Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army											Date: March 2023	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*							
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	-	11.954	27.868	30.659	-	30.659	23.868	30.334	31.328	32.417	0.000	188.428
CM9: *Convergent CEMA Deception*	-	5.421	-	-	-	-	-	-	-	-	0.000	5.421
CN4: *Network Enabling University Applied Research*	-	2.484	2.655	2.675	-	2.675	2.521	2.269	2.270	2.295	0.000	17.169
CN5: *Network Vuln/ Effectiveness Assess Methods (N-VEAM)*	-	4.049	4.418	4.478	-	4.478	4.478	4.484	4.487	4.537	0.000	30.931
CW2: *Exploitation of Atmospheric Impacts across Domains*	-	-	3.051	1.514	-	1.514	-	-	-	-	0.000	4.565
CX3: *Intelligent Env Battlefield Awareness Apl Tech*	-	-	3.141	2.201	-	2.201	0.616	4.188	5.231	4.969	0.000	20.346
CX4: *Persistent Geophysical Sensing-Infrasound Apl Tech*	-	-	2.761	2.576	-	2.576	2.081	3.136	2.614	2.290	0.000	15.458
CX5: *Sensing in Contested Environments Technologies*	-	-	1.007	1.028	-	1.028	-	1.116	2.078	1.597	0.000	6.826
CX6: *Subterranean Detection and Monitoring Apl Tech*	-	-	1.587	1.688	-	1.688	1.533	1.534	0.644	2.220	0.000	9.206
CZ6: *Assured PNT Enabling Applied Technology*	-	-	3.661	3.347	-	3.347	2.319	2.272	2.137	2.160	0.000	15.896
CZ7: *Convergent CEMA Technical Effects*	-	-	5.587	5.472	-	5.472	5.573	5.580	5.584	5.645	0.000	33.441
DA8: *Quantum PNT & Radio Frequency Sensing*	-	-	-	2.612	-	2.612	3.657	5.232	5.236	5.293	0.000	22.030
DB4: *Enabling Long Standoff 3D (ELS3D) Tech*	-	-	-	2.058	-	2.058	1.090	0.523	1.047	1.411	0.000	6.129
DE6: *Understanding Environment as a Threat Tech*	-	-	-	1.010	-	1.010	-	-	-	-	0.000	1.010

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army	Date: March 2023
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*

A. Mission Description and Budget Item Justification

This Program Element (PE) investigates, designs, validates, and conducts experimentation to establish technical solutions for creating integrated future equipment and systems that improve resiliency, survivability, operational effectiveness, mobility, sustainability, and readiness of ground forces. This PE provides mid-to-long term tactical Command, Control, Communications and Intelligence (C3I) capabilities (e.g. networking, cyber, electronic warfare, Positioning, Navigation and Timing (PNT), space, persistent surveillance) based upon promising technologies that address emerging and future threats, and includes research critical and unique to the Army and DoD (e.g., atmospheric modeling and meteorological technologies). Applied research investments focus on the design and investigation of materials, processes, technologies, methodologies, and models to establish architectures, systems, and interfaces that enhance and optimize performance on the future battlefield. The outputs of these efforts inform and transition to advanced research efforts that demonstrate improved C3I capabilities.

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

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

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	12.406	27.892	29.518	-	29.518
Current President's Budget	11.954	27.868	30.659	-	30.659
Total Adjustments	-0.452	-0.024	1.141	-	1.141
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.452	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	1.141	-	1.141
• FFRDC Transfer	-	-0.024	-	-	-

Change Summary Explanation

Increased funding due to revised economic assumptions.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*				Project (Number/Name) CM9 / *Convergent CEMA Deception*			
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
CM9: *Convergent CEMA Deception*	-	5.421	-	-	-	-	-	-	-	-	0.000	5.421

A. Mission Description and Budget Item Justification

This Project investigates, designs, and develops hardware and software to enable cyber and radio frequency (RF) technical effects electronic spoofing and cyber deception along with inconspicuous Cyber Electromagnetic Activity (CEMA) and network operations of Army platforms and dismounts, while maintaining freedom to maneuver, communicate, and sense. This research is critical to counter near-peer ability to geo-locate and put indirect fires onto our positions.

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 2022	FY 2023	FY 2024
Title: Radio Frequency/Cyber Sensing and Effects ***Description:*** This effort develops technologies to avoid geolocation of blue force RF emissions by peer/near- peer adversaries. Research will focus on developing low probability of detection (LPD) communications and RF transceivers to increase freedom of maneuver while maintaining effective communications.	3.017	-	-
Title: Dynamic Intelligent Networks and Cyber Technical Effects for CEMA ***Description:*** This effort investigates techniques and develops methods for combining the physical (Radio Frequency) and network (cyber) layers for enhanced effects when coupled with electromagnetic technical effects.	2.404	-	-
Accomplishments/Planned Programs Subtotals	5.421	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) CN4 / *Network Enabling University Applied Research*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CN4: *Network Enabling University Applied Research*	-	2.484	2.655	2.675	-	2.675	2.521	2.269	2.270	2.295	0.000	17.169

A. Mission Description and Budget Item Justification

The Project leverages applied research from academia, in the focus areas of intelligent networks, self-sensing/self-healing networks, network security, air and ground vehicle teaming and alternatives to Global Positioning System (GPS). This Project will focus on research that supports mid-to-long term tactical Command, Control, Communications and Intelligence (C3I) capabilities (e.g. networking, cyber, electronic warfare, Positioning, Navigation and Timing (PNT), space, persistent surveillance). This Project also focuses on bringing competitively selected Universities with research and development teams into Technical Alliances that will investigate and develop technologies originating from applied research in academia pertaining to intelligent networks, self-sensing/self-healing networks, and network security and artificial intelligence/machine learning as applied to C3I, and other innovative communication as well as alternatives to GPS, leading to potential emerging technologies in areas of strategic importance to the Army in secure and intelligent communication and networking.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project CN3 (Network Enabling University Adv Development).

The work cited 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 2022	FY 2023	FY 2024
Title: Intelligent, Secure and Self-Sensing/Self-Healing Networks Applied Technology	1.179	1.227	1.291
Description: Investigate and design fused networks and decision-making architecture into intelligent networks to provide the actionable autonomous intelligence while denying corruption, and/or attack and to execute operational missions securely and reliably.			
FY 2023 Plans: Will continue research in AI/ML software for Network technologies, predictive analytics software, intelligent data integration software, edge computer processing platforms, edge sensing systems, and other technologies; will continue to research in distributed learning under privacy and resource constraints, and the communication between computing nodes and edge computing AI/ML solutions for network-driven intelligence; will design intelligent multi-modal communication and more reliable, efficient, and effective use of available communication technologies; and will continue to investigate wireless networking and biosensor solutions for intelligent networks.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CN4 / *Network Enabling University Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Will continue to investigate AI/ML emerging technologies for Network solutions, distributed hybrid ML at various scales, adaptable network systems, unified framework for joint sensing, RF-based deceptive tactical networks, improve cyber defense systems through secure and reliable ML, and network localization. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.			
Title: Real-Time Tactical Networks Applied Research ***Description:*** Investigate and design resilient and adaptable network communications to support intelligent systems in challenged environments with denied and constrained resources. ***FY 2023 Plans:*** Will continue to investigate methods and techniques that support a resilient network capable of delivering reliable information pathways with caching, value-based prioritization, and information optimization; will improve time and reliability of information/data over secure tactical networks; and will continue to investigate decentralized networks with knowledge bases, reasoning, planning, sensing, self-healing and control capabilities for advanced teaming and collaborative operations. ***FY 2024 Plans:*** Design and develop an information network that will resiliently support information pathways for sensing, computing, and control in cyber-physical systems, such as autonomous vehicle teams over unreliable communication networks. Design an information network that responds dynamically to changes in operating conditions through real-time adaptation and evolution to enable continuity of the core services that it provides to the networked system. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.	0.569	0.585	0.614
Title: Alternatives to GPS Applied Research ***Description:*** Research performance and assurance improvements against both electronic and kinetic attacks relative to current state of-the-art GPS, and that can provide PNT technology to users in disrupted, degraded or denied GPS environments. ***FY 2023 Plans:*** Will continue to investigate direct use of signals from satellite constellations in LEO for APNT; will investigate autonomous vision-based navigation solutions to address the critical need for reliable operability within GPS denied and contested environments; will develop fusing approaches for vision, radar, inertial, and other sensors technologies for GPS denied/degraded environments; and	0.736	0.746	0.770

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CN4 / *Network Enabling University Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
will research a GNSS independent navigation solution that is computationally lightweight enough to be implemented on low-cost, physically lightweight platforms. ***FY 2024 Plans:*** Investigates and designs GNSS global and tactical sensors, exploitation of LEO satellites for jam-resistant PNT extraction, and create a sensor fusion framework that high integrity PNT. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.			
Title: SBIR/STTR Transfer ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638	-	0.097	-
Accomplishments/Planned Programs Subtotals	2.484	2.655	2.675

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) CN5 / *Network Vuln/Effectiveness Assess Methods (N-VEAM)*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CN5: *Network Vuln/ Effectiveness Assess Methods (N-VEAM)*	-	4.049	4.418	4.478	-	4.478	4.478	4.484	4.487	4.537	0.000	30.931

A. Mission Description and Budget Item Justification

This Project develops analytical methodology and capabilities to characterize hardware and software that enable Electromagnetic Warfare (EW) and Cyber capabilities to assess operations of Army Network and communication platforms and dismounts, while maintaining freedom to maneuver, communicate, and sense. This Project also develops a holistic cross-domain analysis and assessment methodology for network and communication technologies faced with advanced Cyber Electromagnetic Activity (CEMA). These investigations are critical to identifying vulnerabilities of United States systems and technologies so that network and network-enabled systems can be hardened as early in development as possible.

Work in this Project complements Program Element (PE) 0602146 (Network C3I Technology) / Project AN3 (Non- Traditional Waveforms Technology), PE 0602213 (C3I Applied Cyber) / Project 2CY (Information Trust Technology), PE 0602213 (C3I Applied Cyber) / Project CY6 (Autonomous Cyber Technology), PE, 0602146 (Network C3I Technology) / Project CI3 (Mobile and Survivable Command Post (MASCP) Tech), PE 0603457 (C3I Cyber Advanced Development) / Project 8CY (Information Trust Advanced Technology), PE 0603463 (Network C3I Advanced Technology) / Project AN4 (Non-Traditional Waveforms Advanced Technology), PE 0603457 (C3I Cyber Advanced Development) / Project 6CY (Autonomous Cyber Advanced Technology), PE 0603463 (Network C3I Advanced Technology) / Project AM7 (Modular RF Communications Advanced Technology), and PE 0603463 (Network C3I Advanced Technology) / Project CI7 (Mobile and Survivable Command Post (MASCP) Adv Tech).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Understanding, Protecting, and Enabling CEMA Effects	2.064	2.183	2.241
Description: This effort develops and continually improves methodology and approaches for estimating and predicting CEMA effects on networks and network-enabled systems during complex multi-domain operations when significant cross-domain effects can be expected. Methods include drawing upon past research concerning the interaction of cyber and Electromagnetic Warfare threats on operational networks; laboratory operations, over-the-air anechoic chamber experimentation, and open-air field experimentation; and first principles Modeling and Simulation (M&S) and engineering analysis. Abstracting, generalizing, and automating multi-domain CEMA operations will enable the development of analysis and assessment of capabilities to anticipate			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CN5 / *Network Vuln/Effectiveness Assess Methods (N-VEAM)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
the impact of future threats. Live, virtual, and simulated environments will be developed to estimate the potential operational impact of threat CEMA technologies on friendly systems. ***FY 2023 Plans:*** Investigate EW and cyber techniques for converged assessment of EW and Cyber effects on network systems addressing network technology for Integrated Tactical Network Capability Set 23 production and fielded equipment. Investigate EW and cyber techniques for assessment of EW and Cyber effects on network systems through component development and in support of Capability Set 25. ***FY 2024 Plans:*** Will conduct research to assess network technologies using EW and Cyber effects at the component and system level designated for Capability Set 25 and investigate EW and Cyber techniques for converged assessment of EW and Cyber effects on network system at the component level in support of Capability Set 27 (Automation and intelligence for next generation, secure communications and network data transport) ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.			
Title: Vulnerability Analysis Methodology for CEMA Threats ***Description:*** This effort investigates threat/target interactions to develop experimental and analytical methodology for separate and cross-domain cyber and electromagnetic threat attack so that assessed vulnerabilities in a multi-domain complex environment can be reduced or eliminated before fielding new networks and network-enabled systems. Experimental and analysis methodologies will be developed to investigate vulnerabilities of specific configurations of complex future networks with multiple communications modalities, advanced deception techniques in the cyber and electromagnetic areas, and advanced Positioning, Navigation, and Timing (PNT) systems. ***FY 2023 Plans:*** Verify and validate assessment tools, methodologies and metrics (e.g. path loss, scattering in contested/congested electromagnetic environments, Low Probability of Detect, Low Probability of Intercept, UV & optical communication performance) for Integrated Tactical Network technology; design and develop cyber tool stimulus for maturation of tactical network autonomous decision-making engines; continue to develop the contested/congested electromagnetic environment to reflect emerging threats; and determine threat environments for technology experimentation and technology exploration activities to inform them on vulnerability mitigations that improve critical technologies. ***FY 2024 Plans:***	1.985	2.137	2.237

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CN5 / *Network Vuln/Effectiveness Assess Methods (N-VEAM)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Will develop assessment methodologies, tools, and metrics (e.g. LPD/LPI Angle of Arrival, UV line-of-sight (LOS)/beyond-line-of-sight (BLOS), inertial aided PNT) for evaluation of UV and millimeter-Wave dispersed communications in threat representative contested/congested environments; investigate and exploit Cyber vulnerabilities of Artificial Intelligence (AI)/Machine Learning (M/L) based intrusion detection systems (IDS); conduct research to develop and mature contested/congested Cyber and electromagnetic environment threat representation capabilities (e.g. adversary signal detection and identification); conduct research on emerging cloud and Elastic Compute Cloud through creation of use cases to mature methodologies and tools for evaluation of tactical and enterprise systems. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort.			
Title: SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638	-	0.098	-
Accomplishments/Planned Programs Subtotals	4.049	4.418	4.478

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) CW2 / *Exploitation of Atmospheric Impacts across Domains*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CW2: *Exploitation of Atmospheric Impacts across Domains*	-	-	3.051	1.514	-	1.514	-	-	-	-	0.000	4.565

A. Mission Description and Budget Item Justification

This Project enables identification and exploitation of how atmospheric phenomena impact windows of superiority for Army capabilities by developing technologies that characterize, predict, and efficiently express atmospheric impacts in future operating environments. New sensing technologies and algorithms enable heterogeneous sensor networks to extract critical environmental information optimizing performance and reducing the need for dedicated meteorological sensors. Novel physics-based models, empirical parameterizations, and machine learning applications extrapolate this environmental information both spatially and temporally. Uncertainty-aware decision support tools leverage this situational awareness to efficiently express atmospheric effects on friendly and threat weapons systems, sensors, and operations at the point of need and across multiple domains. This information can be exploited by autonomous and human decision makers for mission planning and execution; battlefield visualization; reconnaissance, surveillance, and target acquisition; route planning to maximize stealth and efficiency; long-range precision fires; and modeling of environmental impacts for combat simulations and war games.

This work provides technologies for evaluation by and/or transitions to the Department of Defense weather and operations community including: Program Executive Office (PEO) Ammunition-Program Manager (PM) Combat Ammunition Systems (CAS) and Marine Corps Systems Command (MCSC) for meteorological message input to field artillery targeting systems, PM Intelligence Systems and Analytics (DCGS-A), and the US Air Force 557th Weather Wing to improve their operational weather support to the Army.

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 2022	FY 2023	FY 2024
Title: Atmospheric Impacts	-	2.940	1.514
Description: This effort develops environmental exploitation capabilities though coupled sensing, numerical prediction, and decision support technologies for data-sparse, computationally-limited, and network-constrained domains. ***FY 2023 Plans:*** Mature combined multi-modal sensing capabilities for detection, classification, and localization of small Unmanned Aerial Systems (sUAS); develop new machine-learning-based algorithms to support tactical adaptability of software-defined, portable radar; mature capabilities for rapid optical characterization of hazardous, biological and non-biological aerosols; validate methods to predict bulk atmospheric impacts on directed energy from multi-modal sensor data; mature dispersion calculations of Atmospheric			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CW2 / *Exploitation of Atmospheric Impacts across Domains*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Boundary Layer Environment Lattice-Boltzmann Method (ABLE-LBM) in urban domains; validate uncertainty propagation algorithms in tactical, urban models when assimilating non-traditional, environmental observations. ***FY 2024 Plans:*** Will conclude the combination of multi-modal small Unmanned Aerial Systems (sUAS) detection, classification, and localization sensing capabilities; finalize and transition capabilities for rapid optical characterization of hazardous, biological, and non-biological aerosols. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding decrease reflects planned conclusion of this effort in FY2024.			
Title: SBIR/STTR Transfer ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638	-	0.111	-
Accomplishments/Planned Programs Subtotals	-	3.051	1.514

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) CX3 / *Intelligent Env Battlefield Awareness Apl Tech*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CX3: *Intelligent Env Battlefield Awareness Apl Tech*	-	-	3.141	2.201	-	2.201	0.616	4.188	5.231	4.969	0.000	20.346

A. Mission Description and Budget Item Justification

This Project investigates, develops, and designs technologies to allow Soldiers to maneuver faster in dynamic environments as informed by physical, geological, and biological constraints. This Project enhances visualization tools for mission planning through delivering web modules/software tools which contain crucial geochemical resources and advanced knowledge of geo-environmental infrastructure for mission planners.

This Project supports the Common Operating Environment Army Modernization Priority. These technologies provide situational awareness for multi-source intelligence, particularly in anti-access/area denied (A2/AD) operational environments.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project CX7 (Intelligent Env Battlefield Awareness Adv Tech).

The work cited 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 at the United States Army Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Hydrology Mapping	-	0.991	0.679
Description: This effort provides data tools and models to support high-fidelity battlefield overlay maps that accurately show hydrologic/soil moisture threats (soil, hydrology, and snow/ice) not captured by current terrain mapping capabilities. ***FY 2023 Plans:*** Identify data, models, and techniques to measure, simulate, and forecast hydrologic conditions in the field with a focus on knowledge gaps and develop integration plans to create global coverage in existing tools. ***FY 2024 Plans:*** Will develop Machine Learning (ML) methodologies to derive parameters for a stochastically based hydrologic model using high-resolution hydrologic and remotely sensed data. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort as work transitions to PE 0603042A (C3I Advanced Technology) / Project CX7 (Intelligent Env Battlefield Awareness Adv Tech).			
Title: Predictive Geographic Information System (GIS) Mapping (physical)	-	1.254	1.010

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CX3 / *Intelligent Env Battlefield Awareness Apl Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: This effort develops a comprehensive GIS tool that integrates predictive models of soil, vegetation, hydrology, and permafrost conditions in Outside Continental United States (OCONUS) dark sites from the statistical analysis of known datasets and the application of geophysical principles. ***FY 2023 Plans:*** Identify geophysical model component gaps in temporal and static feature capture sections of planned GIS Mapping capability. ***FY 2024 Plans:*** Will complete development of foundational data layers in a comprehensive GIS tool that integrates predictive models of soil, vegetation, hydrology, and permafrost conditions. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort as work transitions to PE 0603042A (C3I Advanced Technology) / Project CX7 (Intelligent Env Battlefield Awareness Adv Tech).			
Title: Vegetation Property Mapping Tech ***Description:*** This effort investigates and develops the required data to build geospatial overlays that describe forest type and structure as it relates to maneuver and concealment. ***FY 2023 Plans:*** Identify existing tools and data to describe forest type and structure as it relates to maneuver and concealment for integration onto geospatial overlays. ***FY 2024 Plans:*** Will characterize non-forested (single-strata) vegetation attributes at multiple vegetation analog sites relevant for open terrain mobility and proxies in threat area terrain attributes. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects the planned lifecycle of this effort.	-	0.199	0.261
Title: Extreme Environments Environmental Effects on Operations Tech ***Description:*** This effort designs and develops modeling of natural terrain following extreme disturbances that impact operational environments such as wildfires, flash floods, earthquakes and landscape changes induced by high intensity military conflict. ***FY 2023 Plans:***	-	0.582	0.251

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CX3 / *Intelligent Env Battlefield Awareness Apl Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Identify critical environmental parameters for baseline adaptations, select study and analog sites, and collect pre- and post-disturbance event data. ***FY 2024 Plans:*** Will investigate existing data algorithms ability to predict extreme events and will identify which events cause anomalies in model accuracy. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding decrease reflects the planned life cycle for this effort to develop viable algorithms for model accuracy.			
Title: SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638	-	0.115	-
Accomplishments/Planned Programs Subtotals	-	3.141	2.201

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) CX4 / *Persistent Geophysical Sensing-Infrasound Apl Tech*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CX4: *Persistent Geophysical Sensing-Infrasound Apl Tech*	-	-	2.761	2.576	-	2.576	2.081	3.136	2.614	2.290	0.000	15.458

A. Mission Description and Budget Item Justification

This Project designs and develops algorithms, hardware, and software components to provide passive, persistent, non-line-of-sight, multi-modal sensing capable of providing fused battlefield intelligence for increased situational awareness in a dynamic operational environment. These technologies provide near-real-time data collection, processing, and alerting on evolving cross-domain threats including strategic and tactical fires, air and ground platforms, as well as critical transportation infrastructure (bridges) and explosive events with applications for deep sensing.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project CX8 (Persistent Geophysical Sensing-Infrasound Adv Tech).

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

Work is performed by the United States Army Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Battlefield Intelligence by Geophysical Sensing (BIGS)	-	2.660	2.576
Description: This effort develops a suite of geophysical and geo-sensing technologies to persistently assess battlefield elements to include infrastructure and additional sources of interest such as explosive and fires events and various air platforms; refines terrain, topography, and meteorological models related to acoustic propagation detected by the employed sensor suite as well as detection and classification signal processing algorithms for a broader range of sources and/or threats. ***FY 2023 Plans:*** Investigate and validate classification algorithms for additional sources of interest as determined by stakeholders and provide software updates. Will utilize a military user assessment to evaluate alternate array geometry for feedback loop. ***FY 2024 Plans:*** Will mature algorithm components utilizing multiple laboratory and field experiments in conjunction with various array configurations and will design and develop a sensor placement tool with capabilities to account for terrain/topography and meteorological effects. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding decrease reflects the planned lifecycle of this effort.			
Title: SBIR/STTR Transfer	-	0.101	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CX4 / *Persistent Geophysical Sensing-Infrasound Apl Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	-	2.761	2.576

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) CX5 / *Sensing in Contested Environments Technologies*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CX5: *Sensing in Contested Environments Technologies*	-	-	1.007	1.028	-	1.028	-	1.116	2.078	1.597	0.000	6.826

A. Mission Description and Budget Item Justification

This Project characterizes through direct or inferential methods the identification of non-weaponized biological hazards posed to Soldiers in operational environments by advancing sensor technologies and software modules that will detect and characterize hazards within confined environments. This research provides Soldiers the capability to understand biological hazards present in subterranean environments and take necessary steps to mitigate or avoid these threats.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project CX9 (Sensing in Contested Environments Adv Technologies).

The work cited 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 at the United States Army Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Non-traditional Threat Detection in Contested Environments Tech	-	0.970	1.028
Description: This effort identifies, examines and prioritizes previously developed sensor packages as well as commercial of the shelf (COTS) capabilities from multiple sources that can accurately detect biological hazards relevant to operations in subterranean environments from point of ingress/egress to evaluate exposure potential and affects. ***FY 2023 Plans:*** Develop additional detection algorithms for macroscopic threats and create additional zoonotic threat assays. ***FY 2024 Plans:*** Will develop alternative zoonotic assays and antibody/antigen methods; and will assess potential sample techniques for standoff collection and select most appropriate for modification. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects the planned lifecycle of this effort.			
Title: SBIR/STTR Transfer	-	0.037	-
Description: Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CX5 / *Sensing in Contested Environments Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	-	1.007	1.028

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) CX6 / *Subterranean Detection and Monitoring Apl Tech*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CX6: *Subterranean Detection and Monitoring Apl Tech*	-	-	1.587	1.688	-	1.688	1.533	1.534	0.644	2.220	0.000	9.206

A. Mission Description and Budget Item Justification

This Project designs and develops an integrated suite of tunnel detection, subterranean monitoring solutions, and vulnerability assessment technologies to detect, identify, and monitor subterranean threat activities in urban environments through advanced sensing and rapid analysis capabilities. This Project also develops and investigates enhanced technologies to detect tunnels and tunneling activity in complex and varied environments. This research is critical to provide greater situational awareness of the subterranean domain and enhanced survivability for the Soldier.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project CZ5 (Subterranean Detection and Monitoring Adv Tech).

The work cited 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 Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Cavity Assessment in Variable Environments-Subterranean (CAVES)	-	1.529	1.688
Description: This effort will extend current tunnel detection and perimeter security systems beyond austere environments for application in variable terrain, and complex geologic environments, such as mountains, and hard rock geology common in the western pacific. Extended current tunnel detection and perimeter security systems beyond austere environments for application in variable terrain, and complex geologic environments, such as mountains, and hard rock geology common in the western pacific. ***FY 2023 Plans:*** Conduct experiments to determine the feasibility of legacy tunnel detection and perimeter security technologies in variable terrain, and complex geologic environments, such as mountains, and hard rock geology common in the western pacific. ***FY 2024 Plans:*** Will conduct hardware assessment of tunnel detection and perimeter security technologies proven feasible in variable and complex geologic environments, such as mountains, and hard rock geology common in the United States Pacific Command area of responsibility. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects the planned lifecycle of this effort.			
Title: SBIR/STTR Transfer	-	0.058	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CX6 / *Subterranean Detection and Monitoring Apl Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: Funding transferred in accordance with Title 15 USC §638 ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	-	1.587	1.688

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) CZ6 / *Assured PNT Enabling Applied Technology*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CZ6: *Assured PNT Enabling Applied Technology*	-	-	3.661	3.347	-	3.347	2.319	2.272	2.137	2.160	0.000	15.896

A. Mission Description and Budget Item Justification

Assured Positioning Navigation and Timing (APNT) Enabling Technologies project investigates and matures technologies for Space-Based and High Altitude applications for Army tactical ground forces. Efforts include the development of sensors and electronic components for communications, signal and information processing, target acquisition, quantum based communications and sensing, and threat warning for small spacecraft and high altitude applications. Investigations leverage other Department of Defense (DoD) space science and technology applications to support Army space force enhancement and cooperative satellite payload development.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project CJ8 (Assured PNT Communications Advanced Tech).

The research cited 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 Space and Missile Defense.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Assured PNT Enabling Applied Technology	-	3.527	3.347
Description: This effort supports validation of hardware and software components and models to further Space/HA sensor or Deep Sensing capabilities, payload design and development.			
FY 2023 Plans: Will continue to design, develop, and implement an advanced laboratory testbed that will be utilized to mature payloads for APNT, ground launched assets and optical/quantum secure communications on multiple simulated platforms simultaneously with hardware and software in the loop. The testbed will be applicable to high altitude (HA), space based, and ground based platforms utilizing quantum secured communications. Hardware will be developed to optimize transmission of data across multi-domain environments and optimized for Army Program Executive Office (PEO) requirements.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CZ6 / *Assured PNT Enabling Applied Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Will continue to develop, and validate an advanced laboratory testbed that will be utilized to mature payloads for APNT, ground launched assets and optical/quantum secure communications on multiple simulated platforms simultaneously with hardware and software in the loop. Testbed will be applicable for Quantum Entanglement (QE) and HA applications. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to planned lifecycle of this effort.			
Title: SBIR/STTR ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638	-	0.134	-
Accomplishments/Planned Programs Subtotals	-	3.661	3.347

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) CZ7 / *Convergent CEMA Technical Effects*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CZ7: *Convergent CEMA Technical Effects*	-	-	5.587	5.472	-	5.472	5.573	5.580	5.584	5.645	0.000	33.441

A. Mission Description and Budget Item Justification

This Project investigates, designs, and develops hardware and software to enable cyber and radio frequency (RF) technical effects along with inconspicuous Cyber Electromagnetic Activity (CEMA) and network operations of Army platforms and dismounts, while maintaining freedom to maneuver, communicate, and sense. This research will investigate and develop methods to protect blue platforms from adversarial detection and attack. This research is critical to counter near-peer adversary ability to geo-locate and put indirect fires onto blue force positions.

Work in this Project complements Program Element (PE) 0602146A (Network C3I Technology) / Project AM6 (Non Modular RF Communications Technology) and Project AN3 (Non Traditional Waveforms Technology), Program Element (PE) 0602213A (C3I Applied Cyber) / Project CI6 (Network Obscuration and Deception Tech) and Project CY6 (Autonomous Cyber Technology), Program Element (PE) 0603457A (C3I Cyber Advanced Development) / Project 6CY (Autonomous Cyber Advanced Technology), and Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AM7 (Modular RF Communications Advanced Technology) and Project AN4 (Non Traditional Waveforms Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: RF-Enabled CEMA Sensing and Technical Effects	-	3.168	3.335
Description: This effort develops technologies to avoid geolocation of blue force RF emissions by peer/near- peer adversaries. Research will focus on developing low probability of detection (LPD) communications and RF transceivers to increase freedom of maneuver while maintaining effective communications.			
FY 2023 Plans: Develop techniques for heterogeneous and distributed signal transmission; develop signals and waveforms for RF emissions on wideband reconfigurable transceivers and perform proof-of-concept validation; design and implement wideband reconfigurable RF transceiver hardware interoperable with compact antennas, RF frontend hardware, and data converters; develop non-RF integrated breadboard communication demonstrator and assess general capabilities of this system external to the laboratory environment.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CZ7 / *Convergent CEMA Technical Effects*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Will validate RF emulator techniques in relevant outdoor environment; investigate antenna architecture to enhance performance in accordance with RF emulator requirements; validate effectiveness of converged cyber and RF emulation effects in relevant environment; validate performance of non-RF integrated breadboard communication demonstrator. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding increase reflects the planned lifecycle of this effort.			
Title: Convergent Networking and CEMA Effects ***Description:*** This effort investigates techniques and develops methods for combining the physical (Radio Frequency) and network (cyber) layers for enhanced effects when coupled with electromagnetic technical effects. Research also investigates methods of adaptive networking using unconventional communication channels and active tactical cyber defense methods to anticipate adversarial activities and effective responses. ***FY 2023 Plans:*** Develop intelligent networking protocols for controlling novel methods for covert communication; conduct experiments on the use of unconventional spectrum and techniques for covert communications; explore the integration of developed covert networking techniques with multi-domain technical effects; investigate the use of game theory approaches to achieve cyber misrepresentation on tactical networks; build attack graphs to comprehend the interdependencies among vulnerabilities and to analyze the attacker's potential course of action; use game theory for an optimum decoy allocation framework that causes network reconnaissance to be difficult, allows detection of an attacker, and detains the attacker. ***FY 2024 Plans:*** Will investigate radio-frequency low-probability-of-detection techniques and network-level metrics for hybrid coding and diversity approaches to covert communications; develop protocols for and conduct experiments on hybrid radio-frequency/ultraviolet communications networks; develop methods that build asymmetric advantages for defenders over intelligent, near-peer adversaries, to deal with dynamic environments and fast changing mission context that results in uncertainties and partial information; continue to build attack graphs to understand the interdependencies among all known target vulnerabilities and analyze attacker's potential courses of action; develop an architecture of a cyber misrepresentation decision making system in a tactical environment that incorporates graph-based friendly network representation and game theory approaches. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding decrease reflects the planned lifecycle of this effort.	-	2.215	2.137
Title: SBIR/STTR Transfer ***FY 2023 Plans:*** Funding transferred in accordance with Title 15 USC §638 ***FY 2023 to FY 2024 Increase/Decrease Statement:***	-	0.204	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** CZ7 / *Convergent CEMA Technical Effects*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	-	5.587	5.472

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) DA8 / *Quantum PNT & Radio Frequency Sensing*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
DA8: *Quantum PNT & Radio Frequency Sensing*	-	-	-	2.612	-	2.612	3.657	5.232	5.236	5.293	0.000	22.030

Note

Quantum PNT & Radio Frequency Sensing is a new start within the C3I Applied Research program in FY 2024.

A. Mission Description and Budget Item Justification

This Project will investigate quantum sensing approaches for positioning, navigation, and timing (PNT) to improve the accuracy and resilience of Army PNT capabilities independent of Global Positioning System (GPS).

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AW6 (Modular GPS Independent Sensors Advanced Tech) and Program Element (PE) 0602146A (Network C3I Technology) / Project AW5 (Modular GPS Independent Sensors Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Quantum-Enhanced Sensing and PNT	-	-	2.612
Description: This effort will investigate quantum sensing approaches for positioning, navigation, and timing (PNT) to improve the accuracy and resilience of Army PNT capabilities independent of Global Positioning System (GPS). ***FY 2024 Plans:*** Will model, design, and assess solid-state sensors for low-size, weight, and power (SWaP) magnetometry and PNT sensing applications; model, design, and develop Rydberg electric field sensors for comparison with conventional receiver antennas. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** This is a new start in FY24			
Accomplishments/Planned Programs Subtotals	-	-	2.612

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** DA8 / *Quantum PNT & Radio Frequency Sensing*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) DB4 / *Enabling Long Standoff 3D (ELS3D) Tech*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
DB4: *Enabling Long Standoff 3D (ELS3D) Tech*	-	-	-	2.058	-	2.058	1.090	0.523	1.047	1.411	0.000	6.129

Note

Enabling Long Standoff 3D (ELS3D) Tech is a new start within the C3I Applied Research program in FY 2024.

A. Mission Description and Budget Item Justification

This Project investigates and develops a low-SWAP laser transmitter, processing algorithms and calibration models tailored for higher resolution 3D data collections over larger areas from longer stand-off for mapping, Intelligence Surveillance and Reconnaissance (ISR) and targeting.

Work in this Project compliments Program Element (PE) 0603042A (C3I Advanced Technology) / Project DB5 (Enabling Long Standoff 3D Adv Tech).

The work cited 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 Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Signal Processing for Forward Looking Mapping Systems	-	-	2.058
Description: This effort will design and develop hardware and software to enable long standoff airborne collection of high-resolution quick turnaround 3-Dimensional Data. ***FY 2024 Plans:*** Will investigate advanced signal processing and calibration models for new configurations for high quality 3D data coverage for standoff airborne collection. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** This is a new start in FY2024.			
Accomplishments/Planned Programs Subtotals	-	-	2.058

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** DB4 / *Enabling Long Standoff 3D (ELS3D) Tech*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602182A / *C3I Applied Research*	Project (Number/Name) DE6 / *Understanding Environment as a Threat Tech*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
DE6: *Understanding Environment as a Threat Tech*	-	-	-	1.010	-	1.010	-	-	-	-	0.000	1.010

Note

Understanding Environment as a Threat Tech is a new start within the C3I Applied Research program in FY 2024.

A. Mission Description and Budget Item Justification

This Project designs and advances mission planning software enabling the Soldier to identify, track, and plan for industrial or commercial chemical/environmental threats. Software modules will increase capability of mission based planning technologies providing new operational routing options for mission execution with environmental threat overlays.

Work in this Project complements Program element (PE) 0603042A (C3I Advanced Technology) / Project DE7 (Understanding the Environment as a Threat Adv Tech).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. Work in this Project is performed by the United States Army Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Subsurface Forensics	-	-	1.010
Description: This effort will prepare Soldiers for the risks of deliberate or accidental release of toxic industrial chemicals and materials by investigating and developing methods to collect data to characterize and predict the fate and transport of hazards of concern.			
FY 2024 Plans: Will develop new techniques to achieve ultra-low detection levels of explosive constituents, non-weaponized hazards for reverse point sourcing threats increasingly wet, protein rich environments.			
FY 2023 to FY 2024 Increase/Decrease Statement: This is a new start in FY2024			
Accomplishments/Planned Programs Subtotals	-	-	1.010

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*	**Project (Number/Name)** DE6 / *Understanding Environment as a Threat Tech*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A