject matter experts (SMEs) and universities in relevant areas including high-fidelity simulations and wind-tunnel measurements of whirl-flutter and vibrations on advanced geometry tiltrotor configurations. ***FY 2025 Plans:*** The Centers of Excellence at Georgia Institute of Technology, Pennsylvania State University, and University of Maryland will undertake a robust experimental and analytic basic research program in close collaboration with government subject matter experts (SMEs) in areas relevant to future vertical lift such as improved structural performance through microstructure tailored materials, measurements and simulations for high speed rotors, acoustically aware autonomy, proprotor/wing interactional aero/acoustics, and computational fluid dynamics (CFD) trained neural networks and machine learning (ML) for inverse design of rotorcraft components; execute the third annual review of the VLRCOE program at the Centers with a diverse team of SMEs and organizational leaders from the Army, the Navy, and NASA, to provide technical direction; incorporate feedback from the reviews to execute year four of the five-year cooperative agreement to keep the research aligned with the Army's science and technology (S&T) strategic focus. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Automotive Research Center (ARC) ***Description:*** The ARC is an United States Army Center of Excellence for Modeling and Simulation of ground vehicles. The Center relies on the collaboration of researchers from multiple universities and disciplines to bridge fundamental technology gaps in five research thrust areas of strategic importance to the Army: mobility, human factors and man-machine integration, lightweight structure and materials, power and energy, and design integration. A major integrative focus of these five areas are autonomy and manned-unmanned teaming. ***FY 2024 Plans:*** The ARC will work towards solving the complex, inter-disciplinary, multiscale problem that is required to develop the advanced modeling and simulation tools needed to assess the performance of off-road autonomous mobility. This research will include off-road autonomy algorithm development, human-machine trust advancement, innovative materials and structures, intelligent power systems, and multisystem coordination; develop the required companion technologies of computation enhancement, verification and validation improvements, and the understanding of uncertainty in unstructured environments. ***FY 2025 Plans:*** Will continue work towards solving the complex, multi-physics, inter-disciplinary, multiscale problems that are required to develop the advanced modeling and simulation tools needed to assess the performance of off-road autonomous mobility systems. This research will include off-road autonomy algorithm development, human-machine trust advancement, innovative materials and	3.890	4.129	4.354

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB4 / *Army Research Centers*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
structures, intelligent power systems, and multisystem coordination; develop the required companion technologies of computation enhancement, verification and validation improvements, and the understanding of uncertainty in unstructured environments. Additional focus will be on using system data to augment physics-based computation to predict performance and reliability of systems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Historically Black Colleges and Universities and Minority Serving Institutions (HBCU/MI) Research Centers of Excellence (RCE) Program ***Description:*** The focus of the HBCU/MI RCE Program is to enhance Army-relevant research infrastructure, talent, and ecosystems at institutions that have been underrepresented in the Army Futures Command (AFC) research enterprise. The program invests in innovative basic research in areas of strategic importance to the Army identified through the competitive selection of HBCU and MI research teams for grants or cooperative agreements. ***FY 2025 Plans:*** Will investigate, synthesize, and characterize new high-energy density materials formed from simple molecular materials, their alloys, and organic precursor molecules; utilize time-resolved experimental techniques to map the reaction kinetics, intermediate products, and energy release of new candidate materials, that in the long term are expected to enable new energetic materials for the Army with multiple times the power density of materials in use today, and the development of new materials with adaptive, tailorable responses to external stress. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding realigned from Centers of Excellence for Battlefield Capability Enhancements (BCE) effort within this Project in FY 2025.	-	-	1.815
Accomplishments/Planned Programs Subtotals	23.477	25.443	25.699

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 / 1					R-1 Program Element (Number/Name) PE 0601104A / *University and Industry Research Centers*				Project (Number/Name) AB7 / *Army Collaborative Research and Tech Alliances*			
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**
AB7: *Army Collaborative Research and Tech Alliances*	-	57.079	63.445	63.400	-	63.400	71.452	77.545	80.364	88.244	0.000	501.529

A. Mission Description and Budget Item Justification

This Project supports the Army Collaborative Research Alliances (CRAs) and Collaborative Technology Alliances (CTAs). CTAs and CRAs are partnerships between Army laboratories and centers, private industry, and academia that focus on the rapid transition of innovative technologies to the Warfighter to enable the Army's Future Force. The collaboration between industry, academia, and the government is a key element of the alliance concept as each member brings with it a distinctly different approach to research. Academia is known for its cutting-edge innovation; the industrial partners are able to leverage existing research results for transition and to deal with technology bottlenecks; the Army researchers keep the program oriented toward solving complex Army technology problems. This approach enables an Alliance to bring together world class research and development talent and focus it on Army-specific technology objectives for application to Army needs.

The topics covered by CRAs and CTAs include cyber security (funded in PE 0601121A / Cyber Collaborative Research Alliance), the internet of battlefield things, distributed and collaborative intelligent systems technology, neuroergonomics and neuroscience, advanced materials, exploitation of quantum effects, semiconductor modeling, convergent manufacturing, autonomous maneuver and machine learning and artificial intelligence.

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Internet of Battlefield Things CTA (IoBT CTA)	3.090	3.166	3.120
Description: The IoBT CTA seeks to gain fundamental understanding of Internet of Things (IoT) phenomena and its performance in tactical environments, ranging from sparse, remote settings to complex, dense urban environments. Research will address intelligent resourcing and influence in complex, constrained, and uncertain networks (demand from massive numbers of dynamically connected devices, limited and unpredictable connectivity, shared civilian networks, computation at or near the device), heterogeneous sensing and actuation devices (efficient, smart devices with self-organizing/preservation/directing capabilities), and variable and unreliable provenance and dynamisms of information and device signals. ***FY 2024 Plans:*** Will research resilient and efficient tactical edge intelligence by exploiting data from large-scale networks to support decision advantage in a set of intelligent systems-of-systems; research and develop algorithms that prioritize and filter information from vast amounts of ubiquitous sensor/actuators; explore methods to quantify uncertainty across uncontrolled resources with denied, degraded, intermittent, or limited characteristics; establish algorithms that expose adjustable system parameters to enable			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
rapid reconfigurability utilizing lightweight and/or information-theoretic compression methods and resource provisioning across Command and Control information-networks; develop foundations for determining required sensing cadence and multi-scale sampling approaches to maintain longevity; investigate algorithms and theoretical foundations of edge node coordination in dynamic and contested networks. ***FY 2025 Plans:*** Will conduct research to provide distributed intelligent analytics at scale through cooperative data communication, fusion, and processing; continue research and development of algorithms that prioritize and filter information from vast amounts of ubiquitous heterogenous sensors/actuators; investigate novel methods for joint sensing, computation, and communication in resource-constrained networks; explore trust assessment to maintain safety and security assurances when leveraging uncontrolled sensors/processors for analytics composition; examine the use of hybrid, rule-based plus data-based algorithms for tactical edge processing; research real-time adaptive task scheduling algorithms to provide resilience against adversarial disruption. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Distributed Analytics and Information Science International Technology Alliance (ITA) ***Description:*** This research will address the fundamental science underpinning the complex information network issues that are vital to future United States (US) / United Kingdom (UK) coalition military operations and to fully exploit the joint development of emerging technologies necessary to enable coalition operations. These efforts provide enhanced ability to perform adaptive, goal-driven, semantically-aware, distributed analytics for situational understanding in coalition operations. ***FY 2024 Plans:*** Will investigate theories and techniques to improve the efficiency of distributed resource awareness algorithms to reduce the required bandwidth and improve the freshness of the information; investigate theories and techniques to reduce the complexity and improve scalability of the resource allocation optimizations; investigate theories, models, and techniques for joint allocation and orchestration of networking resources, computational resources, and analytic microservice optimizations to support federated learning at the tactical edge; investigate theories, models, and techniques to automate and optimize neural network algorithms, and the discovery, monitoring, joint orchestration, and dynamic adaption of computational, network, and communication resources, across multiple tasks, to support dynamic, distributed analytics at the tactical edge. ***FY 2025 Plans:*** Will develop adaptive machine learning models for use in resource-constrained tactical environments to enable distributed analytics; develop improved methods for machine learning model training with limited or unlabeled data; investigate local and global optimization schemes for network and computational resource monitoring, orchestration, and allocation subject to multiple	2.918	3.013	3.016

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
analytical task requests; investigate methodologies for optimizing neural network model development and training for use in a range of Army applications. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Distributed Collaborative Intelligent Systems Technology CTA ***Description:*** Establish the underpinning science to extend the reach, situational awareness, and operational effectiveness of intelligent system and Soldier teams against dynamic threats in complex and contested environments and provide technical and operational superiority through fast, intelligent, resilient, and collaborative behaviors. Research efforts will enable distributed systems to engage in complex, time-varying, and contested environments to accomplish Army missions by leveraging a mix of online adaptation and system-wide resilience. ***FY 2024 Plans:*** Will investigate theories and techniques to advance multi-robot collaborative autonomy to overcome the curse of dimensionality, increase robustness in complex and dynamic environments, and provide an understanding of performance guarantees and limitations in multi-agent operations; develop computationally efficient strategies for multi-robot real-time and high-tempo adversarial engagements to include methods for hierarchical planning and control and the development of models for the use of deception and misinformation; establish approaches to enable dynamic and coordinated mission specification task allocation and planning within and across large heterogeneous teams. ***FY 2025 Plans:*** Will unify joint perception, action, and communication capabilities previously developed to establish the common foundation for learning-based multi-robot collaboration in complex, adversarial environments; expand a new science of deception in autonomous maneuver that links adversarial reasoning, team coordination, autonomous behaviors, learning, and game theory to support operations in complex environments against intelligent and adaptive adversaries; develop formalisms and planning techniques for multi-robot mission specifications that build on natural language reasoning and semantic environment representations and enable adaptive mission execution and scaling to large heterogeneous multi-agent teams; design and conduct experimentation to inform the program capstone and support technology transition. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	6.520	6.700	6.706
Title: Neurosciences CRA ***Description:*** This effort performs multidisciplinary basic research in the area of neuroscience through collaboration with the University of California at Santa Barbara.	0.670	0.690	0.690

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2024 Plans: Will probe changes in neural task representations during training of complex decision tasks in the novice and mastery domains; develop Machine-Optimized Models of auditory scene perception; explore human and neuro-inspired artificial-intelligence visual reasoning; investigate behavioral and neural optimizations for adaptable decision-making during uncertainty; build a universal translator for neural codes to support cognitive tasks; develop methods for tracking the temporal dynamics of continuous changes in global state and cognition. ***FY 2025 Plans:*** Will investigate and identify brain areas that allow humans to reason and understand new environments to inform artificial intelligence models and deep neural networks to better recognize and respond to dynamic changes in the environment; conduct experiments to understand the cognitive and neurobiological mechanisms of complex decision making; examine how different brain areas interact and network during the transition from novice to expert in complex task completion.			
Title: Identification and characterization of team-level processes for enhancing performance of heterogeneous Soldier-Agent teams CRA ***Description:*** By developing and validating theoretical principles of human-agent team states and processes, this effort defines methods for exploiting individual dynamics and variability to improve team-level properties and performance. ***FY 2024 Plans:*** Will identify preferred human agent teaming futures and how to enable them; uncover the underlying meanings that humans attach to the guidance they provide to agents and explore allowances for agents to understand these implied meanings; research what properties agents possess that human agent teams can use to naturally adapt on-the-fly through situated interactions; describe how human agent team performance is impacted by co-training humans and agents. ***FY 2025 Plans:*** Will investigate theory-of-mind approaches to allow for humans and agents to predict each other's capabilities and strategies to improve team performance in tasks that require flexibility and adaptability; identify new methodologies to create agents based on the brain's spatial reasoning and decision making networks and conduct experiments to assess their efficacy in human-machine teams; discover new human-machine team interactions that improve team adaptability in tasks which require super-human capabilities; analyze the impact of new types of machine intelligence such as large language models to enable unprecedented human-technology team interactions; explore ways to enable hybrid intelligence through development of neuro-enhancement and crowd sourcing methodologies. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	5.207	5.333	5.338

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Funding change reflects planned lifecycle of this effort.			
Title: Army Artificial Intelligence Innovation Institute (A2I2) ***Description:*** This effort coordinates, conducts, and accelerates basic research to address Army-specific challenges, with a focus on advancing artificial intelligence (AI) and machine learning (ML) capabilities for autonomous maneuver in multi-domain operations (MDO). A broad-spectrum of AI capabilities are critical to the integration of operations in the contested environment including human-agent teaming for faster and more informed decisions, multi-domain Command, Control, Communications, and Computers (C4) that is resilient to Cyber Electromagnetic Activities (CEMA), and AI enabled cyber security that is robust to enemy deception. The Army Futures Command (AFC) will leverage existing High Performance Computing (HPC) and network infrastructure, along with regional laboratory extensions to enable basic research on AI that is open, with top-tier universities, commercial businesses, and established Department of Defense industrial partners. The A2I2 creates an accessible database of heterogeneous data, a repository of AI and ML algorithms and software tools, and military-relevant challenge problems. ***FY 2024 Plans:*** Will increase artificial intelligence capabilities to process image classifiers for adversarial threat detection; develop autonomous agent skills to traverse rugged terrain through contested environments; identify and implement methods for automatic cyber protection in autonomous, mobile platforms; conduct experiments to refine and extend the ability of autonomous platforms to navigate indoor environments with awareness of adversarial threats and minimal human intervention; create algorithms that can use a robotic shield to deflect incoming projectiles in real time. ***FY 2025 Plans:*** Will conduct lab experiments to investigate multi-robot coordination algorithms in Military Operations in Urban Terrain (MOUT) environments; create neural networks for Internet of Battlefield Things (IoBT) edge-network resource management; investigate joint understanding and dialogue interface for improved natural language communications between robots and robot operators; create adaptable command-and-control decision support tools to operationalize new scenarios from original training scenarios; investigate robotic ability to learn and create physics abstractions from real-world interactions in the field. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	7.606	7.751	7.762
Title: Army Radio-Frequency (RF) Electronics Center ***Description:*** The Army RF Electronics Center will develop ultra-wide bandgap (UWBG) materials and device concepts designed to enable next generation RF semiconductor technology for the Army. This research will enable advanced, robust, high-power RF electronics for radars, comms, directed energy, and electronic warfare (EW). The resulting robust high power operation will	5.060	5.130	5.135

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
provide longer ranges for sensing and effect-on-target under adverse conditions and improved sized, weight, and power (SWaP) will give small systems (Unmanned Aerial Vehicles, countermeasures, etc.) new capabilities. ***FY 2024 Plans:*** Will explore UWBG semiconductor devices for millimeter wave operation and how to achieve a 10x increase in power density; investigate the use of physics-informed multi-scale machine learning to augment the selection of both material parameters and device architectures to improve power density that if successful could enable improved communication systems, sensors, and electronic countermeasures. ***FY 2025 Plans:*** Will develop the theoretical understanding and experimental techniques needed to create UWBG devices that exceed state-of-art technology with respect to signal gain, output power density, and power added efficiency; develop an artificial intelligence and machine learning (AI/ML) augmented theoretical framework and experimental validation methodology to enable the design of novel UWBG semiconductor devices intended for millimeter-wave (mm-wave) operation with increased power density. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Army Advanced Biological Control Center ***Description:*** The Army Advanced Biological Control Center will develop a fundamental knowledge base for precise, reliable control of engineered biological systems for functional effect during military operations. By exploiting fundamental relationships governing the functions and properties of biological systems, the Center will develop advanced control schemes using synthetic biology targeting two key areas: 1) Genetic Control of Material Properties and 2) Biological Control in Competitive Environments. ***FY 2024 Plans:*** Will expand protein-based functional material discovery by integrating modeling-directed protein designs with metals to emulate fibrous proteins from nature with an expanded tool kit; develop an experimental platform to functionally screen protein-metal composite libraries defined from the modeling, that if successful will enable future, advanced manufacturing methods that leverage synthetic biology to produce Army-relevant materials at a quality and efficiency not possible using existing tools; design and assess a resilient engineered living materials platform for the fabrication of robust biomaterials; develop genetic tools for creating a chassis using biomaterials fabrication; identify the mechanisms for cell surface functionalization and protein secretion, and elucidate the mechanisms and principles for the design of hierarchical, functional living biomaterials, that if successful, will enable the development of future biosensors and functional coatings. ***FY 2025 Plans:***	5.060	5.130	5.135

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will create a Design-Build-Test-Learn framework comprised of novel computational and high-throughput tools for elucidating sequence-structure-function-property relationships for engineered biological materials; explore the ability of the Design-Build-Test-Learn framework to enable the predictive design of multifunctional biomaterials with differing properties (e.g., electronic, optical, sensing); explore the predictive design of engineered cellular systems by identifying microbial consortia amenable to carrying synthetic functions, rendering them receptive to engineering, designing genetic functions to work in never-before-tried species, and then simulating environments to assess engineered microbes in military-relevant environments. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Army Advanced Energetics Center ***Description:*** The Army Advanced Energetics Center will develop a fundamental knowledge base for greater than 5x lethality and range of guns and projectiles through the discovery of disruptive energetic materials and exceeding the strategic objectives of current programs. This research focuses on high through-put synthesis and rapid characterization to accelerate discovery of next generation materials to enable Army domination of the future battlefield. ***FY 2024 Plans:*** Will synthesize new high density energetic materials, (organic and inorganic) targeting higher detonation velocities, blast effects, thermal outputs, and for enhancing rocket propellants; create fundamental understanding of the initiation, break-up, and fragmentation of energetic materials during and after detonative energy release; develop advanced models and experimental methodologies to enhance fundamental understanding of polymers in formulations as pertains to stress/strain properties, aging, impact of high temperatures, and understanding the evolution of microstructure during reactive and non-reactive events; develop understanding of how shockwaves interact with material grain boundaries, material interfaces, and material defects. ***FY 2025 Plans:*** Will explore non-traditional synthetic methodologies to enable novel energetic materials; conduct experiments with new diagnostic and modeling techniques to study the role of microstructure and geometry on energetic release; develop a novel technique that enables in-operando fast response and high resolution imaging of the thermal and reaction front of energetic materials; explore a new aluminum shell chemistry that will promote controllable surface reactions and aluminum energy release rates at time scales relevant to a detonation; create a physics-based reactive burn model to study the reaction dynamics of heterogeneous energetic materials in the weak-to-moderate shock regimes; explore time-resolved diffuse back-illuminated extinction imaging (DBEI) as a method for imaging explosively generated reactive particle fields. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	5.060	5.129	5.135

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Funding change reflects planned lifecycle of this effort.			
Title: Tactical Behaviors for Autonomous Maneuver ***Description:*** This effort focuses on development of the algorithmic underpinnings of adaptive, resilient, and tactically relevant behaviors for teams of autonomous ground and aerial vehicles, which will enable multi-domain autonomous maneuver. ***FY 2024 Plans:*** Will explore foundational theoretical approaches to enable small teams of agents to utilize coordinated, tactically-relevant maneuvers to achieve positions of advantage with respect to adversaries with increasing degrees of complexity and uncertainty; create algorithms which enable the application of learned tactics in novel, adjacent domains; investigate methods and techniques to predict and project future positions of advantage in scenarios with dynamic elements with limited prior information. ***FY 2025 Plans:*** Will investigate methods and techniques that allow small teams of agents to mimic human navigation tactics based on limited training samples; conduct fundamental research on strategies to counter anticipated movement through partial unknown environments; continue to investigate theoretical approaches to gaining tactical advantages with respect to increasingly complex and capable adversarial models. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	2.590	2.734	2.736
Title: Materials Discovery for Extreme Environments ***Description:*** Research will focus on material discovery for next-generation ballistic materials by using accelerated material-by-design approach to include consideration of nonhomogeneous, anisotropic, and hierarchical material systems. A data-driven material design approach will be developed utilizing high-throughput material processing and characterization, multi-scale modeling, and machine intelligence to produce leap-ahead material solutions. ***FY 2024 Plans:*** Will continue to engage in collaborative research with selected Centers and Seedlings, with a focus on aligning internal research efforts with partners; collaborate with down-selected Data Management Seedling to further refine High-Throughput Materials Discovery for Extreme Conditions data management platform; conduct experiments with top candidate materials in relative environment; examine rapid screening methods for high dimensional material datasets; analyze high-throughput synthesis and characterization of material classes suitable for high-rate applications. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	6.488	6.555	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Funding realigned in FY 2025 to support the creation of High-Throughput Materials Discovery for Extreme Conditions within this Project.			
Title: Fundamentals for Quantum Technologies ***Description:*** This work supports quantum information science basic research for next generation capabilities in entanglement-enhanced novel sensors and communications for Army dominance on the future battlefield. ***FY 2024 Plans:*** Will investigate approaches to magnetometry using nitrogen-vacancy (NV) centers in diamond and other defect systems; investigate collective effects in nanofiber; investigate entangled photon pair generation and propagation in topological systems; explore distributed sensing using ion traps; explore methods for using telecom-compatible energy levels for long-range entanglement generation; explore ion traps in optical cavities for increased generation of infrared photons suitable for propagation over fiber networks. ***FY 2025 Plans:*** Will investigate approaches to rapidly assess samples of NV centers in diamond and other defect systems for use in quantum sensors and clocks; investigate collective effects in nanofiber over 10x longer ranges; develop stable cryogenic ion traps; discover methods to reduce background noise when generating telecom-compatible photons for long-range entanglement. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding reduction reflects a decrease in research in the area of photon pair generation and propagation in topological systems.	4.850	5.069	3.002
Title: Convergent Manufacturing for High Performance Material Interfaces ***Description:*** This research will address novel additive deposition, high fidelity subtractive methods, and high resolution directed energy processes to investigate complex, non-discrete, high performance, multi-material interfaces with improved adhesion, gradual coefficient of thermal expansion changes, and gradual wavespeed changes to enable high performance under extreme ballistic and thermal conditions. ***FY 2024 Plans:*** Will investigate novel transformative manufacturing, including strategies to affect quality of multi-material interfaces; investigate methodologies for development of high-performance interfaces between another set of dissimilar materials (planned as metal-ceramic) and characterize the resulting materials and interfaces; investigate multi-material model development for metal-ceramics to begin to enable digital twin development. ***FY 2025 Plans:***	1.000	1.039	1.040

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will investigate non-reactive hybrid additive manufacturing processes to study dissimilar metal-metal and metal-ceramic interfaces using novel embedded design technique; validate working convergent manufacturing (CM) platform by converging two manufacturing processes (additive and subtractive) and two dissimilar materials in one manufacturing platform; develop and assess first generation digital twin for CM. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Semi-Conductor Modeling Consortium ***Description:*** As a result of the Army's investment in electronic material modeling and simulation, tools are now available to predict semiconductor material and device performance with high fidelity. Through modeling and simulation, the Center for Semiconductor Modeling of Materials and Devices (CSM) assesses performance, guides improvements, and reduces technology risk for niche Department of Defense (DoD) semiconductor applications before large investment is committed. The intent of the CSM is to simulate real materials and devices in real environments, understand the limits of the technology, understand the parameters that control the performance, eliminate variances to the maximum extent possible, and arrive at a materials and device design which will reproducibly yield the required performance. Doing so at an early stage of innovation will undoubtedly lead to acceleration toward the next disruptive innovation. This acceleration is becoming increasingly important, because the environment is changing rapidly and to stay ahead the Army must innovate faster. ***FY 2024 Plans:*** Will explore and assess new emerging semiconductors for electro-optical devices; apply new material understanding to reduce blinking pixels in imagers; assess diffractive devices for new imaging modalities; augment initiatives in new applied materials including ultra-wide bandgap materials or neuromorphic materials. ***FY 2025 Plans:*** Will examine the performance of Geiger and linear mode avalanche photodiode arrays; identify mitigation strategies for blinking pixels; develop breakdown simulation models for wide band gap/ultrawide band gap devices. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects reduced research being conducted in the area of diffractive devices.	0.960	0.693	0.521
Title: HBCU/MI Research Partnerships ***Description:*** These research partnerships will support basic research focused on partnerships with Historically Black Colleges and Universities and Minority Institutions (HBCUs/MIs). The focus of this effort is to advance innovative basic research in areas of strategic importance to the Army by bringing competitively selected HBCUs and MIs research teams into existing Army Collaborative Research Alliances (CRAs), Collaborative Technology Alliances (CTAs), and centers. The Army CRAs, CTAs, and	-	2.000	2.004

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
centers work with Army, industry, and other academic partners to transition research to technology demonstration. These new research partnerships will provide opportunities to recruit, educate, and train outstanding students and post-doctoral researchers in science and technology areas relevant to the Army. ***FY 2024 Plans:*** Will establish three to five new HBCU/MI research partnerships, each selected to enhance existing research under an individual Army CRA, CTA, or center. ***FY 2025 Plans:*** Will continue to support three to five HBCU/MI research partnerships selected to enhance existing research under an individual Army CRA, CTA, or center, and recruit, educate, and train students and post-doctoral researchers in science and technology areas relevant to the Army. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Army Military Academic CRA ***Description:*** This CRA provides a framework across the U.S. Army Combat Capabilities Development Command (DEVCOM) to establish and sustain efforts to strengthen the incorporation of the United States Military Academy (USMA) and Senior Military Colleges faculty and cadets into the Army Modernization Enterprise (AME) through research collaborations. This CRA seeks to understand the ethical, legal, policy, and operational impacts on emerging technologies, and to build the framework to enhance personnel exchanges between DEVCOM, USMA, and Senior Military Colleges. ***FY 2024 Plans:*** Will conduct foundational research through seedling efforts in areas such as photonics, autonomy, power and energy, quantum sensing, cyber operations, materials for hypersonic systems, and recommendations for policy and strategy in ethics, operations, business, and legal domains for Army Modernization. ***FY 2025 Plans:*** Will continue to conduct foundational research through annual, competitively awarded seedling efforts in areas such as photonics, autonomy, power and energy, quantum sensing, cyber operations, materials for hypersonic systems, and recommendations for policy and strategy in ethics, operations, business, and legal domains for Army Modernization. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	-	1.835	1.761
Title: Collective Judgement Formation	-	1.478	2.305

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort establishes the underpinning science needed to understand how humans receive, process, and ultimately accept and reject information that leads to the formation of judgments. Individual and social constructs, the role of bias, and other cognitive and environmental factors will be incorporated. Research will address synthetic forms of intelligence, the speed and scale of information sharing, and integrating human and machine intelligence. ***FY 2024 Plans:*** Will develop preliminary models to characterize fundamental mechanisms of how human-technology relationships drive belief formation. ***FY 2025 Plans:*** Will refine models in context of a defined domain (such as, inclusion/exclusion criteria) to characterize fundamental mechanisms of how human-technology relationships drive belief formation; explore how coordinated information presentation at extremely high-rates and multiple sources leads to biases, limitations, and misperceptions in the human's innate systems for aggregating information into judgements. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase in FY 2025 to support additional research in the area of collective judgement formation.			
Title: Novel Robotic Controls ***Description:*** This effort establishes the scientific framework and approaches to enable low cognitive reflexive components for robotic platform development to include the interdependencies of actuation, sensing, perception, and low cognition controls for greater resilience, efficiency, and agility. Research will focus on highly adaptive and reflexive platform components with multiple degrees of freedom capable of interacting (trip, fall, impact) with the environment without catastrophic consequences. ***FY 2025 Plans:*** Will design a reflexive controls architecture coupled with a highly dynamic morphology to optimize the maneuverability of the platform; explore skeletal-musculature for an autonomous agent capable of exceptional maneuverability; develop control responses via perception and actuation within the platform, and design control architectures for actualizing complex maneuvers to include external perception. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase in FY 2025 to support research in the area of robotic controls.	-	-	1.432
Title: High-Throughput Materials Discovery for Extreme Conditions ***Description:*** This effort will rapidly accelerate the discovery of materials for extreme conditions (e.g. high strain rate, high temperatures) through the integration of artificial intelligence (AI), machine learning (ML), data science, and high-throughput	-	-	6.562

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB7 / *Army Collaborative Research and Tech Alliances*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
processes into the materials development cycle. Research will focus on data-driven materials design, high-throughput synthesis and processing, high-throughput characterization, and development of ML-augmented physics-based models. ***FY 2025 Plans:*** Will identify most promising physics-informed models and investigate validation methodologies; conduct experiments on natural language processing for data-mining of materials literature; investigate high-throughput synthesis of artificial intelligence-predicted materials; investigate utilization of machine learning to expand sparse data sets; conduct high-throughput experiments on surrogate high-strain rate tests; examine automation and autonomous experimentation; assess integration of a data management platform into US Army infrastructure. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding realigned in FY 2025 from Materials Discovery for Extreme Environments from within this Project to create High-Throughput Materials Discovery for Extreme Conditions.			
Accomplishments/Planned Programs Subtotals	57.079	63.445	63.400

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 / 1					R-1 Program Element (Number/Name) PE 0601104A / *University and Industry Research Centers*				Project (Number/Name) AB8 / *Army Educational Outreach Program*			
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**
AB8: *Army Educational Outreach Program*	-	10.834	12.485	12.756	-	12.756	12.771	12.780	12.920	13.049	0.000	87.595

A. Mission Description and Budget Item Justification

This Project supports science, technology, engineering, and mathematics (STEM) activities that encourage elementary/middle/high school and undergraduate youths to develop an interest in and pursue education in the STEM fields to support the Army, and the nation's growing dependence on STEM skills. These activities are coordinated within the Army Educational Outreach Program (AEOP) that links and networks appropriate components to derive the best synergies to present the Army to a larger pool of technical talent and to provide students with Army-unique practical experiences at Army laboratories, centers, and institutes and expose them to Department of Defense (DoD) careers. AEOP increases interest and involvement of students and teachers across the nation in STEM at all proficiency levels and backgrounds to include underserved and economically disadvantaged groups, and military affiliated communities, through exposure to Army sponsored research, education, competitions, internships, and practical experiences. This Project utilizes Army STEM assets to contribute to a STEM literate citizenry as well as enhances the national pool of science and engineering personnel that in turn supports defense industry and Army laboratory and research, development, and engineering center needs.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: AEOP Coop Agreement	10.834	12.485	12.756
Description: The Army Educational Outreach Program Cooperative Agreement encompasses a cohesive and coordinated portfolio of STEM education experiences to develop, enhance, and reward students in pursuit of STEM education. This activity supports a strong partnership with government, academia and industry to leverage assets and provide a broader and deeper STEM experience for students and teachers to address the Department's, and the nation's, challenge of acquiring clearable STEM literate talent in positions throughout the workforce and in the industrial base. These activities include Army-sponsored research, education, competitions, apprenticeships, internships, and practical experiences designed to engage and guide students and teachers in Army sponsored STEM programs. AEOP has targeted efforts to reach and engage underserved and military affiliated communities in STEM initiatives to build the pool of diverse STEM competitive talent. The West Point Cadet Research Program provides West Point Cadets an opportunity to work on Army research projects alongside Army and industry scientists and engineers during the summer.			
FY 2024 Plans: Will continue Army sponsorship of students and STEM education opportunities; provide incentives in STEM competitions that include scholarships, experiences and mentorships, as well as expose students to DoD career opportunities; streamline processes, leverage funding and build educational partnerships; and perform annual comprehensive reviews and educational			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB8 / *Army Educational Outreach Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
assessments to support future decisions and best practices. Continue career development opportunities that support agile human capital needs within laboratories with a concentration on continued STEM education development. Will increase partnerships with like-minded organizations in an effort to increase participation from underserved students and military affiliated communities. Will conduct West Point cadet research internship program to enhance cadet training through field experience in Army research labs and engineering centers. ***FY 2025 Plans:*** Will continue Army sponsorship of students and STEM education opportunities; provide incentives in STEM competitions that include scholarships, experiences and mentorships, as well as expose students to DoD career opportunities; streamline processes, leverage funding and build educational partnerships, and perform annual comprehensive reviews and educational assessments to support future decisions and best practices; continue career development opportunities that support agile human capital needs within laboratories with a concentration on continued STEM education development; increase partnerships with like-minded organizations in an effort to increase participation from underserved students and military affiliated communities; conduct West Point cadet research internship program to enhance cadet training through field experience in Army research labs and engineering centers. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	10.834	12.485	12.756

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 / 1					R-1 Program Element (Number/Name) PE 0601104A / *University and Industry Research Centers*				Project (Number/Name) AC6 / *International Science and 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**
AC6: *International Science and Technology*	-	7.180	7.573	7.871	-	7.871	7.881	7.886	7.972	8.053	0.000	54.416

A. Mission Description and Budget Item Justification

This Project funds: 1) the Combat Capabilities Development Command's (DEVCOM) International Basic Research Mission, 2) the DEVCOM International Technology Centers (ITCs), and 3) the Foreign Technology (and Science) Assessment Support (FTAS) program. The International Basic Research Mission seeks to discover highly promising basic research from the universities of our foreign partners and awards seed funding to discoveries that support the United States Army's Science and Technology (S&T) strategy. The ten ITCs located in North America, South America, Asia, and Europe support the Army's goals of providing the best technology in the world to our Warfighters by leveraging the international S&T investments of our international partners, thereby increasing our ability to use limited S&T funds on promising research opportunities. The DEVCOM ITCs will identify and assess international technology programs, 'technology finds', to assess their potential impact on the Army's S&T investment strategy and modernization priorities. These 'technology finds' are submitted to various Army S&T organizations for assessment and consideration to determine their suitability for investment. Highly promising research will be awarded seed funding by the Army Research Office (ARO) and/or the ITC through a grant, contract, or cooperative agreement. The FTAS program also builds upon the 'technology finds' submitted by the ITCs. In some cases, the find is truly unique and may well meet an Army requirement or potentially support ongoing Army S&T investments or modernization priorities. In such cases, the FTAS program can provide initial resources (seed money) to determine the appropriateness of these technology areas identified as having potential relevance to the Army. These efforts will provide information useful in making early assessments of the technology's potential contributions to the Army's S&T strategy and modernization priorities.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: International Technology Centers	1.664	4.936	5.119
Description: The ten International Technology Centers (ITCs) located in North America, South America, Asia, and Europe support the Army's goals of providing the best technology in the world to our Warfighters by leveraging the research investments in Science and Technology (S&T) of our international partners. The ITCs perform identification and assessment of international technology programs to assess their potential impact on the Army's S&T investment strategy and modernization priorities. ITC 'technology finds' are submitted to various Army S&T organizations for assessment and consideration to determine their suitability for investment through avenues such as the basic and applied research program or the Foreign Technology (and Science) Assessment Support (FTAS) Program. Highly promising research is awarded seed funding by the ITC through a grant, contract, or cooperative agreement - typically to a foreign researcher. ***FY 2024 Plans:*** Will continue to scout for foreign S&T within geographic areas of responsibility on behalf of AFC and the United States Army DEVCOM Lab and Centers to identify early emerging technologies of interest to the United States Army's research and			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AC6 / *International Science and Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
development efforts in support of the Army's Modernization Priorities. In accordance with the Army S&T Strategy and Army Modernization Priorities, seek and connect foreign technology developers with United States Army science and technology enterprise. The ITCs will support funding of promising and relevant research through grants, contracts, cooperative agreements, or other existing award mechanisms (e.g., Coalition Warfare Program, Foreign Technology and Science Assessment Support, Foreign Comparative Testing, etc.); will continue to enhance and refine technology search capabilities using customer feedback to focus on mid- and long-term capabilities for the Army enterprise. ***FY 2025 Plans:*** Will continue to scout for foreign S&T within geographic areas of responsibility on behalf of AFC and the United States Army DEVCOM Lab and Centers to identify early emerging technologies of interest to the United States Army's research and development efforts in support of the Army's Modernization Priorities. In accordance with the Army S&T Strategy and Army Modernization Priorities, seek and connect foreign technology developers with United States Army science and technology enterprise. The ITCs will fund promising technologies and relevant research through grants, contracts, cooperative agreements, or other existing award mechanisms (e.g., Coalition Warfare Program, Foreign Technology and Science Assessment Support, Foreign Comparative Testing, etc.); continue to enhance and refine technology search capabilities using customer feedback to focus on mid- and long-term capabilities for the Army enterprise. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Foreign Technology (& Science) Assessment Support ***Description:*** The FTAS program serves as a catalyst for the Army Futures Command to assess potentially game-changing technologies discovered in friendly foreign nations by the Army International ITCs which may meet future Army needs. The technology finds can often times be truly unique and may well meet an Army requirement or potentially support ongoing Army S&T investments. These efforts could fund international challenges/searches, DEVCOM international extramural research, and non-traditional international researchers to provide information useful in making early assessments of a technology's potential contributions to the Army's S&T strategy. ***FY 2024 Plans:*** Will continue to solicit proposals, assess scientific quality/alignment to Army priorities of candidate proposals, and fund highly relevant and rigorous projects for potential contribution to the Army's S&T programs. Funds will be used to support research grants, innovation challenges, procurement of foreign technology, partnering with international allies and partners to include non-traditional entities, and enabling efforts for international research and technology collaboration with the Army Modernization	2.512	2.637	2.752

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AC6 / *International Science and Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Enterprise; provide funding for approved proposals to support development and/or assessment of foreign technologies by U.S. Army laboratories and foreign partners in topical areas supporting Army priorities. ***FY 2025 Plans:*** Will continue to solicit proposals, assess scientific quality/alignment to Army priorities of candidate proposals, and fund highly relevant and rigorous projects for potential contribution to the Army's S&T programs. Funds will be used to support research grants, innovation challenges, procurement of foreign technology, partnering with international allies and partners to include non-traditional entities, and enabling efforts for international research and technology collaboration with the Army Modernization Enterprise; provide funding for approved proposals to support development and/or assessment of foreign technologies by U.S. Army laboratories and foreign partners in topical areas supporting Army priorities. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: International Basic Research Mission ***Description:*** ARL/ARO will execute the international basic research mission in support of the ITCs. ARO will create and exploit new international scientific discoveries and technology breakthroughs with foreign universities to improve the Army's transformational capabilities. Highly promising fundamental research finds will be awarded seed funding through a grant, contract, or cooperative agreement. 'Technology finds' are submitted to various Army S&T organizations for assessment and consideration for further research and development.	3.004	-	-
Accomplishments/Planned Programs Subtotals	7.180	7.573	7.871

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 / 1	R-1 Program Element (Number/Name) PE 0601104A / *University and Industry Research Centers*	Project (Number/Name) J13 / *UNIVERSITY AND INDUSTRY INITIATIVES (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
J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*	-	20.700	-	-	-	-	-	-	-	-	0.000	20.700

Note

Congressional Increase

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for University and Industry Initiatives.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
Congressional Add: Program Increase - MATERIALS IN EXTREME DYNAMIC ENVIRONMENTS ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Materials in Extreme Dynamic Environments	5.000	-
Congressional Add: Program increase - BIOTECHNOLOGY ADVANCEMENTS ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for BIOTECHNOLOGY ADVANCEMENTS	4.000	-
Congressional Add: Program Increase - INFUSION OF CYBERSECURITY CONCEPTS INTO NONTECHNICAL HIGH SCHOOL COURSES ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for INFUSION OF CYBERSECURITY CONCEPTS INTO NONTECHNICAL HIGH SCHOOL COURSES	2.000	-
Congressional Add: Program Increase - NEXT GENERATION SURVIVAL RADIO ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Next Generation Survival Radio	3.800	-
Congressional Add: Program Increase - QUANTUM COMPUTING TECHNOLOGIES ***FY 2023 Accomplishments:*** Congressional Interest Item funding provided for Quantum Computing Technologies	1.400	-
Congressional Add: Program Increase - HYPERSONIC TECHNOLOGY RESEARCH AND TESTING INITIATIVE	4.500	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** J13 / *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Interest Item funding provided for HYPERSONIC TECHNOLOGY RESEARCH AND TESTING INITIATIVE		
Congressional Adds Subtotals	20.700	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A