Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army												Date: May 2021
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 1: *Basic Research*					R-1 Program Element (Number/Name) PE 0601104A *I University and Industry Research Centers*							
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
Total Program Element	-	123.654	118.716	94.003	-	94.003	-	-	-	-	-	-
AB4: *Army Research Centers*	-	25.075	22.425	23.204	-	23.204	-	-	-	-	-	-
AB7: *Army Collaborative Research and Tech Alliances*	-	41.100	45.147	52.832	-	52.832	-	-	-	-	-	-
AB8: *Army Educational Outreach Program*	-	10.035	10.275	10.641	-	10.641	-	-	-	-	-	-
AC6: *International Science and Technology*	-	6.444	6.869	6.951	-	6.951	-	-	-	-	-	-
CI9: *Strategic University Basic Research Alliance*	-	-	-	0.375	-	0.375	-	-	-	-	-	-
J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*	-	41.000	34.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This 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 Institution (HBCU/MI) Centers of Excellence that address critical research areas for Army Transformation.

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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*

FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

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

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	127.164	87.877	89.591	-	89.591
Current President's Budget	123.654	118.716	94.003	-	94.003
Total Adjustments	-3.510	30.839	4.412	-	4.412
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	34.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.011	-			
• SBIR/STTR Transfer	-3.499	-3.161			
• Adjustments to Budget Years	-	-	4.412	-	4.412

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*		
Congressional Add: *Congressional Program Increase - University and Industry Research Centers - Army Artificial Intelligence Innovation Institute*	20.000	-
Congressional Add: *Congressional Program Increase - University and Industry Research Centers - Bioenabled Materials*	4.000	-
Congressional Add: *Congressional Program increase - Materials in Extreme Dynamic Environments*	5.000	10.000
Congressional Add: *Congressional Program Increase - university assisted hypervelocity testing*	2.000	-
Congressional Add: *Catalyst*	10.000	-
Congressional Add: *Program increase - biotechnology development*	-	4.000
Congressional Add: *Program increase - Army artificial intelligence innovation*	-	20.000
Congressional Add Subtotals for Project: J13	41.000	34.000
Congressional Add Totals for all Projects	41.000	34.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army	Date: May 2021
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*

Change Summary Explanation

Project AB7 (Army Collaborative Research and Tech Alliances) experienced increase of $18M in FY22 for the creation of three Army Centers (Army Advanced Biological Control Center, Army Advanced Energetics Center and Army Radio-Frequency (RF) Electronics Center).

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AB4: *Army Research Centers*	-	25.075	22.425	23.204	-	23.204	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project encompasses three types of Centers. The first is the Partnered Research Initiative (PRI) which supports Army's research partnerships with Historically Black Colleges and Universities and Minority Institutions (HBCU/MI). The PRI Program was established as the next phase of what was previously known as Partnership in Research Transition (PIRT) Program that ended in FY16. The focus of the PRI Program is to advance innovative basic research leading to potential technology development in areas of strategic importance to the Army by bringing competitively selected HBCUs and Minority-Serving Institutions (MIs) research teams into existing Army Futures Command Collaborative Research Alliances (CRAs) and Collaborative Technology Alliances (CTAs). The CTAs and CRAs are large collaborative centers focused on developing and transitioning research in Army critical areas.

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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Centers of Excellence for Battlefield Capability Enhancements (BCE)	1.431	1.669	1.685
Description: The focus of the PRI Program is to advance innovative basic research leading to potential technology development in areas of strategic importance to the Army by bringing competitively selected HBCUs and MIs research teams into existing Army Futures Command CRAs and CTAs. The CRAs and CTAs are large collaborative centers focused on developing and transitioning research in Army critical areas.			
FY 2021 Plans:			

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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 2020	FY 2021	FY 2022
The PRI Program continues in its second multi-year phase, supporting Army's research partnerships with HBCU/MI via collaborations with UARCs. ***FY 2022 Plans:*** Will support three competitively-selected HBCU/MI-led collaborative research centers in the areas of information, engineering, and physical sciences that were competitively-selected and awarded in FY 2021. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Institute for Collaborative Biotechnologies ***Description:*** This effort performs sustained multidisciplinary basic research supporting technologies that provide the Army with bio-inspired materials and biomolecular sensor platforms. ***FY 2021 Plans:*** Create a new generalizable platform using synthetic biology to engineer materials with novel optical and electronic properties that are impossible to produce using non-biological routes; create a platform to build genetic circuits in Magnetospirillum and G. hansenii to control the primary structure and spatial arrangement of composite nanomaterials; investigate control of the shape, composition, and supermolecular assembly of composite metal nanocrystals integrated into silica structures and investigate organic polymers as conductors. In the long term, these efforts are expected to translate solutions from biological systems into high-performance technologies, materials, and systems for the Army. ***FY 2022 Plans:*** Will develop innovative platforms by using the tools of synthetic and systems biology, genetic circuitry, biocatalytic enzymes, and directed evolution to design and engineer new types of multi-functional materials with novel properties; design and assess enabled functionalities that include optical signature management, solar-to-electrochemical energy conversion, mechanical and thermal robustness, self-assembly and healing, highly selective chemical reactivity, sense-and-respond properties, and logging of environmental signals and events. These basic research efforts will combine state-of-the-art methods in synthetic and systems biology with advanced materials synthesis and characterization to provide unique biologically-derived material solutions for the Army?s future challenges. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	5.146	4.565	4.783
Title: Institute for Creative Technologies ***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,	6.484	4.506	4.737

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
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 2021 Plans:*** Explore deep learning in the context of creating virtual assistants and immersive environments for synthetic training; automatically create 3-D models of humans from a few photographs, currently an arduous manual task, as well as realistic behavioral models of humans, such as speaking patterns and behavioral gestures, when interacting in groups; conduct studies to understand human intent and state of mind from video for potential applications in coaching and after-action reports; investigate explainable models of Reinforcement Learning that could form the basis of transparent artificial intelligent systems. ***FY 2022 Plans:*** Will explore understanding human behavior to be able to create generators and classifiers at the right level of fidelity in a virtual environment; research Artificial Intelligence-based systems that make it easy to author Army training systems; advance scientific understanding on how technology can assist the performance of individuals within tasks that are assumed to require social and emotional intelligence within a virtual environment; assess whether the effect of the virtual environment itself (e.g., poor vs. affluent neighborhood) on responses during the training or simulation (e.g., training outcomes, stress, impressions of virtual human (VH) characters in the environment, etc.) is significant (i.e., reliable) for simulations with different content (e.g., wayfinding, active shooter simulation, negotiation); build a theoretical and end-to-end framework based on 3D deep learning to enable AI-driven synthesis of dynamic 3D objects from 2D views. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Institute for Soldier Nanotechnologies	5.800	5.196	4.954

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Description: This effort investigates Nanomaterials and Nanotechnologies for Soldier applications focused on light-weight, multifunctional nanostructured fibers and materials. ***FY 2021 Plans:*** Determine if packed granular particles of shape memory ceramic materials can dissipate energy through inter-particle friction and intra-particle martensitic phase transformations for application to vibrational damping, and synthesis of novel mechano-optic, electro-optic, and thermo-optic fibers. In the long term, this work may enable high bandwidth communications and reflectivity management of Soldier clothing and platforms. ***FY 2022 Plans:*** Will design a novel, durable, shape-stable metamaterial composite for future high-temperature high Mach Number hypersonic applications; design superelastic granular materials to enable novel ductile (as opposed to current brittle) ceramic plates for greatly improved Soldier armor; design low-power on-chip beam-steering capabilities by exploiting a Luneburg lens design in a nanophotonic platform, to enable efficient directed Soldier comms that cannot be adversary-detected; design rapid and effective treatment of incompressible and internal wounds by systemically injectable hemostasis, based on nanoparticles crosslinked through bio-orthogonal click chemistry, designed to hone-in to location of bleeding even if location cannot be identified. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, funding was realigned to Program Element (PE) 0601601A / CL3 Artificial Intelligence Basic Research Hub which is reduction in energy dissipation research.			
Title: Vertical Lift Research Center of Excellence (VLRCOE)	3.051	3.190	3.349
Description: VLRCOE agreements with Penn 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 2021 Plans:*** Complete the final year of the current VLRCOE technology interchange agreements with the Georgia Institute of Technology, the Penn State University, and the University of Maryland; conduct fundamental experimental measurements and analysis of Future Vertical Lift relevant configurations such as coaxial rotors and winged compound; identify new research thrust areas of interest to Army Aviation, such as autonomy and teaming; solicit proposals for a new Center of Excellence program that provides a robust experimental and analytic basic research program coupled with a vertical lift focused education program. ***FY 2022 Plans:***			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will kick-off a new, five year program combining graduate education and university research to explore frontier areas relevant to Future Vertical Lift; assess proposals based on a combination of criteria that requires a critical mass of expertise to form an inter-disciplinary research and education center; individual research tasks will be selected predominantly based on their scientific merit and relevance to Army Science and Technology (S&T) goals; conduct multi-disciplinary experimental, computational, and analytical basic research tasks in vertical lift technology disciplines spanning aeromechanics, structures and materials, flight dynamics and control, Vertical Take-Off and Landing (VTOL) concepts and design, vibration and noise control, propulsion, affordability, and safety and survivability. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Automotive Research Center (ARC)	3.163	3.299	3.696
Description: The ARC is an U.S. 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 2021 Plans:*** Continue to conduct advanced modeling and simulation research for ground vehicles focusing on autonomy and mobility problems. Topics include: teleoperated, semi-, fully-, and multiple autonomous vehicle operation and control, high fidelity operational evaluations of autonomy-related technologies, perception in degraded sensor environments, machine learning, robotic trust, high performance terramechanics models, ground vehicle power generation, storage, and distribution models, and the usage of modeling and simulation techniques to shorten the vehicle/technology/capabilities development for future combat vehicles. ***FY 2022 Plans:*** Will enhance modeling and simulation (M&S) capabilities for ground systems with a concerted effort in autonomous vehicle off-road mobility M&S in harsh terrains and contested environments; other major ground system M&S focus areas for enhancements include: Vehicle-Level Sensing, Perception and Acting for autonomous vehicles in different situational and teaming environments; Communication, Trust and Cognition between humans and conventional/autonomous vehicles; Intelligence, Off-Road, Resilience for vehicle structures and large-scale computational methods; Adaptability and Self-Awareness for power systems; Fleet Dynamics, Decision-Making, and System of Systems. Will research usage of operational data-driven techniques to analytics models to improve prediction accuracy and efficiency. ***FY 2021 to FY 2022 Increase/Decrease Statement:***			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Funding realigned from all the Projects in Basic Research portfolio as part of the Program Evaluation Groups (PEG) efficiency drill.			
Accomplishments/Planned Programs Subtotals	25.075	22.425	23.204

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
AB7: *Army Collaborative Research and Tech Alliances*	-	41.100	45.147	52.832	-	52.832	-	-	-	-	-	-

Note

In Fiscal Year (FY) 2022, funding realigned from Program Element (PE) 0601102A / Defense Research Sciences/ Project AA3 / Single Investigator Basic Research for the following efforts:
Army Advanced Biological Control Center, Army Advanced Energetics Center, Army Radio-Frequency (RF) Electronics Center and Army Advanced Energetics Center

In Fiscal Year (FY) 2022, funding realigned to Program Element (PE) 0601601A/ CL3 Artificial Intelligence Basic Research.

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 Futures Command 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, 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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Internet of Battlefield Things CTA (IoBT CTA)	5.804	5.856	2.921
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 2021 Plans:			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Investigate methods for Dynamic and Autonomous Composition that enable automatic and transparent cooperation between intelligent devices through Deep Learning and Satisfiability Modulo Convex (SMC) optimizations; explore computational methods provide artificial intelligence algorithmic bounding and guarantees, as well as provide resilience to threats and adversarial activities through quantified machine learning (ML) such as deep learning algorithms that provide quantified uncertainty in responses for use in automated processes; create theories and methods for distributed learning and inference that can support collective intelligence through progressive machine learning and continuous learning, such as Zero Shot algorithms that combine deep learning with classifiers and semantic projection. ***FY 2022 Plans:*** Will explore foundational theories and methods for quantifying uncertainty in data and predictive or classifying algorithms given highly heterogeneous and pervasive intelligent systems; create approaches that quantitatively improve the overall dependability/ stability of complex, smart command and control systems-of-systems; investigate algorithms that capitalize on ubiquitous sensor/ actuators and the ability to derive information outside of their intended/advertised use; investigate theories and algorithms that enable agile composite systems to have self-awareness and autonomy to reconfigure/react to adversarial battlefield environment and information dynamics. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Partial funding realigned in FY 2022 to support artificial intelligence advancements by the Army Artificial Intelligence Task Force.			
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 2021 Plans:*** Investigate theories, models, and techniques for content-based software defined networking, policy-based secure coalition information infrastructures, composability of adaptive distributed coalition data services, dynamic context-aware information processing services, distributed processing and analytics to derive situational understanding, and complex adaptive human systems in the context of ad-hoc coalition operations at the tactical-edge. ***FY 2022 Plans:*** Will investigate theories, models, and techniques for distributed control of policy-enabled dynamic infrastructures, federated policy learning and management, federated learning for coalition analytics, interpretability of neural networks in distributed and contested coalition environments, understanding internal group behavior and dynamics in complex multi-domain environments, and learning	3.935	4.074	2.734

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
and inferencing for uncertainty-aware human-machine situational understanding, in the context of ad-hoc coalition operations at the tactical-edge. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Partial funding realigned in FY 2022 to Program Element (PE) 0601601A / CL3 Artificial Intelligence Basic Research in support of artificial intelligence advancements			
Title: Materials in Extreme Dynamic Environments and Multiscale Multidisciplinary Modeling of Electronic Material CRA ***Description:*** Research will focus on two-way multiscale modeling for predicting performance and designing materials; investigating analytical and theoretical analyses to effectively define the interface physics across length scales; advancing experimental capabilities for verification and validation of multiscale physics; and modeling and strategies for the synthesis of high loading rate tolerant materials. The multiscale modeling capability will be applied across multiple disciplines to facilitate revolutionary advances in materials for coupled environments (electromagnetic, high rate, high pressure, and other extreme environments). ***FY 2021 Plans:*** Conduct iterative research through the materials-by-design paradigm to create newly designed metal, ceramic and composites systems for armor applications; continue to investigate multiscale models to enable the transition of software codes and tools to improve armor design codes for the selected material systems; study integrative multi-mechanism models using canonical experiments; use synthesis and processing to control the critical mechanisms which determine the material performance in high strain rate extreme environments; generalize the integrative models based on these mechanisms, thus enabling the materials-by-design paradigm to be applied to other materials within the same class; investigate physics-informed machine learning for multiscale/multi-physics modeling for the advancement of electrochemical and electro-optical materials devices for sensing, energy and power applications; study extending multiscale modeling to optoelectronic and electrochemical materials and devices to explore physics based materials by design. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, funding realigned to support Tactical Behaviors for Autonomous Maneuver and Materials Discovery for Extreme Environments within this Project during a planned change in scope for Materials in extreme environments.	8.522	8.363	-
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	5.914	6.059	6.295

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
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 2021 Plans:*** Conduct fundamental research to investigate scalable methods for heterogeneous multi-agent autonomous maneuver through complex environments; explore methods for resource-constrained coordination and local and global situational awareness and understanding between multi-agent heterogeneous team members; investigate techniques for increased resiliency of multi-agent teams to adapt to large changes in state and situational understanding; investigate approaches that will enable multi-agent heterogeneous teams to react to and adapt to adversarial behaviors and operations in contested environments; conduct research to increase understanding of team formation, tasking, and control in collaborative heterogeneous human/multi-agent teams. ***FY 2022 Plans:*** Will conduct fundamental research in heterogeneous multi-agent situational awareness to explore how a heterogeneous team can collaborate to build shared situational awareness while moving through a contested environment and perform collaborative decision making over long timescales with high operational tempo in complex, dynamic environments; explore dynamic teaming operations, heterogeneous team control and strategy, and synthesis and adaptation of team behaviors with high operational tempo; establish resource aware communication required for coordination and collaboration amongst team members and increase distributed resilience in the team response. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
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. ***FY 2021 Plans:*** Identify neural biomarkers that correspond to individual differences in spatial and navigational abilities, thereby testing specific predictions about the structural and functional correlates of different skills; investigate training paradigms to improve navigational abilities, testing the hypothesis that training involving making explicit predictions about upcoming locations when learning a novel environment will improve performance; determine how brain structure and function changes with training, testing the hypothesis that prediction training will increase intrinsic connectivity between prefrontal cortex and hippocampus and will lead to structural changes in white matter and diffusivity. If successful, these studies may enable new training techniques to enhance navigational skills. ***FY 2022 Plans:***	0.438	0.629	0.626

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
Will employ state-of-the-art techniques in neuroscience to develop and test neural biomarkers associated with human cognition that track with directed attention, modes of planning and problem solving, memory-guided decision-making, and visual search; characterize the influence of arousal, fatigue, stress, and other demands on cognitive states and their neural biomarkers; assess the potential for biomarkers to inform human-machine interfaces, to accelerate learning, and to enhance integrated human-artificial intelligence system performance. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Center for Exploitation of Quantum Effects ***Description:*** This work supports needed quantum information science basic research for next generation capabilities in security, decision aids, sensing, and position, navigation, and timing (PNT) for Army dominance on the future battlefield. ***FY 2021 Plans:*** Investigate, through experiment and theory: approaches for manipulating quantum systems with strong atom-light interaction; nanophotonic materials that protect quantum information from perturbations; optimization techniques for quantum algorithms and non-classical measurement that beats classical limits. Identify solid-state materials and excitation pathways in atoms that optimize response to electric and magnetic fields. ***FY 2022 Plans:*** Will investigate approaches to solid-state sensing of magnetic fields using Nitrogen-Vacancy (NV) diamond and Silicon Carbide (SiC) defects in solids; investigate long-range atom-atom interactions through optical fiber and solid-state emitters near integrated waveguides; investigate topological light sources for low-loss routing of entangled photon pairs; explore distributed sensing using ion traps; explore methods for using telecom-compatible energy levels in ytterbium (Yb) ions for long-range entanglement distribution. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	2.784	2.888	2.926
Title: Neuroergonomics CTA ***Description:*** By utilizing fundamental principles that underlie Soldier neurocognitive performance, this effort provides individualized and adaptive technologies that enhance Soldier-agent interaction.	1.084	-	-
Title: Identification and characterization of team-level processes for enhancing performance of heterogeneous Soldier-Agent teams CRA	3.314	4.758	4.931

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
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 2021 Plans:*** Execute multiple focused lines of research prioritizing discovery and operationalization of the relationships between individual dynamics and team-level states and processes in human-autonomy teams; investigate novel metrics of team-level states and processes in human-autonomy teams that impact team effectiveness, accounting for specific roles and characteristics of humans and intelligent agents cooperatively performing complex tasks; and explore advancements in dynamic models linking individual and team states. ***FY 2022 Plans:*** Will characterize and model critical individual processes and dynamics in relation to team-level emergence in military-relevant team tasks involving multiple humans and multiple intelligent agents; extend and validate human-based theories of team effectiveness incorporating micro, meso, and macro signatures of emergence to human-agent teams; explore team emergent responses to perturbations; incorporate agent-based learning from humans to improve dynamic teaming. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** 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 2021 Plans:*** Further investigate the underpinning science to extend the reach, situational awareness, and operational effectiveness of Intelligent System/Soldier teams against dynamic threats in complex and contested environments; research will work to explain	9.305	7.202	7.537

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
how diverse, embodied agents collectively sense, infer, reason, plan, and execute in collaboration with Soldiers and in the face of a peer adversary. ***FY 2022 Plans:*** Will assess current research and combine, re-direct, or initiate efforts to meet progressively harder challenge problems through experimentation and physics based criteria; transition most promising results and models to Army specific applications enabling rapid improvement of ML techniques; increase database accessibility and tools to provide an array of software and processing capabilities to academic, industry, and other Department of Defense partners; provide access to curated, labeled dataset covering a large variety of applications to meet Army requirements. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Partial funding realigned in FY 2022 to support artificial intelligence advancements by the Army Artificial Intelligence Task Force.			
Title: Artificial Intelligence Hub ***Description:*** The AI Hub is located at Carnegie Mellon University as a consortium of industry, government, and academia focused on building and optimizing the Army's AI and ML initiatives with the goal of accelerating the fielding of capability. The AI Hub will utilize the A2I2 data and AI/ML algorithms and software tools to investigate AI and ML capabilities to address the Army's unique problems. The AI Hub will focus on research into AI technologies for future application to Army-relevant areas such as predictive maintenance, operations for intelligence in support of Long Range Precision Fires, human relations/talent management; and autonomous threat recognition. ***FY 2021 Plans:*** Investigate AI and ML models for: identifying emerging trends in helicopter maintenance records and/or on-board flight and/or vibration data; autonomous collection, integration, and analysis of information from myriad sensors/systems to rapidly produce actionable intelligence and facilitate targeting; branching models which align Army personnel talent with branch needs; AI that raises the level and number of tasks that can be executed autonomously or semi-autonomously by vehicles in the fleet. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding realigned in FY 2022 to Program Element (PE) 0601601A / CL3 Artificial Intelligence Basic Research which is a new PE/ Project to show visibility of the strategic partnerships of the AI Task Force Center in support of artificial intelligence advancements	-	5.318	-
Title: Army Radio-Frequency (RF) Electronics Center ***Description:*** The Army Radio-Frequency (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	-	-	4.892

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
power operation will 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 2022 Plans:*** Will implement a combination of approaches designed to create a basic research paradigm in UWBG semiconductor materials using data-driven physics informed computer science approaches; undertake research that will understand materials/device physics and performance limits under extreme conditions; create innovative device concepts and circuit architectures to realize or overcome these limits. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, funding realigned from Basic Research in Chemical Sciences; Basic Research in Computing Sciences; Basic Research in Materials Sciences; Basic Research in Electronics and Photonics; and Basic Research in Mathematical Sciences in PE 0601102A Project AA3.			
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 2022 Plans:*** Will initiate concepts for a comprehensive information pipeline for the creation of new algorithms and scalable computational models that extract the critical genetic parameters driving material properties; develop robust predictive models to inform genetic manipulation using synthetic biology for precision material synthesis with targeted properties across scales; design and assess experimental approaches to measure interactions of engineered microorganisms with the biological, chemical, and physical parameters of the microenvironment and bulk environment compared to naturally occurring microorganisms. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, funding realigned from Basic Research in Mathematical Sciences; Basic Research in Computing Sciences; Basic Research in Electronics and Photonics; Basic Research in Life Sciences; and Basic Research in Materials Sciences in PE 0601102A Project AA3.	-	-	4.892
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	-	-	4.892

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
current programs. This research focuses on high through-put synthesis and rapid characterization to accelerate discovery of next, next generation materials to enable Army domination of the future battlefield. ***FY 2022 Plans:*** Will develop concepts around future energetic materials for tailorable effects which enable increased lethality of warhead fragments and enable new concepts for shape charge weapons; develop energetic materials with higher energy density and enable lighter, smaller, more lethal warheads for smart munitions; design materials for high specific impulse propellants, enable increased range of munition systems, and enable reduced time-of-flight, increased munitions survivability, and end-game maneuverability to avoid threat countermeasures. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, funding realigned from Basic Research in Life Sciences; Basic Research in Mechanical Sciences; and Basic Research in Chemical Sciences in PE 0601102A Project AA3.			
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 2022 Plans:*** Will conduct fundamental research on planning algorithms that can passively learn tactics from observed data in constrained terrains using limited resources, and predict positions of advantage for area reconnaissance based on external observations. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, funding realigned from Materials in Extreme Dynamic Environments and Multiscale Multidisciplinary Modeling of Electronic Material CRA within this Project to support this effort.	-	-	2.425
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 2022 Plans:*** Will conduct research in data-driven and machine intelligence approaches to correlate material structure, property, and requirements for multiple harsh military environments such as launch and flight, high-temperature and high ablation, and impacts at unprecedented velocity; enable rapid screening of high dimensional material datasets; establish parameter space and methods	-	-	6.255

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
for synthesis and high-throughput characterization of material classes suitable for high rate applications to produce large variations in properties. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY 2022, funding realigned from Materials in Extreme Dynamic Environments and Multiscale Multidisciplinary Modeling of Electronic Material CRA within this Project to support this effort.			
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 2022 Plans:*** Will investigate foundational approaches to light-matter interfaces to understand how to efficiently store, retrieve, and distribute quantum information between atoms and ions. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding realigned from all the Projects in Basic Research portfolio as part of the Program Evaluation Groups (PEG) efficiency drill.	-	-	0.506
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 2022 Plans:*** Will develop a basic convergent manufacturing platform that is capable of depositing two classes of materials (i.e., polymers, metals, or ceramics) and transform those materials into their desired morphology independently; investigate a complex interface, such as a gradient, composed of two classes of materials using convergent processing. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding realigned from all the Projects in Basic Research portfolio as part of the Program Evaluation Groups (PEG) efficiency drill.	-	-	1.000
Accomplishments/Planned Programs Subtotals	41.100	45.147	52.832

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AB8: *Army Educational Outreach Program*	-	10.035	10.275	10.641	-	10.641	-	-	-	-	-	-

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 careers. AEOP increases interest and involvement of students and teachers across the nation in STEM at all proficiency levels and backgrounds to include under-represented 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.

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities and the Office of Science and Technology Policy (OSPT) Federal Coordination efforts outlined by the American's Strategy for STEM Education Report.

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 2020	FY 2021	FY 2022
Title: AEOP Coop Agreement	9.725	9.975	10.641
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 2021 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
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 will perform annual comprehensive reviews and educational assessments to support future decisions and best practices. ***FY 2022 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. 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 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort			
Title: West Point Cadet Program ***Description:*** 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 2021 Plans:*** Conducts West Point cadet research internship program to enhance cadet training through field experience in Army research labs and engineering centers. Between 40 and 60 cadets will intern for a period of 3 to 6 weeks. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Efforts and funding are realigned to the AEOP Cooperative Agreement effort within this Project.	0.310	0.300	-
Accomplishments/Planned Programs Subtotals	10.035	10.275	10.641

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601104A / *University and Industry Research Centers*	**Project (Number/Name)** AB8 / *Army Educational Outreach Program*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AC6: *International Science and Technology*	-	6.444	6.869	6.951	-	6.951	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project funds the Combat Capabilities Development Command's (CCDC) International Basic Research Mission, the CCDC International Technology Centers (ITCs), and 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 U.S. Army's Science and Technology (S&T) strategy. The nine 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 S&T investments of our international partners. The CCDC ITCs and CCDC's Army Research Laboratory Army Research Office (ARO) 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. ITC These 'technology finds' are submitted to various Army S&T organizations for assessment and consideration for further research and development. Highly promising research will be awarded seed funding by ARO and/or the ITC through a grant, contract, or cooperative agreement. The FTAS program also builds upon the 'technology finds' submitted by ARO and 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 2020	FY 2021	FY 2022
Title: International Technology Centers	4.319	4.469	4.531
Description: The nine 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 Science and Technology (S&T) investments 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 for further research and development through avenues such as 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. The international basic research mission exploits new scientific discoveries and technology breakthroughs from international universities that have the potential to deliver future Army transformational capabilities. Highly promising 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.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
FY 2021 Plans: Continue to seek out promising foreign science and technology solutions within geographic areas of responsibility that may have interest and applicability to the U.S. Army?s research and development efforts in support of the Army?s Modernization Priorities. In accordance with the Army S&T Strategy and the Combat Capabilities Development Command (CCDC) Global Engagement Plan, the ITCs will seek-out and connect foreign researchers with U.S. Army scientists and engineers, with the explicit intent to fund promising and relevant research through a grant, contract, or cooperative agreement. Will also continue to enhance and refine technology search capabilities using customer feedback to focus on mid- and long-term capabilities. ***FY 2022 Plans:*** Will continue to continue to seek out promising foreign Science and Technology (S&T) basic research within geographic areas of responsibility that may have interest and applicability 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 the CCDC Global Engagement Plan (GEP), continue to seek -out and connect foreign researchers with United States Army scientists and engineers, with the explicit intent to fund promising and relevant research through a contract or cooperative agreement; continue to enhance and refine technology search capabilities using customer feedback to focus on mid- and long-term capabilities. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Foreign Technology (& Science) Assessment Support ***Description:*** The FTAS program serves as a catalyst for the US Army Futures Command to assess potentially game-changing technologies discovered in friendly foreign nations by the US 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 will provide information useful in making early assessments of a technology's potential contributions to the Army's S&T strategy. ***FY 2021 Plans:*** Solicit proposals and assess scientific quality of candidate projects by utilizing U.S. Army Senior Scientist Corps expertise. Provide seed funding for approved proposals to U.S. Army laboratories to develop and/or assess technology areas identified by the Army?s ITCs. ***FY 2022 Plans:***	2.125	2.400	2.420

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will solicit proposals and assess scientific quality of candidate projects by utilizing United States Army scientific expertise; continue to provide funding for approved proposals to United States Army Science and Technology (S&T) centers and laboratories to develop and/or assess technology areas identified by the ITCs and S&T community and ARO personnel. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	6.444	6.869	6.951

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 1	R-1 Program Element (Number/Name) PE 0601104A / *University and Industry Research Centers*	Project (Number/Name) CI9 / *Strategic University Basic Research Alliance*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
CI9: *Strategic University Basic Research Alliance*	-	-	-	0.375	-	0.375	-	-	-	-	-	-

Note

This is a new start in FY 2022.

In Fiscal Year (FY) 2022, this Project is a New Start.

A. Mission Description and Budget Item Justification

The Strategic University Basic Research Alliance, coordinated by the Army Future Command's University Technology Development Division (UTDD), enables enduring strategic academic partnerships focused on providing academia a gateway to identify, propose, and pursue basic research efforts that may lead to unique solutions for Warfighter problems. This Project supports basic research originating in academia in areas with the potential to impact future Army modernization including, but not limited to, autonomy, artificial intelligence and machine learning (AI/ML), robotics, network integration, decisive lethality, soldier performance, resulting in high-value, shared-risk partnerships for the enterprise to influence, leverage, and accelerate Army priorities. The Strategic University Basic Research Alliance exploits state-of-the-art research programs at academic institutions to increase the supply of scientists and engineers to advance and enhance research within Army laboratories. This effort conducts basic research leading to potential emerging technologies in sister Projects of applied research and advanced technology areas of strategic importance pertinent to Army prioritization, by bringing competitively selected Universities into strategic Alliances. This approach enables persistent, competitive partnerships fostering deep awareness, knowledge, and expertise for Warfighter modernization efforts.

This Project is fully coordinated with PE 0602144A (Ground Technology), PE 0602141A (Lethality Technology), PE 0602182A (C3I Applied Research), PE 0602183A (Air Platform Applied Research), and PE 0602184A (Soldier Applied Research).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: University Basic Research Strategic Partnerships	-	-	0.375
Description: Conducts basic research leading to potential emerging technologies in areas of strategic importance to the Army by bringing competitively selected Universities with research teams into strategic alliances. Investigates novel principles, ideas, and theories potentially leading to novel technologies in collaboration with academic entities that might not otherwise collaborate with the DoD, with the end goal of accelerating the adoption of cutting-edge technology for the warfighter.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2022 Plans: Will conduct fundamental research employing a multidisciplinary research strategy to advance new capabilities in such areas as autonomy, artificial intelligence, machine learning, robotics, all terrain navigation/routing, and novel materials and sensing modalities; discover novel methods for seamless cooperation between intelligent agents and humans; and investigate network resiliency. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** New start in FY22 to develop strategic partnerships with the academic community to deliver world class science in support of the Army's Modernization Priorities. Funding realigned from Program Element 0601102/AB4.			
Accomplishments/Planned Programs Subtotals	-	-	0.375

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army												Date: May 2021
Appropriation/Budget Activity 2040 / 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 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
J13: *UNIVERSITY AND INDUSTRY INITIATIVES (CA)*	-	41.000	34.000	-	-	-	-	-	-	-	-	-

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 2020	FY 2021
Congressional Add: Congressional Program Increase - University and Industry Research Centers - Army Artificial Intelligence Innovation Institute ***FY 2020 Accomplishments:*** Congressional Increase. Basic research to support artificial intelligence algorithm development and evaluation.	20.000	-
Congressional Add: Congressional Program Increase - University and Industry Research Centers - Bioenabled Materials ***FY 2020 Accomplishments:*** Congressional increase. Basic research to harnes biotechnology advancements.	4.000	-
Congressional Add: Congressional Program increase - Materials in Extreme Dynamic Environments ***FY 2020 Accomplishments:*** Congressional increase: Accelerating basic research on materials in extreme dynamic environments. ***FY 2021 Plans:*** Congressional increase: Accelerating basic research on materials in extreme dynamic environments.	5.000	10.000
Congressional Add: Congressional Program Increase - university assisted hypervelocity testing ***FY 2020 Accomplishments:*** Congressional increase. Basic Research on university assisted hypervelocity testing	2.000	-
Congressional Add: Catalyst	10.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021
FY 2020 Accomplishments: Program Increase to support Catalyst - Soldier Inspired Solutions. Work will be done to mature, integrate, and demonstrate soldier-centric design technology solutions through partnering with academia and industry. Work will be executed by Army Futures Command.		
Congressional Add: Program increase - biotechnology development	-	4.000
FY 2021 Plans: Congressional increase: Accelerating basic research on biotechnology development.		
Congressional Add: Program increase - Army artificial intelligence innovation	-	20.000
FY 2021 Plans: Congressional Increase: Basic Research to support Army Artificial Intelligence Innovation.		
Congressional Adds Subtotals	41.000	34.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A