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 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603463A *I Network C3I Advanced 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**
Total Program Element	-	138.937	216.520	155.867	-	155.867	-	-	-	-	-	-
AM7: *Modular RF Communications Advanced Technology*	-	14.744	12.057	9.288	-	9.288	-	-	-	-	-	-
AM9: *Protected SATCOM Advanced Technology*	-	-	16.032	25.552	-	25.552	-	-	-	-	-	-
AN2: *Narrowband SATCOM Advanced Technology*	-	-	4.813	11.630	-	11.630	-	-	-	-	-	-
AN4: *Non Traditional Waveforms Advanced Technology*	-	5.126	7.508	9.300	-	9.300	-	-	-	-	-	-
AN6: *Prot SATCOM-WB Global SATCOM Inter Canc Adv Tech*	-	1.864	1.925	-	-	-	-	-	-	-	-	-
AN8: *COE - Every Receiver is a Sensor Advanced Tech*	-	5.571	2.934	2.887	-	2.887	-	-	-	-	-	-
AO1: *UNT - Every Receiver is a Sensor Advanced Tech*	-	6.044	2.888	2.944	-	2.944	-	-	-	-	-	-
AO3: *Stand-In Advanced RF Effects (STARE) Adv Tech*	-	1.864	2.888	-	-	-	-	-	-	-	-	-
AO6: *Tag Track and Locate Small Satellites Adv Tech*	-	13.034	16.051	-	-	-	-	-	-	-	-	-
AO7: *EW for Maneuver Operations (EMO) Adv Tech*	-	3.974	2.810	5.803	-	5.803	-	-	-	-	-	-
AP6: *C4ISR Integrated Demonstrations Advanced Tech*	-	4.233	3.603	-	-	-	-	-	-	-	-	-
AP8: *Comms/Horiz Int for Army Mod Priorities Adv Tech*	-	0.633	7.781	-	-	-	-	-	-	-	-	-
AP9: *Next Generation HF Advanced Technology*	-	5.592	6.739	7.835	-	7.835	-	-	-	-	-	-

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 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603463A *I Network C3I Advanced Technology*							
AQ1: *Spectrum Obfuscation Advanced Technology*	-	5.592	3.744	-	-	-	-	-	-	-	-	-
AQ5: *Sensor CE-Integrated Sensor Architecture Adv Tech*	-	1.406	1.971	1.645	-	1.645	-	-	-	-	-	-
AQ8: *High Tempo Data Driven Decision Tools Adv Tech*	-	-	2.911	3.121	-	3.121	-	-	-	-	-	-
AR2: *Energy Informed Operations Advanced Technology*	-	1.864	-	-	-	-	-	-	-	-	-	-
AR4: *Intelligent Env Battlefield Awareness Adv Tech*	-	0.641	3.138	4.075	-	4.075	-	-	-	-	-	-
AR6: *Understanding the Environment as a Threat Adv Tech*	-	2.155	2.706	2.524	-	2.524	-	-	-	-	-	-
AR8: *Sensing in Contested Environments Adv Tech*	-	-	0.948	1.611	-	1.611	-	-	-	-	-	-
AS9: *Persistent Geophysical Sensing-Infrasound Adv Tech*	-	2.257	4.600	2.448	-	2.448	-	-	-	-	-	-
AT3: *Subterranean Detection and Monitoring Adv Tech*	-	1.016	3.360	2.217	-	2.217	-	-	-	-	-	-
AT8: *Network-Enabled GeoSpatial-GEOINT Services AdvTech*	-	3.521	2.888	3.059	-	3.059	-	-	-	-	-	-
AU1: *Tactical GeoSpatial Information Capabilities ATech*	-	1.929	3.603	4.207	-	4.207	-	-	-	-	-	-
AU2: *Optimization of Geospatial Data for Visualization*	-	-	2.022	2.171	-	2.171	-	-	-	-	-	-
AU4: *Geospatially Enabled Operational Design Adv Tech*	-	4.610	7.905	7.956	-	7.956	-	-	-	-	-	-
AU6: *Automated Analytics for Operational Environment AT*	-	1.593	-	-	-	-	-	-	-	-	-	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army												Date: May 2021
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*							
AV1: *GEOInt/Ops Logistics Integration-Planning Adv Tech*	-	-	3.771	3.867	-	3.867	-	-	-	-	-	-
AV2: *LEO Advanced Technology*	-	1.891	1.949	-	-	-	-	-	-	-	-	-
AV4: *Foundational S&T for Network C3I Advanced Tech*	-	-	2.068	7.751	-	7.751	-	-	-	-	-	-
AV8: *Navigation Warfare (NAVWAR) Advanced Technology*	-	5.707	2.535	1.927	-	1.927	-	-	-	-	-	-
AW2: *Autonomous Navigation Advanced Technology*	-	0.280	-	-	-	-	-	-	-	-	-	-
AW4: *DoD PNT M&S Collaborative Initiative (CI) Adv Tech*	-	2.796	2.888	-	-	-	-	-	-	-	-	-
AW6: *Modular GPS Independent Sensors Advanced Tech*	-	-	10.684	6.813	-	6.813	-	-	-	-	-	-
BP4: *ELECTRONIC WARFARE ADVANCED TECHNOLOGIES (CA)*	-	39.000	64.800	-	-	-	-	-	-	-	-	-
CF9: *Automated IPB Adv Tech*	-	-	-	0.989	-	0.989	-	-	-	-	-	-
CI7: *Mobile & Survivable Command Post (MASCP) Adv Tech*	-	-	-	7.809	-	7.809	-	-	-	-	-	-
CJ8: *Assured PNT Communications Advanced Tech*	-	-	-	16.438	-	16.438	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates technologies to provide an Army tactical network and enabling infrastructure that support operations in any environment, to include where the electromagnetic spectrum is denied or degraded. This is accomplished through the exploitation and optimization of components and systems for robust, low signature communications and data networks; assured positioning, navigation, and timing in contested environments; converged and coordinated cyber and electronic warfare activities; resilient mission command on the move; and the collection, processing, and dissemination of information for intelligence, surveillance, and reconnaissance.

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 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603463A *I Network C3I Advanced Technology*

Work in this PE complements PE 0602146A (Network C3I Technology), PE 0602143A (Soldier Lethality Technology), PE 0602145A (Next Generation Combat Vehicle Technology), PE 0602147A (Long Range Precision Fires Technology), PE 0602148A (Future Vertical Lift Technology), PE 0602150A (Air and Missile Defense Technology), PE 0602213A (C3I Applied Cyber), PE 0603118A (Soldier Lethality Advanced Technology), PE 0603462A (Next Generation Combat Vehicle Advanced Technology), PE 0603464A (Long Range Precision Fires Advanced Technology), PE 0603465A (Future Vertical Lift Advanced Technology), and PE 0603466A (Air and Missile Defense 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 is performed by the U.S. Army Futures Command (AFC), the U.S. Army Space and Missile Defense Command (SMDC) and U.S. Army Engineer Research and Development Center (ERDC).

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	142.899	158.608	163.892	-	163.892
Current President's Budget	138.937	216.520	155.867	-	155.867
Total Adjustments	-3.962	57.912	-8.025	-	-8.025
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-1.750			
• Congressional Rescissions	-	-			
• Congressional Adds	-	64.800			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.962	-5.138			
• Adjustments to Budget Years	-	-	-8.025	-	-8.025

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: BP4: *ELECTRONIC WARFARE ADVANCED TECHNOLOGIES (CA)*		
Congressional Add: *Unmanned Aerial Systems and Aerostat Operations*	4.000	-
Congressional Add: *Sensor Advanced Technology*	10.000	-
Congressional Add: *Assured Position, Navigation, and Timing Technology*	9.000	6.300
Congressional Add: *Payload and Ground Segment Research and Development for Small Satellite Science and Security Applications*	5.000	-
Congressional Add: *Urban Subterranean Mapping Technology*	3.000	-
Congressional Add: *Anticipating Threats to Natural Systems*	6.000	-

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 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603463A *I Network C3I Advanced Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Congressional Add: *Army Visual and Tactical Arctic Reconnaissance*	2.000	2.000
Congressional Add: *Program increase - anticipating threats to natural systems*	-	6.000
Congressional Add: *Program increase - S?UAS cyber threat management*	-	7.500
Congressional Add: *Program increase - sub?surface infrastructure in arctic environments*	-	1.000
Congressional Add: *Program increase - mesh network-enabled small satellites*	-	10.000
Congressional Add: *Program increase - geospatial artificial intelligence analytic tools*	-	4.000
Congressional Add: *Program increase - advanced materials and technologies for command post modernization*	-	10.000
Congressional Add: *Program increase - advanced materials for resilient sensors*	-	8.000
Congressional Add: *Program increase - tactical geospatial information capabilities*	-	10.000
Congressional Add Subtotals for Project: BP4	39.000	64.800
Congressional Add Totals for all Projects	39.000	64.800

Change Summary Explanation

$5.250 million of FY222 will be realigned to APE 633463AV4 from APE GA0750000, Abrams Upgrade Program.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army											Date: May 2021	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AM7 / *Modular RF Communications Advanced 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**
AM7: *Modular RF Communications Advanced Technology*	-	14.744	12.057	9.288	-	9.288	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022, funding is realigned from:
PE 0603463A (Network C3I Advanced Technology) Project AP8 (Comms/Horiz Int for Army Mod Priorities Adv Tech)

A. Mission Description and Budget Item Justification

This Project optimizes autonomous networking protocols to automate the Primary, Alternate, Contingency, and Emergency (PACE) communication plan to initialize, adapt, and continue operations under changing environments and threats.

Work in this Project complements PE 06022146A (Network C3I Technology) Project AM6 (Modular RF Communications Technology) and PE 0602213A (C3I Applied Cyber), Project CY1 (Information Assurance and Network Resiliency 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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Modular Radio Frequency (RF) Communications Advanced Technology	14.744	12.057	9.288
Description: This effort optimizes autonomous networking protocols to automate the Primary, Alternate, Contingency, and Emergency (PACE) communication plan to initialize, adapt, and continue operations under changing environments and threats.			
FY 2021 Plans: Mature the design to perform over disparate transport networks across multiple security classifications enabling a unified network operations across the Army Brigade network; refine and mature the algorithms to enable distributed decision making by coordinating and cooperating among decision engines distributed across the network; demonstrate the auto Primary, Alternate, Contingency, and Emergency (PACE) capability to initialize, detect, and adapt the network to the changing conditions and threats in a relevant field based experiment; refine the architecture for modularity, develop interfaces with external systems to exchange			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AM7 / *Modular RF Communications Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
information, and mature interface standards; and develop specifications for the next phase of capability to incorporate Artificial Intelligence/Machine Learning (AI/ML) techniques. ***FY 2022 Plans:*** Will optimize the network protocols design for disparate transport networks across multiple security classifications enabling a unified network operations across the Army Brigade network; optimize the algorithms of the decision engine to process data received from external systems; integrate the automated PACE (A-PACE) solution with Program of Record products (e.g. Mounted Mission Command Software, AFAATDS, and PF-D) and other S&T products; will use opportunities such as, Network Modernization Experiment (NetMod X), Joint Capabilities Technology Demonstration (JCTD), and Dynamic Front to optimize the design. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Overall funding decrease in FY22 reflects planned lifecycle level of effort.			
Accomplishments/Planned Programs Subtotals	14.744	12.057	9.288

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AM9 / *Protected SATCOM Advanced 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
AM9: *Protected SATCOM Advanced Technology*	-	-	16.032	25.552	-	25.552	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022 funding is realigned from:
PE 0602146A (Network C3I Technology) Project AP7 (Comms/Horiz Int for Army Mod Priorities Tech)
PE 0603463A (Network C3I Advanced Technology) Project AP6 (C4ISR Integrated Demonstration Advanced Tech)

A. Mission Description and Budget Item Justification

This project matures and demonstrates technologies and components to increase resiliency of Wideband Satellite Communications (SATCOM) in contested and congested electromagnetic environments. This effort improves resiliency through science & technology investigation. Will compliment technologies that provide obfuscation of radio frequency (RF) spectrum signature in order to counter enemy electronic surveillance capabilities.

Work in this Project complements PE 0602146A (Network C3I Technology) Projects AM8 (Protected SATCOM Technology) and BZ8 (Aerial Tier Networking).

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 U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Protected SATCOM Advanced Technology and Resilient Tactial Networking and Comms	-	12.223	25.351
Description: This project matures and demonstrates technologies and components to increase resiliency of Wideband SATCOM in contested and congested electromagnetic environments. This effort improves resiliency through science & technology investigation. Will compliment technologies that provide obfuscation of radio frequency (RF) spectrum signature in order to counter enemy electronic surveillance capabilities. ***FY 2021 Plans:*** Optimize and select those SATCOM technologies that will automatically adapt to constantly changing, congested, and contested environments; conduct demonstrations to establish a baseline for future research of intelligent satellite communications (i.e., systems that automatically adapt and mitigate network problems); mature and optimize components that support the control of the Army satellite network in a contested environment; mature and optimize Army capabilities through the exploitation of emerging commercial Low Earth Orbit (LEO) technologies and conduct demonstrations using these same technologies in a			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AM9 / *Protected SATCOM Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
contested environment; and provide tactical SATCOM advantage to the US Army by demonstrating commercial LEO technologies that will validate improvements to Tactical SATCOM Network Resiliency and inform future Next Generation Tactical Terminal Development. ***FY 2022 Plans:*** Will mature and demonstrate components that support the control of the Army satellite networks in a contested environment, enabling automated tactical communications resiliency technologies; mature and optimize select SATCOM technologies for basic SATCOM waveforms that will automatically adapt to changing contested environments, leading to protection which improves throughput in tactical and enterprise environments; mature On-the-Move (OTM) satellite ground terminal technology that supports operation over multiple satellite constellations with low available size, weight, and power (SWAP), leading to Army communications resiliency through diversity for tactical vehicles; and mature At-the-Halt (ATH) satellite ground terminal technology that supports operation over multiple satellite constellations simultaneously, leading to Army communications resiliency through diversity for Army Tactical Operations Centers (TOC). ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase in FY22 will support increased technology maturity and optimization of OTM and ATH satellite ground terminal technology leading to resiliency through diversity for Army TOCs. Funds realigned from PE 0602146A Project AP7 (Comms/Horiz Int for Army Mod Priorities Tech) and PE 0603463A Project AP6 (C4ISR Integrated Demonstration Advanced Tech).			
Title: High Altitude: Wideband Global Satellite Communications (SATCOM) (WGS) Ka Band Surrogate Payload / Aerial Tier Networking ***Description:*** Demonstrate a WGS surrogate payload for usage on a High Altitude Platform (HAP) with seamless transition to existing ground terminals by modifying existing solutions to support Capability Sets (CS), beginning with CS 23: Capacity & Resiliency. ***FY 2021 Plans:*** Mature and demonstrate WGS Ka Band Surrogate Payload which includes low power RF components and antenna optimized for the HAP field of view; improve performance of SATCOM terminal and modem so that they can acquire and track the HAP and be able to hand over to a second HAP; and integrate the WGS Surrogate Payload into the platform utilizing leased or purchased HAP enabling the anticipated performance improvement. ***FY 2022 Plans:*** Will validate the potential use of the WGS Surrogate?s receive signals to identify and geo-locate adversary electronic warfare threats. ***FY 2021 to FY 2022 Increase/Decrease Statement:***	-	3.809	0.201

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AM9 / *Protected SATCOM Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 22 funding decrease is aligned to lifecycle glide path to the post demonstration and transition to POR activities at the end of FY22.			
Accomplishments/Planned Programs Subtotals	-	16.032	25.552

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AN2 / *Narrowband SATCOM Advanced 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
AN2: *Narrowband SATCOM Advanced Technology*	-	-	4.813	11.630	-	11.630	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022, funding is realigned from:
PE 0603463A (Network C3I Advanced Technology) Project AP8 (Comms/Horiz Int for Army Mod Priorities Adv Tech)

A. Mission Description and Budget Item Justification

This Project validates and demonstrates technologies to enable gateway communications across disparate Narrowband Satellite Communications (SATCOM) networks, enabling resiliency in contested environments. The Narrowband SATCOM network is the largest tactical network operated by the Army to provide situational understanding across all echelons. This project optimizes technologies and protocols to enable risk mitigation solution sets and awareness through adaptive learning capabilities.

Work in this Project complements PE 0602146A (Network C3I Technology) Project BZ6 (Narrowband SATCOM Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Narrowband SATCOM Advanced Technology	-	4.813	11.630
Description: This effort validates and demonstrates technologies to enable gateway communications across disparate Narrowband Satellite Communications (SATCOM) networks, enabling resiliency in contested environments. ***FY 2021 Plans:*** Optimize Narrowband SATCOM products based on schedule requirements, performance requirements, and integration needs for laboratory demonstrations in support of the Network, Long Range Precision Fires, Air & Missile Defense and Next Generation Combat Vehicle use case scenarios; demonstrate in a congested and contested environment to determine system design performance and assess human in-the-middle activities; demonstrate augmented artificial intelligence/machine learning operations in a congested and contested environment; and mature and demonstrate Narrowband SATCOM hardware and software. ***FY 2022 Plans:*** Will optimize the Narrowband SATCOM gateway network transport management system to incorporate capabilities such as artificial intelligence, machine learning and cognitive computing; validate system design performance and resiliency in maintaining an acceptable level of communication services; perform integrated demonstrations using multiple use-case scenarios of the			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AN2 / *Narrowband SATCOM Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Networks, Long Range Precision Fires, Air & Missile Defense and Next Generation Combat Vehicle; and mature system to Technology Readiness Level of 5. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Increase supports integrated demonstrations for multiple use-case scenarios of the Networks, Long Range Precision Fires, Air & Missile Defense and Next Generation Combat Vehicle. Funding in this effort was realigned from PE 0603463A Project AP8 (Comms/Horiz Int for Army Mod Priorities Adv Tech).			
Accomplishments/Planned Programs Subtotals	-	4.813	11.630

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 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AN4 / *Non Traditional Waveforms Advanced 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**
AN4: *Non Traditional Waveforms Advanced Technology*	-	5.126	7.508	9.300	-	9.300	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022, funding is realigned from:
PE 0603463A (Network C3I Advanced Technology) Project AP6 (C4ISR Integrated Demonstrations Advanced Tech)

A. Mission Description and Budget Item Justification

This Project demonstrates non-traditional waveforms and technologies for resilient communications in contested environments providing anti-jam, low probability of intercept, and low probability of detection for the dismounted and vehicular user. This Project optimizes technologies not typically applied to the tactical environment, such as millimeter wave communications and directional networking with coherent combining of radio frequency signals, to maintain networked communications in and under contested and congested electromagnetic spectrum environments.

Work in this Project complements PE 0602146A (Network C3I Technology)/Project AN3 (Non Traditional Waveforms Technology) and AO4 (Energy Efficient Devices 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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Non Traditional Waveforms Advanced Technology	5.126	7.508	9.300
Description: This effortdemonstrates non-traditional waveforms and technologies for resilient communications in contested environments providing anti-jam, low probability of intercept, and low probability of detection for the dismounted and vehicular user. This effort optimizes technologies not typically applied to the tactical environment, such as millimeter wave communications and directional networking with coherent combining of radio frequency signals, to maintain networked communications in and under contested and congested electromagnetic spectrum environments. ***FY 2021 Plans:*** Will enhance low probability of intercept, low probability of detection as well as anti-jam technology while supporting dismounted and mounted systems to operate in relative contested and congested environments, using technologies such as distributed cooperative beamforming in conjunction with dismounted communication devices and highly directional millimeter wave systems			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AN4 / *Non Traditional Waveforms Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
using techniques such as amplitude control and advanced signal processing techniques; mature adaptive power control techniques and dismounted networking; and mature the millimeter wave demonstration system for at least a three node system with enhanced discovery and tracking speeds as well as advanced networking protocol enhancements for a highly directional network Mobile Ad hoc Network (MANET) for mounted operations at operational distances and throughputs. ***FY 2022 Plans:*** Will mature anti-jam and low probability of intercept, low probability of detection communications capabilities for protected communications to be better suited for operationally relevant, contested environments; enable directional millimeter wave communications to support additional users in complex scenarios (e.g. on-the-move high speed directional ad-hoc network at operational distances); exploit and mature government owned millimeter wave antenna aperture to reduce the unit cost of mmW communications systems; apply techniques developed in previous years, (cooperative beamforming for voice and data communications) and enable upgrade of a legacy waveform(s) via software/firmware update only; and enhance waveform protection in contested environments using methods, such as combining cooperative beamforming with additional anti-jam low probability of intercept, low probability of detection techniques. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase in FY22 will support enhancement of millimeter wave communications technology to add resiliency for complex scenarios and improve waveform capabilities. Funding in this effort was realigned from PE 0603463A Project AP6 (C4ISR Integrated Demonstrations Advanced Tech).			
Accomplishments/Planned Programs Subtotals	5.126	7.508	9.300

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 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AN6 / *Prot SATCOM-WB Global SATCOM Inter Canc Adv Tech*			
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**
AN6: *Prot SATCOM-WB Global SATCOM Inter Canc Adv Tech*	-	1.864	1.925	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

This effort is an elimination in Fiscal Year (FY) 2022.

A. Mission Description and Budget Item Justification

This Project matures technologies providing increased resiliency for Wideband Satellite Communications (SATCOM) from contested and congested electromagnetics through the use of technologies including adaptive interference mitigation and diversity through multiple paths. Wideband SATCOM is the primary high-bandwidth Beyond Line of Sight (BLOS) communications used by the tactical Army and this project demonstrates protection of this valuable communication link.

Work in this Project complements PE 06022146A (Network C3I Technology) Project AN5 (Protected SATCOM-WB Global SATCOM Inter Canc 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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Prot SATCOM-WB Global SATCOM Inter Canc Adv Tech	1.864	1.925	-
Description: This effort matures technologies providing increased resiliency for Wideband SATCOM from contested and congested electromagnetics through the use of technologies including adaptive interference mitigation and diversity through multiple paths. Wideband SATCOM is the primary high-bandwidth BLOS Communications used by the tactical Army and this project demonstrates protection of this valuable communication link. ***FY 2021 Plans:*** Mature and demonstrate Ka-band interference cancelling technology and planning tool in field based demonstrations and support transition of the Ka-band interference cancelling technologies into a Program of Record. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** This effort completes in FY21.			
Accomplishments/Planned Programs Subtotals	1.864	1.925	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AN6 / *Prot SATCOM-WB Global SATCOM Inter Canc Adv Tech*

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AN8 / *COE - Every Receiver is a Sensor Advanced Tech*	

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
AN8: *COE - Every Receiver is a Sensor Advanced Tech*	-	5.571	2.934	2.887	-	2.887	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project optimizes automated exploitation and fusion analysis tools, applications, and software services that harvest, correlate and fuse tactical receiver sources with new and emerging data sources to improve understanding of the threat picture and more efficiently support near-real time Situational Understanding of the battlefield.

Work in this Project complements PE 0603463A (Network C3I Advanced Technology) Project AO1 (UNT - Every Receiver is a Sensor Advanced Tech) and PE 0602146A (Network C3I Technology) Project AN7 (COE - Every Receiver is a Sensor 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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Advanced Data Analytics for Situational Awareness	5.571	2.934	2.887
Description: This effort improves software technologies for intelligence/mission command (MC) mission collaboration to provide faster and higher quality decision-making support for the commander and his key staff. Specific efforts focus on integrating intelligence, surveillance and reconnaissance (ISR) planning and execution at the Task Force/Battalion through troop-level, as well as efforts that provide the capability to identify, fuse, and trace/track specific targets in an asymmetric environment.			
FY 2021 Plans: Mature the data platform with emphasis on intelligence and operations convergence through the application of advanced analytic capabilities; conduct a capability demonstration with a user jury to help establish baseline performance enhancements to situational awareness, and decreased time to action; and integrate additional data stores to capture estimates of future costs to extend the data platform further into relevant data stores.			
FY 2022 Plans: Will add and demonstrate enhanced attribute and cell level security capabilities within the converged intelligence and operations platform to show functionality across different classification boundaries; Will integrate machine learning frameworks to demonstrate machine learning capabilities within the converged platform; Will demonstrate tactical distributed PED workflows and			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AN8 / *COE - Every Receiver is a Sensor Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
efficient data synchronization at lower echelons by developing and demonstrating Tactical Edge data synchronization to support the Disconnected, Intermittent, and Limited (DIL) environment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	5.571	2.934	2.887

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AO1 / *UNT - Every Receiver is a Sensor Advanced Tech*	

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
AO1: *UNT - Every Receiver is a Sensor Advanced Tech*	-	6.044	2.888	2.944	-	2.944	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project demonstrates high fidelity Cyber-Electromagnetic Activity (CEMA) situational understanding by exploiting tactical receivers with sufficient capabilities as sensors. This Project optimizes real-time radio frequency mapping of the tactical environment in support of network operation and decision making.

Work in this Project complements PE 0602146A (Network C3I Technology) Projects AN9 (UNT - Every Receiver is a Sensor Technology) and AN7 (COE - Every Receiver is a Sensor Technology); and PE 0603463A (Network C3I Advanced Technology) Project AN8 (COE Every Receiver is a Sensor Advanced 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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Unified Network Transport (UNT) - Every Receiver is a Sensor Advanced Tech	1.821	-	-
Description: This effort demonstrates high fidelity Cyber-Electromagnetic Activity (CEMA) situational understanding by exploiting tactical receivers with sufficient capabilities as sensors. This effort optimizes real-time radio frequency mapping of the tactical environment in support of network operation and decision-making.			
Title: Multi Intelligence Modernization supporting Multifunction Operations	2.655	2.888	2.944
Description: This effort will optimize Intelligence Community investments in software frameworks and exploits against threat signals of interest (SOI) to mature a library of open, modular, and scalable software solutions that address identified capability gaps and to provide the commander with electronic situational awareness while at the same time protecting his assets from enemy deception and jamming. Work accomplished under PE 0602146A Project AN7 (COE - Every Receiver is a Sensor Advanced Tech) complements this effort.			
FY 2021 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AO1 / *UNT - Every Receiver is a Sensor Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Optimize high altitude long stand-off RF payloads designed to operate above contested environments; demonstrate techniques and technologies developed to protect Electronic Support assets from adversaries? deception and jamming; and mature and demonstrate software frameworks that facilitate rapid fielding of new capabilities. ***FY 2022 Plans:*** Demonstrate Electronic Warfare payloads designed to operate from high altitude, long endurance platforms; mature and demonstrate small, form factor hardware standards to facilitate the use of modular hardware on small Size, Weight and Power (SWAP) platforms such as high altitude, long endurance platforms and small, unmanned aerial vehicles. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Highly Distributable UGS ***Description:*** This effort will mature a small, low cost sensor capability that can be distributed in mass quantity and tailored to specific electro-magnetic signals or other modalities (i.e. seismic) to allow the tactical commander to obtain relevant situational awareness data within a signal dense and contested operational environment.	1.568	-	-
Accomplishments/Planned Programs Subtotals	6.044	2.888	2.944

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AO3 / *Stand-In Advanced RF Effects (STARE) Adv Tech*	

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
AO3: *Stand-In Advanced RF Effects (STARE) Adv Tech*	-	1.864	2.888	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022 funding is realigned to:
PE 0603463A (Network C3I Advanced Technology) Project AO7 (EW for Maneuver Operations (EMO) Adv Tech)

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies and capabilities to provide a robust and reliable communications capabilities by leveraging commercial technologies and enhancing their operation to maintain network connectivity in contested and congested environments.

Work in this Project complements PE 0602146A (Network C3I Technology) Project AO2 Stand-In Advanced RF Effects (STARE)). 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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Robust Grey C3I Advanced Technology ***Description:*** This effort matures and demonstrates technologies and capabilities to provide a robust and reliable communications capabilities by leveraging commercial technologies and enhancing their operation to maintain network connectivity in contested and congested environments.	1.864	-	-
Title: Stand-In Advanced RF Effects Advanced Technology ***Description:*** This effort harvests investments from 6.2 component level maturation and hardware synchronization research, to mature hardware for demonstration of capabilities for distributed Electronic Warfare. ***FY 2021 Plans:*** Harvest investments from 6.2 component level maturation, and hardware synchronization research and development, to mature hardware demonstration capabilities for distributed Electronic Warfare; validate initial countermeasures on distributed systems for evaluating performance metrics; evaluate performance metrics against one category of threats. ***FY 2021 to FY 2022 Increase/Decrease Statement:***	-	2.888	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AO3 / *Stand-In Advanced RF Effects (STARE) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Funding in this effort is realigned to PE 0603463A Project AO7 (EW for Maneuver Operations (EMO) Adv Tech) continuing the technical effort under a consolidated project.			
Accomplishments/Planned Programs Subtotals	1.864	2.888	-

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AO6 / *Tag Track and Locate Small Satellites Adv Tech*	

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
AO6: *Tag Track and Locate Small Satellites Adv Tech*	-	13.034	16.051	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In FY 2022, funding is realigned to:
Program Element (PE) 0603463A (Network C3I Advanced Technology Project CJ8 (Assured PNT Communications Advanced Tech)

A. Mission Description and Budget Item Justification

Tag, Track, and Locate (TT&L) Small Satellites Advanced Technology matures and demonstrates payloads, sensors, and data down link systems for tactically responsive Space and High Altitude platforms supporting Army ground forces. TT&L matures, demonstrates, and integrates lightweight materials, hardware components with reduced power consumption, and advanced data collection, processing, and dissemination capabilities. Also improves algorithms that process space and near space sensor data in real and near real time for integration into battlefield operating systems.
TT&L efforts will include:
- Technical demonstration of a sensor designed to provide space-based situational awareness to the tactical Warfighter;
- Development and demonstration of small satellite capabilities, which include classified payloads, to provide Assured Positioning, Navigation, and Timing services to the tactical ground component Warfighters;
- Constellation of space-based sensors that provide Reconnaissance, Surveillance, and Target Acquisition (RSTA) and Situational Awareness (SA) to the ground force commander to support Multi-Domain Operations (MDO);
- Applied research in quantum sciences based communications, sensing, and data teleportation to mature current technologies for small spacecraft applications.
These efforts support the Army's ability to control and exploit space assets that contribute to current and future military operations as defined in the national, Department of Defense (DOD), and Army future space strategies.
Work supports the Army Modernization Priorities.
Work in this Project complements PE 0602146A (Network C3I Technology) \ Project AO5 (UNT - Tag Track and Locate Small Satellites 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 Space and Missile Defense Command (USASMDC) Technical Center (TC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Tag, Track, and Locate Small Satellites	13.034	16.051	-
Description: This effort matures and demonstrates technologies required for smaller, warfighter-responsive sensor and communication Low Earth Orbit (LEO) small satellite constellations. Work will augment, improve, exploit and optimize existing commercial and DoD technologies and networks.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AO6 / *Tag Track and Locate Small Satellites Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
This effort validates software, hardware, and algorithms used to enable space-based capabilities in support of the Army's Modernization Priorities. This effort will exploit commercial advances and opportunities in small satellite constellation and payload management toward future Army concepts. ***FY 2021 Plans:*** Will mature and demonstrate technologies and validate software/algorithms for tracking and locating objects of interest to improve performance of space-based signal detection/processing/dissemination protocols, processes, and procedures; exploit existing commercial technologies to improve warfighter capabilities to overcome Anti Access/Area Denial (A2/AD). Perform on-orbit checkout testing of SVs including developmental testing prior to executing demonstrations; conduct JMUA and multiple tech demonstrations; participate in joint exercises; perform evaluations of spacecraft performance; participate in exercises to asses military utility; and demonstrate LEO based communications experiment aligned with tactical terminal and waveform development. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funds realigned to PE 0603463A Project CJ8 (Assured PNT Communications Advanced Tech) in FY2022.			
Accomplishments/Planned Programs Subtotals	13.034	16.051	-

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AO7 / *EW for Maneuver Operations (EMO) Adv Tech*	

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
AO7: *EW for Maneuver Operations (EMO) Adv Tech*	-	3.974	2.810	5.803	-	5.803	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies that understand contested spectrum points, sense, locate, and cue fires missions to create windows of opportunity in Anti-Access/ Area Denial (A2/AD) environments, restore network capabilities, and enable maneuver and fires.

Work in this Project complements PE 0602146A (Network C3I Technology) Projects AO2 (Stand-In Advanced RF Effects (STARE)) and AP5 (Electronic Warfare (EW) 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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: EW for Maneuver Ops	2.863	1.601	1.746
Description: This effort matures and demonstrates hardware and software to conduct electronic warfare (EW) for intelligence, surveillance, and reconnaissance (ISR) in support of Army tactical operations. This effort complements PE 0602146A (Network C3I Technology) Project AO2 (Stand-In Advanced RF Effects (STARE)).			
FY 2021 Plans: Mature Electronic Warfare capabilities, for use against sensor systems, that will optimize and demonstrate low Size Weight and Power-Cost (SWaP-C) hardware; validate distribution and coordination capabilities for novel geolocation capabilities in simulated environments; and demonstrate these critical technologies for Electronic Warfare (EW) at the Brigade and Below tactical engagement.			
FY 2022 Plans: Will mature (i.e., technology readiness level 6) and demonstrate EW capabilities for use against sensor systems in representative environments, threats, and hardware; and flight-demonstrate distributed and coordinated capabilities for novel geolocation.			
FY 2021 to FY 2022 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AO7 / *EW for Maneuver Operations (EMO) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Funding change reflects planned lifecycle of this effort.			
Title: Simultaneous Countermeasure for Active Reconnaissance and Surveillance (SCARS) ***Description:*** This effort matures and demonstrates EW capabilities leveraging hardware-in-the-loop and modeling and simulation (M&S) of threat ISR systems to validate coordinated and collaborative non-kinetic effects. ***FY 2021 Plans:*** Demonstrate simultaneous Electronic Warfare (EW) techniques against layered adversary ISR capabilities; and perform evaluation of metrics within high fidelity laboratory environment to validate EW techniques capabilities to alter the kinetic engagement. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle conclusion of this effort.	1.111	1.209	-
Title: Stand-in Advanced RF Effects (STARE) Advanced Technology ***Description:*** This effort matures and demonstrates highly advanced hardware and software to improve power-on-target for EW systems against certain threat systems. This effort complements PE 0602146A Projects AP5 (Electronic Warfare Technology) and AO2 (Stand-In Advanced RF Effects (STARE)). ***FY 2022 Plans:*** Will mature and optimized synchronization hardware, advanced signal processing, and EW system designs for distributed EW. Field demonstrate hardware system improvements to validate the effectiveness of distributed EW against certain classes of threat systems. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle initiation of this effort. In FY22 funding was realigned from PE 0603463A Project AO3 (Stand-In Advanced RF Effects (STARE) Adv Tech).	-	-	2.817
Title: Tactical Force Signature Effects (TForSE) Advanced Technology ? Counter ISR Techniques ***Description:*** This effort matures and demonstrates Electronic Warfare capabilities against adversary counter-fire sensors and Intelligence, Surveillance, and Reconnaissance (ISR) systems leveraging high fidelity hardware-in-the-loop, modeling and simulation (M&S), and representative systems. ***FY 2022 Plans:***	-	-	1.240

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AO7 / *EW for Maneuver Operations (EMO) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will mature initial EW capabilities against adversary systems that provide battlefield situational understanding and localization; and validate EW effectiveness in laboratory or representative environments to mask and deceive blue locations. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle initiation of this effort.			
Accomplishments/Planned Programs Subtotals	3.974	2.810	5.803

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AP6 / *C4ISR Integrated Demonstrations Advanced Tech*	

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
AP6: *C4ISR Integrated Demonstrations Advanced Tech*	-	4.233	3.603	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022, funding is realigned to:.
PE 0603463A (Network C3I Advanced Technology) Projects AN4 (Non Traditional Waveforms Advanced Technology), AM9 (Protected SATCOM Advanced Technology), AP9 (Next Generation HF Advanced Technology)

A. Mission Description and Budget Item Justification

Provides System of Systems (SoS) engineering rigor on Science & Technology (S&T) projects by providing field-based risk reduction processes, quantifiable technology performance in a SoS context, data-driven programmatic decision support, and field-based performance data to supplement Technology Readiness Level (TRL) assessments.

All FY 2020 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.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: C4ISR Integrated Demonstrations Advanced Tech	4.233	3.603	-
Description: This effort provides appropriate System of Systems (SoS) engineering rigor for multiple Science & Technology (S&T) projects by providing field-based risk reduction processes, quantifiable technology performance in a SoS context, data- driven programmatic decision support, and field-based performance data to supplement Technology Readiness Level Assessments. This project provides network automation, resiliency, and situational understanding through S&T advancements.			
FY 2021 Plans: Demonstrate maturing and emerging commercial and government off-the-shelf research and development advanced technologies in threat-based field experimentation to inform the Army's Modernization Priorities, including Network/C3I, Future Vertical Lift, Next Generation Combat Vehicle, and Soldier Lethality; assess science & technology efforts in a field-relevant environment to demonstrate technology maturation; optimize virtualization to increase venue capabilities by incrementally building a more			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AP6 / *C4ISR Integrated Demonstrations Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
scalable tactical network; and mature and demonstrate advancement of spectrum collection, injection, and management capabilities. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding realigned to these individual projects performing the Field Based Risk Reduction (FBRR) experiments for integration alignment to the individual projects? plans. Program Element (PE) 0603463A Projects AN4 (Non Traditional Waveforms Advanced Technology), AM9 (Protected SATCOM Advanced Technology), and AP9 (Next Generation HF Advanced Technology)			
Accomplishments/Planned Programs Subtotals	4.233	3.603	-

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AP8 / *Comms/Horiz Int for Army Mod Priorities Adv Tech*	

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
AP8: *Comms/Horiz Int for Army Mod Priorities Adv Tech*	-	0.633	7.781	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022, funding is realigned to:
PE 0603041A (Project Convergence) Projects CL9 (Collaborative Battlefield Networked Lethality System Adv Technologies), CM2 (Collaborative Convergence Adv Tech), and CM8 (Convergence Battlefield Integration)
PE 0603463A (Network C3I Advanced Technology) Project AN2 (Narrowband SATCOM Advanced Technology)

A. Mission Description and Budget Item Justification

This Project provides unified communications for the Army's modernization priorities through operationally-relevant, end-to-end network demonstrations which leverage Science & Technology (S&T) and commercial technology adapted to mitigate performance gaps in the presence of electronic warfare (EW) systems and reduce network complexity.

Work in this Project complements PE 06022146A (Network C3I Technology) Project AP7 (Comms Support to CSA / Horizontal Integ Fields 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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Communications Support to Army Modernization Priorities/Horizontal Integration Fields Advance Technology	0.633	7.781	-
Description: This effort provides unified communications for the Army's modernization priorities through operationally-relevant, end-to-end network demonstrations which leverage S&T and commercial technology adapted to mitigate performance gaps in the presence of EW systems and reduce network complexity.			
FY 2021 Plans: Conducts demonstrations at NetModX 21 Field experiment, which is NGCV themed to align with NGCV Robotic Combat Vehicle(RCV) Phase 2 demonstration. Provides support to Next Generation Combat Vehicle (NGCV) Robotic Combat Vehicle phase 2 demonstration.			
FY 2021 to FY 2022 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AP8 / *Comms/Horiz Int for Army Mod Priorities Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Effort terminated. Funding and work realigned to Program Element (PE) 0603041A Projects CL9 (Collaborative Battlefield Networked Lethality System Adv Technologies), CM2 (Collaborative Convergence Adv Tech), and CM8 (Convergence Battlefield Integration); and Program Element (PE) 0603463A Project AN2 (Narrowband SATCOM Advanced Technology).			
Accomplishments/Planned Programs Subtotals	0.633	7.781	-

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AP9 / *Next Generation HF Advanced 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
AP9: *Next Generation HF Advanced Technology*	-	5.592	6.739	7.835	-	7.835	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022 funding is realigned from:
PE 0603463A (Network C3I Advanced Technology) Project AP6 (C4ISR Integrated Demonstration Advanced Tech)

A. Mission Description and Budget Item Justification

This Project improves performance of technologies to provide assured and resilient reach-back communications in satellite denied or degraded environments. This Project optimizes performance of new high frequency (HF) technology to provide low probability of detection and anti-jam capabilities to overcome emerging electronic warfare threats.

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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Next Generation HF Advanced Technology	5.592	6.739	7.835
Description: This effort improves performance of technologies to provide assured and resilient reach-back communications in satellite denied or degraded environments. This project optimizes performance of HF technology to provide low probability of detection and anti-jam capabilities to overcome emerging electronic warfare threats.			
FY 2021 Plans: Mature the High Frequency (HF) Communications Hub proof-of-concept to provide an assured, resilient, alternate beyond line-of-sight communications link for tactical and strategic Army assets in satellite denied, area denied environments and increased resiliency to enemy detection and interception; demonstrate HF Communications Hub proof-of-concept operating with legacy HF radios in beyond line-of-sight operationally relevant environments to validate desired capabilities, performance, and interoperability; quantify anti-jam, low probability of intercept, and low probability of detection metrics to inform the Army?s HF requirements for resiliency in contested and congested environments; and validate performance metrics through modeling and simulation and demonstrations.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AP9 / *Next Generation HF Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will enhance the High Frequency (HF) Communications Hub and mature the edge terminal HF radio hardware and software to provide an assured, resilient, alternate beyond line-of-sight communications link for tactical and strategic Army assets; conduct technology readiness level 6 demonstration in a beyond line-of-sight operationally relevant environment of the HF Communications Hub proof-of-concept operating with legacy HF radios, other edge radio terminals, and the Regional Hub Node integrated into the larger tactical network executing mission threads; provide final assessment of performance from technology demonstration and provide recommendations to transition organizations; assess the performance against pacing threats in satellite denied and area denied environments to determine the increased resiliency to enemy detection and interception. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding in this project increased to support maturation of the HF Communications Hub. Funding increase was realigned from PE 0603463A (Network C3I Advanced Technology) AP6 (C4ISR Integrated Demonstrations Advanced Tech).			
Accomplishments/Planned Programs Subtotals	5.592	6.739	7.835

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 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AQ1 / *Spectrum Obfuscation Advanced 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**
AQ1: *Spectrum Obfuscation Advanced Technology*	-	5.592	3.744	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022,funding is realigned to:
PE 0603463A (Network C3I Advanced Technology) Project CI7 (Mobile and Survivable Command Post (MASCP) Adv Tech).

A. Mission Description and Budget Item Justification

This project validates and demonstrates technologies that provide obfuscation of radio frequency (RF) spectrum signature in order to counter enemy electronic surveillance capabilities. This Project optimizes, matures and demonstrates novel materials, technologies, techniques and applications that increase camouflage and concealment capabilities against known and emerging sensor threats, provide effective deception capabilities, increase survivability, mature analytical processes for modeling performance of signature management technologies during multi-domain operations as well as developing combinations of physical and electronic signature decoy components. These technologies will produce proof of concept system demonstrators that decrease the probability of detection and targeting by peer and near-peer adversaries, enabling freedom of movement of semi-independent and dispersed formations

Work in this Project complements PE 0603463A (Network C3I Advanced Technology) Project CI7 (Mobile and Survivable Command Post (MASCP) Adv Tech) and 0603118A (Soldier Signature Management Advanced Technology; Project AZ6 (Soldier Signature Management).

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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Spectrum Obfuscation Advanced Technology ***Description:*** This effort validates and demonstrates technologies that provide obfuscation of RF spectrum signature in order to counter enemy electronic surveillance capabilities.	5.592	-	-
Title: Camouflage, Concealment and Deception ***Description:*** This effort demonstrates innovative camouflage, concealment and deception technologies for expeditionary assets (i.e. mission command platforms, battle management centers and supporting equipment) to defeat advanced current and emerging adversary Intelligence, Surveillance and Reconnaissance (ISR) threats, and to reduce the probability of detection	-	3.744	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AQ1 / *Spectrum Obfuscation Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
in multi-domain operations. Matures physics-based models for material and system performance that support probability of detection metrics in the multi-domain operational environment, assisting in closing the capability gap between current camouflage, concealment and deception technologies and defeating enemy sensorial capabilities in future operating environments. ***FY 2021 Plans:*** Mature technologies with the goal of improving the performance of materials and component technologies in support of camouflage and deception efforts for use with high value assets (i.e. mission command platforms, battle management centers and supporting equipment); mature and demonstrate integrated signature management technologies for high-valued assets to improve effectiveness and survivability against hyperspectral sensors to enable expeditionary maneuver and mission command during multi-domain operations. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22, the work performed in this effort is realigned to PE 0603463A Project CI7 (Mobile and Survivable Command Post (MASCP) Adv Tech).			
Accomplishments/Planned Programs Subtotals	5.592	3.744	-

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AQ5 / *Sensor CE-Integrated Sensor Architecture Adv Tech*	

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
AQ5: *Sensor CE-Integrated Sensor Architecture Adv Tech*	-	1.406	1.971	1.645	-	1.645	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates a sensor interoperability architecture consisting of standards, interfaces, and services. The application managers will have adaptive functionality that allows for improved collaboration, survivability and recoverability, security, and adaptability to a dynamic network. Work in this Project supports the Army Science and Technology Network, Next Generation Combat Vehicle, Soldier Lethality, Air and Missile Defense, Long Range Precision Fires and Future Vertical Lift 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.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Sensor CE - Integrated Sensor Architecture	1.406	1.971	1.645
Description: This effort matures and demonstrates an agile and adaptive interoperability sensor architecture that allows a system to dynamically discover and leverage other systems on a network without any specific or prior knowledge across limited, heterogeneous resources and against a peer adversary. The goal of this effort is to develop standards, models, and protocols that provide a common language for sensor systems to connect, publish their capabilities and needs, and interact with other systems, even on disadvantaged networks. The benefits of this effort are increased sensor collaboration, reduced decision timelines, reduced soldier load, and reduced integration costs.			
FY 2021 Plans: Demonstrate an improvement on bandwidth utilization by performing smart data summary and aggregation; show intelligent high level tasking of multiple disparate sensors to reduce the need for details on each sensor?s unique characteristics; and continue to mature smart subscription services to ensure sensor data goes where it is needed.			
FY 2022 Plans: Will optimize network awareness technologies to improve bandwidth utilization for sensor interoperability; will demonstrate dynamic allocation of resources to show the correct sensor data assisting in providing targeting information to effectors.			
FY 2021 to FY 2022 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AQ5 / *Sensor CE-Integrated Sensor Architecture Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	1.406	1.971	1.645

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AQ8 / *High Tempo Data Driven Decision Tools Adv Tech*	

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
AQ8: *High Tempo Data Driven Decision Tools Adv Tech*	-	-	2.911	3.121	-	3.121	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022, funding is realigned to:
Program Element 060346A (Network C3I Advanced Technology) Project C17 (Mobile and Survivable Command Post (MASCP) Adv Tech)

A. Mission Description and Budget Item Justification

This Project matures and demonstrates data driven decision tools that help develop cyber situational understanding (SU) for Commanders. It enhances decision-making and accurately assesses and integrates cyber impacts with all of the domains in Multi-Domain Operations (MDO) and thereby enhances mission effectiveness by improving decision cycles.

Work in this Project complements PE 0602146A (Network C3I Technology) Project AQ7 (High Tempo Data Driven Decision Tools).
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: High Tempo Data Driven Decision Tools Advanced Technology	-	2.911	3.121
Description: This effort matures and demonstrates data driven decision tools tailored to reflect specific mission / information needs of the commander and individual staff members comprised of the following: software that facilitates the exchange of cyber data and mission information between the cyber electromagnetic activities (CEMA) cell, the S-6 and other staff officers (e.g., S-3, S-2, Fire Support Officer (FSO)), helping to assess higher-level impacts of lower-level events, and capturing the information as part of models for possible re-use; and software that dynamically populates the Common Operating Picture (COP) with visualizations designed for exploration and understanding of the impact of the cyber domain on the current mission.			
FY 2021 Plans: Using vignettes, demonstrate S-6 / S-3 / Commander perspectives and collaboration that show improved cyber situational understanding (SU); and demonstrate that the model/cyber impact tool dynamically updates the Common Operating Picture.			
FY 2022 Plans: Update COP Visualizations based on soldier/stakeholder feedback; develop cyber visualization guides to inform COP Visualization development; incorporate additional commander's cyber needs into COP Visualizations; demonstrate improved cyber SU in S-6 / S-3 / Commander perspectives and collaboration in field environment and dynamically connect to canned data;			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AQ8 / *High Tempo Data Driven Decision Tools Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
demonstrate that the Collaborative Cyber Understanding software dynamically updates the COP Visualizations and cyber decision models; conduct a soldier evaluation of cyber decision model (cyber workflow/decision making process). ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	-	2.911	3.121

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AR2 / *Energy Informed Operations Advanced 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
AR2: *Energy Informed Operations Advanced Technology*	-	1.864	-	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates software, algorithms, communication and control methodologies that allow more expedient, efficient, and informed use of energy resources across the battlefield. It provides Commanders at all echelons with situational awareness (SA) that allows them to understand and control their power and energy resources to ensure continuous operations of mission equipment and maintain overmatch of adversaries.

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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Expeditionary Energy Informed Operations	1.864	-	-
Description: This effort matures and demonstrates advanced power and thermal management and distribution technologies for command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) applications as well as validates and integrates designs in power generation, hybrid energy storage, and assessments.			
Accomplishments/Planned Programs Subtotals	1.864	-	-

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AR4 / *Intelligent Env Battlefield Awareness Adv Tech*	

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
AR4: *Intelligent Env Battlefield Awareness Adv Tech*	-	0.641	3.138	4.075	-	4.075	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project demonstrates and optimizes technologies to allow Soldiers to maneuver faster around or through existing environmental (urban/industrial) conditions and physical landscape constraints. This effort matures and demonstrates web modules/software tools delivering crucial geo-chemical resources and advanced knowledge of geo-environmental infrastructure to mission planners.

Work in this Project complements PE 0602146A (Network C3I Technology) Project AR3 Intelligent Env Battlefield Awareness 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 U.S. Army Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Geo-Forensics for Reconnaissance Exploitation	0.641	1.503	1.185
Description: This effort provides unique terrestrial patterns to describe and predict the geological, biological, and overall ecological information associated with A2/AD sites from CONUS analogs. ***FY 2021 Plans:*** Demonstrate a software tool to predict soil behavior and its impact to Army maneuver and mobility that will be represented on a geospatial map to be used for mission planning; and mature prediction algorithms of ice structure, permafrost, and freeze/thaw events for sub-Arctic and Arctic terrain across seasons. ***FY 2022 Plans:*** Will mature search algorithms to match global analogs, ?smart? interpolation function, and expand search criteria by desired geochemical characteristics. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle of this effort.			
Title: Arctic Threat Demonstrations	-	1.635	1.284

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AR4 / *Intelligent Env Battlefield Awareness Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Description: This effort matures and demonstrates visualization tools which enable geospatial decisions based on anticipated physical threats, hazards and dependencies posed by terrain and weather extremes in cold regions. ***FY 2021 Plans:*** Integrate sophisticated weather models into high resolution remotely sensed terrain for a platform of terrain state changes such as freeze/thaw, snowmelt, and ice vulnerability to aid in preventing risks to operational effectiveness and efficiency in cold regions. ***FY 2022 Plans:*** Will demonstrate environmental prediction algorithms to accurately assess ice structure, permafrost and freeze thaw events for operational movement. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle of this effort.			
Title: Predictive Geographic Information System (GIS) Mapping (physical) Demonstration ***Description:*** This effort reduces the impact of unknown and changing terrain conditions by automating the integration of disparate datasets and overlays of terrain obstacles producing a high-fidelity map that integrates soil composition, vegetation, hydrology, and permafrost/ice data. ***FY 2022 Plans:*** Will demonstrate a comprehensive database of input and output variables used across terrain (soil, hydrologic, and arctic) models and identify compatible integration points. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle of this effort Starting in FY 2022.	-	-	1.606
Accomplishments/Planned Programs Subtotals	0.641	3.138	4.075

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AR6 / *Understanding the Environment as a Threat Adv Tech*	

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
AR6: *Understanding the Environment as a Threat Adv Tech*	-	2.155	2.706	2.524	-	2.524	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates tools that provide capability to inform the Solider of different routes through a complex urban landscape. Optimizes tools that balance exposure to environmental threats with mission constraints to provide a risk versus reward capability of operating in different areas of the urban theater. This Project matures and demonstrates predictive software accurately integrating the risks of physical, chemical, and biological threats in an urban environment into route planning tools.

Work in this Project complements PE 0602146A (Network C3I Technology) Project AR5 (Understanding the Environment as a Threat 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 Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Environmental Threat Technology Demonstrations for route planning	2.155	1.357	1.340
Description: This effort matures and demonstrates a software tool informing and balancing the risk of exposure to environmental threats with maneuver constraints along potential routes. The software integrates the risks associated with different environmental matrices in complex urban environments and includes the capability for routing in off-road scenarios.			
FY 2021 Plans: Demonstrate threat overlays to synergize battlefield intelligence modules with visualized threats and course forecasting; and provide an interactive simulation environment to evaluate tool performance in urban theaters.			
FY 2022 Plans: Will mature and validate a risk-course forecasting algorithms that account for dynamics and persistence of toxic industrial chemicals and materials (TIC/Ms) in air, water, and soil in denied urban terrain.			
FY 2021 to FY 2022 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AR6 / *Understanding the Environment as a Threat Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Funding change reflects the planned lifecycle of this effort.			
Title: Hazard Prediction Demonstration ***Description:*** This effort matures and demonstrates a mission planning platform that provides Soldiers with a predictive visualization technology to identify, track and plan for industrial or commercial chemical/environmental threats in operational environments. ***FY 2021 Plans:*** Mature predictive software algorithms that integrate air and/or spill releases with water, soil, infrastructures, and sub-terrain domains for immediate and persistent risk assessments; and demonstrate threat overlays to synergize battlefield intelligence and visualize threats across multiple domains (i.e., air, water, soil). ***FY 2022 Plans:*** Will mature and demonstrate developed algorithms that integrate contaminant mobility based on hydrology and soils and the sorption/degradation products. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle of this effort.	-	1.349	1.084
Title: Subsurface Forensics Demonstration ***Description:*** This effort demonstrates sensing technologies for toxic industrial chemicals and materials (TIC/Ms) that are indicative of illicit activities in increasingly complex matrices where testing terminates with authentic wastewater treatment influent. ***FY 2022 Plans:*** Will mature data transmission capabilities from sensor through sewer systems and determine interoperability with commercial off the shelf robotic platforms. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle of this effort starting in FY 2022.	-	-	0.100
Accomplishments/Planned Programs Subtotals	2.155	2.706	2.524

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 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AR6 / *Understanding the Environment as a Threat Adv Tech*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AR8 / *Sensing in Contested Environments Adv Tech*	

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
AR8: *Sensing in Contested Environments Adv Tech*	-	-	0.948	1.611	-	1.611	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced sensor technologies that characterize hazards posed to warfighters by non-weaponized biological hazards in subterranean environments. Demonstrations of adaptive commercial off the shelf sensor technologies on existing UGV platforms to gather end-user feedback.

Work complements PE 0602146A (Network C3I Technology) Project AR7 (Sensing in Contested Environments 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 U.S. Army Engineer Research and Development Center and coordinated with U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Non-Traditional Threat Detection Advance Technology	-	0.948	1.611
Description: This effort matures and demonstrates combined commercial off the shelf capabilities from multiple sources as an integrated robotic-operable expeditionary kit for accurate detection of biological hazards for early warning in subterranean environments from point of ingress/egress prior to exposure. ***FY 2021 Plans:*** Validate candidate sensor technologies for maturity and effectiveness and demonstrate scenarios to detect and characterize of chemical hazards including water quality, heavy metals in soils, air quality, and non-weaponized radiological hazards. ***FY 2022 Plans:*** Will demonstrate an integrated optical sensor platform capable of identification of relevant environmental threats. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	-	0.948	1.611

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 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AR8 / *Sensing in Contested Environments Adv Tech*

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AS9 / *Persistent Geophysical Sensing-Infrasound Adv Tech*	

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
AS9: *Persistent Geophysical Sensing-Infrasound Adv Tech*	-	2.257	4.600	2.448	-	2.448	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates kitted hardware and software solutions that persistently monitor (through non-line-of-sight sensing including infrasound) critical infrastructure conditions and threat activities in dynamic battlefields. These technologies provide near real time data collection, processing, and alerts of infrastructure go/no-go condition required for maneuver planning. This Project also matures and demonstrates methodologies to assign maneuver relevant engineering attributes to geospatial feature data such as bridge load classification, road condition, and bathymetry.

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 conducted at U.S. Army Engineer Research and Development Center and coordinated with U.S. Army Futures Command.

Work in this Project complements PE 0602146A (Network C3I Technology) / Project AR9 (Persistent Geophysical Sensing-Infrasound Tech).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Remote Assessment of Infrastructure for Ensured Maneuver (RAFTER) Demonstrations	2.257	4.600	-
Description: This effort matures and demonstrates a light-weight, low-power, persistent monitoring system that is capable of integration with mission command platforms with associated software for processing geophysical data in near-real-time (with no SME in the loop) to provide actionable intelligence concerning critical transportation assets. ***FY 2021 Plans:*** Mature and demonstrate autonomous geophysical data processing and alerts for decision making using the persistent monitoring system and software in the battlespace; and mature and demonstrate the next generation sensors as part of the autonomous geophysical data processing and alerts for decision making. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding decrease in FY22 reflects planned lifecycle of this effort, completing in FY21.			
Title: Battlefield Intelligence by Geophysical Sensing (BIGS) Demonstration	-	-	2.448
Description: This effort matures and demonstrates geophysical and geo-sensing technologies to persistently assess battlefield elements to include infrastructure (algorithm refinements) and additional sources of interest, such as explosive and fires events			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AS9 / *Persistent Geophysical Sensing-Infrasound Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
and various threats. Optimization of the array sensors and geometry to improve array performance for new sources of interest while reducing logistics will also be matured and demonstrated. New detection and classification signal processing algorithms will be validated throughout the life of the task in a phased demonstration schedule. ***FY 2022 Plans:*** Will mature and validate non-HPC meteorological and terrain/topography overlays for detection thresholds through internal demonstrations before integrating with existing software and will provide configuration updates to Integrated Sensor Architecture (ISA) messaging within the existing software to be compatible with Command Post Computing Environment (CPCE). ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase in FY22 reflects planned lifecycle of this effort, beginning in FY22.			
Accomplishments/Planned Programs Subtotals	2.257	4.600	2.448

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AT3 / *Subterranean Detection and Monitoring Adv Tech*	

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
AT3: *Subterranean Detection and Monitoring Adv Tech*	-	1.016	3.360	2.217	-	2.217	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project validates and demonstrates advanced subterranean monitoring and vulnerability assessment technologies providing mobile and man-portable solutions to enhance survivability and threat awareness during urban operations and negate enemy subterranean operation advantage. This Project also optimizes and demonstrates enhanced technologies to detect tunnels and tunneling activity in complex and varied environments.

This effort complements PE 0602146A (Network C3I Technology) / Project AT2 (Subterranean Detection and Monitoring 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 conducted at U.S. Army Engineer Research and Development Center and coordinated with U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Subterranean Threat Assessment by Real-time Sensing Demonstrations	1.016	3.360	2.217
Description: This effort validates and demonstrates integrated suite of tunnel detection and persistent surveillance technologies, mobile and man-portable solutions to detect underground municipal infrastructure, voids, and other subterranean vulnerabilities in urban and complex domains. ***FY 2021 Plans:*** Validate passive sensor algorithms and sensor installation methods in variable geo-materials; and demonstrate the EMI electromagnetic induction (EMI) transmitter at a live experiment in an appropriate operational environment. ***FY 2022 Plans:*** Will demonstrate an integrated suite of tunnel detection and persistent surveillance technologies to detect subterranean avenues of approach in an operationally relevant urban environment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding decrease in FY22 reflects planned lifecycle of this effort, ending in FY22. Multiple demonstration events and technology maturation occurred in FY21. FY22 will culminate in a single demonstration of multiple technologies (suite of detection technologies).			
Accomplishments/Planned Programs Subtotals	1.016	3.360	2.217

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AT3 / *Subterranean Detection and Monitoring Adv Tech*

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AT8 / *Network-Enabled GeoSpatial-GEOINT Services AdvTech*	

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
AT8: *Network-Enabled GeoSpatial-GEOINT Services AdvTech*	-	3.521	2.888	3.059	-	3.059	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project integrates and demonstrates the geo-registration, feature extraction, change detection, data visualization and transmission capabilities developed in the applied research portion of this effort. Tools developed for the exploitation of 3D datasets will be integrated into a streamlined workflow requiring low levels of expertise, putting advanced processing capabilities in the hands of the Soldier. This effort includes demonstrations of tactical enhancements and the integrated ability to rapidly share mission critical 3D information in support of planning and execution.

Work in this Project complements PE 0602146A (Network C3I Technology) Project AT7 (Network-Enabled GeoSpatial and GEOINT Services 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 U.S. Army Engineer Research and Development Center and coordinated with U.S. Army Futures Command.
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: 3D Terrain Automated Geospatical Co-Registration and Change Detection (Previously: Integration & Demonstration of 3D Data Model Feature Extraction, Geo-registration, Analytical Tool Development & Vis)	3.521	2.888	3.059
Description: This effort matures, integrates and demonstrates the design and formulation of new urban terrain data models, frameworks and processes to automate the transformation of tactical unit generated source data (e.g. LiDAR, imagery, and full motion video derived data) to new model constructs for rapid and accurate geo-registration of features (manmade infrastructure).			
FY 2021 Plans: Demonstrate in a high fidelity laboratory environment successful co-registration of disparate sources of field generated 3D geospatial data for incorporating into the tactical foundation layer terrain dataset.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AT8 / *Network-Enabled GeoSpatial-GEOINT Services AdvTech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will mature, integrate and test digital elevation model co-registration and change detection algorithms providing tactical units rapid access to newly collected 3D terrain data. Will demonstrate the optimization of algorithms for near real time processing, advanced analytics, and 3D data dissemination in a laboratory environment utilizing the Army Geospatial Enterprise Node. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	3.521	2.888	3.059

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AU1 / *Tactical GeoSpatial Information Capabilities ATech*	

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
AU1: *Tactical GeoSpatial Information Capabilities ATech*	-	1.929	3.603	4.207	-	4.207	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates next generation geospatial analytical tools for 3D complex environments applicable to low echelon and tactical edge exploitation. These new capabilities will allow deployed units to enhance/update provisioned (baseline) standard, sharable, geospatial foundation (SSGF) data through automated analytics on multi-sourced spatial data resulting in streamlined, high fidelity terrain analysis products. Reducing data gaps and processing timelines will greatly increase Soldier situational awareness and support faster decision making in complex terrain.

Work in this Project complements PE 0602146A Network C3I Technology Project AT9 (Tactical GeoSpatial Information Capabilities 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 U.S. Army Engineer Research and Development Center and coordinated with U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: 3D Terrain Analysis	1.255	3.064	2.230
Description: This effort integrates and demonstrates software models and workflows provisioned on the geospatial and GEOINT workstations for improved capabilities to generate, process and exploit terrain products enabling situational awareness and rapid decision making at the tactical edge.			
FY 2021 Plans: Develop and demonstrate enhanced terrain processing for generating a high resolution foundation feature layers providing enhanced situational awareness through new tactical terrain products supporting the Distributed Common Ground Station - Army.			
FY 2022 Plans: Will demonstrate advanced terrain data processing capabilities, followed by toolkit testing and delivery, targeted for the Distributed Common Ground System (DCGS-A). Will test automated feature extraction and faster processing times for higher-resolution data sources. Will demonstrate enhanced terrain processing tools providing highly accurate, tactical scale decision aids supporting situational awareness, actionable maneuver and force protection in complex terrain through an enhanced geospatial feature layer of combined dense terrain and external image sources.			
FY 2021 to FY 2022 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AU1 / *Tactical GeoSpatial Information Capabilities ATech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Funding change reflects the planned lifecycle of this effort.			
Title: Previously Advanced Airborne LiDAR	0.674	0.539	1.977
Description: This effort integrates and demonstrates enhanced Geiger-mode LiDAR hardware/software, for advanced testing of protocols, equipment, and products for enhanced high-altitude/wide area terrain data collection, to support tactical operations. ***FY 2021 Plans:*** Demonstrate (through analysis of FY2020 flight campaign results) a performance assessment of various hardware components (laser, scanner, and detector) being matured to reduce risk for airborne LIDAR prototypes. ***FY 2022 Plans:*** Will mature new airborne LIDAR sensors signal processing algorithms to increase collection speed and enhance terrain feature collection accuracy providing evolutionary improvements to airborne collection of enhanced 3D urban data with expanded area coverage and decreased workflow timelines. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase in Fiscal Year 2022 will support maturation efforts in advance of demonstrations and transitions in Fiscal Year 2023.			
Accomplishments/Planned Programs Subtotals	1.929	3.603	4.207

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AU2 / *Optimization of Geospatial Data for Visualization*	

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
AU2: *Optimization of Geospatial Data for Visualization*	-	-	2.022	2.171	-	2.171	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project develops and demonstrates new open source software defined data models, and establishes an architecture to provide correct (mission context) geospatial content to the end-user consistent with device, tactical assessment/need, available bandwidth, and user movement. Advanced software and processes will reduce file size and network requirements, enabling near real-time updates to Soldiers. Resulting 3D foundation data and associated accuracy information will enable position and navigation determination, through analysis with a variety of Soldier and vehicle borne sensors.

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 U.S. Army Engineer Research and Development Center and coordinated with U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Optimization of Geospatial Data for Tactical Visualization-Demonstration	-	2.022	2.171
Description: This effort matures and demonstrates new open source software, data models and processes to generate a vision-based geospatial foundation layer to enable end-users systems to visualize real-time mission critical geospatial content at the required level-of-detail (LOD) and enable position-navigation self-localization capability applicable to end-user devices at required accuracies optimized for the device, application, and mission. ***FY 2021 Plans:*** Mature and demonstrate full motion video (FMV) to 3D data processing algorithm achieving geometric accuracy of terrain and infrastructure for integration into the tactical unit's geospatial foundation layer. ***FY 2022 Plans:*** Will demonstrate push of tactically relevant GEOINT to mobile devices, with consideration paid to factors determining level of detail and new 3D data representation selected to minimize bandwidth. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	-	2.022	2.171

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AU2 / *Optimization of Geospatial Data for Visualization*

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AU4 / *Geospatially Enabled Operational Design Adv Tech*	

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
AU4: *Geospatially Enabled Operational Design Adv Tech*	-	4.610	7.905	7.956	-	7.956	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project demonstrates, integrates and transitions to the Army Command Post Computing Environment, a geospatially enabled collaborative planning environment, accessible across echelons, with capabilities that support Army Design Methodology (ADM) by providing the ability to perform conceptual planning and problem framing, supporting a greater understanding and visualization of the dynamic operational environment, a shared understanding of the operations purpose across echelons, and enhanced products to drive detailed budget planning and operational assessment processes, enhancing the collaborative interaction between commanders, staffs, and unified action partners.

Work in this Project complements PE 0602146A (Network C3I Technology) Project AU3 (Geospatially Enabled Operational Design 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 U.S. Army Engineer Research and Development Center and coordinated with U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Geospatially Operational Design (GEOD) - Demonstration (Previously Virtual Collaborative Operational Design Demonstrations)	2.233	7.905	7.956
Description: This effort integrates and demonstrates automation technologies to digitally visualize, create and assess critical elements of the Operational Environment required to inform the Operational Design functions, including collaborative conceptual framing of the problem.			
FY 2021 Plans: Mature and demonstrate analytics and tools for framing an operational environment (OE), facilitating models that represent the current conditions of the OE (current state) and models that represent what the OE should resemble (represent) at the conclusion of an operation (desired end state); and demonstrate a suite of automated data aggregation, analysis and visualization algorithms that perform operational assessments to compare planning criteria against current estimates enabling continuous updates of planning staff running estimates.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AU4 / *Geospatially Enabled Operational Design Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will demonstrate tools to support Army Design Methodology (ADM) to frame the problem and visualize the desired end state in a geospatial context. Will evaluate a suite of data visualization capabilities that allow commanders and staffs to bridge conceptual planning to deliberate planning at echelons down to battalion. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle of this effort.			
Title: Tactical Data Analysis and Visualization Demonstration ***Description:*** This effort integrates and demonstrates a suite of automated data aggregation analysis and visualization capabilities allowing commanders and staffs the capability to bridge conceptual planning (ADM) to deliberate planning at echelons down to battalion.	2.377	-	-
Accomplishments/Planned Programs Subtotals	4.610	7.905	7.956

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AU6 / *Automated Analytics for Operational Environment AT*	

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
AU6: *Automated Analytics for Operational Environment AT*	-	1.593	-	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project demonstrates advanced technologies to understand and visualize threat patterns and operational environment changes and support mission planning by contextualizing results based on battlefield conditions and on hidden patterns discovered and merged from textual reporting. Work supports the Common Operating Environment LOE.

Work in this Project complements PE 0602146A (Network C3I Technology) Project AU5 (Automated Analytics for Operational Environment).

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 U.S. Army Engineer Research and Development Center and coordinated with U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Simultaneous Multi-Domain Data Representation ***Description:*** This effort demonstrates advanced capabilities to provide commanders and staffs with the ability to understand and operate in multiple domains simultaneously, utilizing data representations and algorithms to seamlessly track the enemy, determine patterns of behavior or actions, identify operational environment changes, and support mission planning by contextualizing results from textual data analysis based upon battlefield conditions.	0.593	-	-
Title: Automated Analysis of Multi-Domain Data ***Description:*** This effort demonstrates data models to support automated sense making and analysis and advanced relevancy ranking approaches to identify and prioritize knowledge gaps and contextualized results.	1.000	-	-
Accomplishments/Planned Programs Subtotals	1.593	-	-

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 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AU6 / *Automated Analytics for Operational Environment AT*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AV1 / *GEOInt/Ops Logistics Integration-Planning Adv Tech*	

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
AV1: *GEOInt/Ops Logistics Integration-Planning Adv Tech*	-	-	3.771	3.867	-	3.867	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates a suite of analytical and visualization tools designed to facilitate analysis of courses of action (COAs) through modeling and simulation (M&S) and wargames to support development of alternate COAs and approval of the operational plan (OPLAN). This Project will integrate existing M&S and wargaming applications (One Semi-Automated Forces; Infantry Warrior Simulation ; Logistics Composite Model), to assess multiple courses of action to be analyzed in a multi-domain environment.

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 U.S. Army Engineer Research and Development Center and coordinated with U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Integration of intel and logistics Multi Echelon Planning	-	3.771	3.867
Description: This effort demonstrates a suite of analytical and visualization tools designed to facilitate analysis of multiple courses of action through M&S and wargames to support development of alternate COAs and approval of the operational plan. ***FY 2021 Plans:*** Optimize application programming interfaces (APIs) that allow automated ingestion of data into M&S and war-game applications and then back into mission planning software. ***FY 2022 Plans:*** Will demonstrate automated analysis and synchronization of multiple courses of action with modeling and simulation (M&S) and war-games, streamlining the course of action (COA) comparison and approval processes, and ultimately the operational plan approval. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	-	3.771	3.867

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AV1 / *GEOInt/Ops Logistics Integration-Planning Adv Tech*

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AV2 / *LEO Advanced 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
AV2: *LEO Advanced Technology*	-	1.891	1.949	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022, funding is realigned to:
PE 0603463A (Network C3I Advanced Technology) CJ8 (Assured PNT Communications Advanced Tech)
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A. Mission Description and Budget Item Justification

This Project matures Low Earth Orbit (LEO) constellation management for space order-of-battle architectures and protocols. The advanced technology development will involve using two spacecraft and will leverage commercial LEO mega-constellation investments to develop capabilities, which support direct sensor-to-shooter data links while under control by a maneuver battalion commander. Technology will be optimized to enable communications and deep strikes in contested environments. This Project supports the Army's efforts to proliferate and control space assets to support the tactical ground commander. It includes exploration efforts to augment missile warning, Global Positioning System (GPS), and global communications.

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 US Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT) Technical Center in Huntsville, AL and the Defense Advanced Research Projects Agency (DARPA), Arlington, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Payload Technology Development	1.891	1.949	-
Description: Mature the technology for Low Earth Orbit satellites. Payload integration will be validated as well as the architectureand design of two LEO satellites for support to an Army tactical commander. ***FY 2021 Plans:*** Will mature LEO constellation management technologies. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funds realigned to PE 0603463A (Network C3I Advanced Technology) CJ8 (Assured PNT Communications Advanced Tech) in FY2022.			
Accomplishments/Planned Programs Subtotals	1.891	1.949	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AV2 / *LEO Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AV4 / *Foundational S&T for Network C3I Advanced Tech*	

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
AV4: *Foundational S&T for Network C3I Advanced Tech*	-	-	2.068	7.751	-	7.751	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates underlying technologies applicable to artificial intelligent agents and holistic network integration as applied to, but not limited to autonomous manned-unmanned teaming for ground and air platforms. This Project also matures and demonstrates emerging research leading to potential technology development in areas of strategic importance to the Army in network technologies, by bringing competitively selected Universities with research teams into Technical Alliances.

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

Work in this Project is performed by the Army Futures Command (AFC).

This work is done in coordination with PE 0602146A (Network C3I Technology), Project AV3 (Foundational S&T for Network C3I Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Demonstration of emerging technologies for holistic network integration	-	2.068	-
Description: This effort matures and demonstrates underlying technologies applicable to next generation networks and integration of the same.			
FY 2021 Plans: Will mature and demonstrate emerging technologies from the sister 6.2 effort focusing on Autonomy, Artificial intelligence/Machine Learning as applicable to, but not limited to, holistic network integration; and investigate Autonomy-related machine learning technologies, advanced teaming, and navigation/routing necessary for the Ground and Air platforms in support of the Army Modernization Priorities.			
FY 2021 to FY 2022 Increase/Decrease Statement: Funding from the effort was realigned to planned Enabling University Advanced Development (Air Platform, NC3I, and Soldier) effort executed by AFC University Technology Development Division under PE 0603042A (C3I Advanced Technology) Project CN3 (Network Enabling University Adv Development), PE 0603043A (Network C3I Advanced Technology) Project CL4 (Air			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AV4 / *Foundational S&T for Network C3I Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Platform Enabling University Adv Development), and PE 0603044A (Soldier Advanced Technology) Project CN8 (Soldier Enabled University Advanced Development).			
Title: Demonstration of Disruptive, Innovative Research for Emerging (DIRE) Advanced Network Capabilities ***Description:*** This effort demonstrates innovative network capabilities using a rapid and agile methodology to evaluate the feasibility of incorporation into Army network problem sets. ***FY 2022 Plans:*** Will demonstrate and evaluate innovative emerging technologies focusing on network resiliency, artificial intelligence, and autonomy enabled machine learning technologies that will be integrated into a holistic network in support an MDO enabled environment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22, funding for this effort increases to support the rapidly changing need for innovative network solutions to an all domain battlefield. Funding was realigned from Abrams Recapitalization, APE GA0750000, Abrams Upgrade Program.	-	-	7.751
Accomplishments/Planned Programs Subtotals	-	2.068	7.751

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AV8 / *Navigation Warfare (NAVWAR) Advanced 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
AV8: *Navigation Warfare (NAVWAR) Advanced Technology*	-	5.707	2.535	1.927	-	1.927	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates capabilities allowing the Army to monitor, understand, and control the Navigation Warfare (NAVWAR) environment. This requires an integrated approach to Electronic Protection (EP), Electronic Support (ES), and Electronic Attack (EA) to rapidly characterize the NAVWAR environment, deny Positioning, Navigation, and Timing (PNT) based capabilities to our adversaries, and maintain Army capabilities.

Work accomplished under Program Element (PE) 0602146A Project AW1 (Autonomous Navigation Technology) complements this effort.

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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: NAVWAR for Ground Soldiers ***Description:*** This effort matures and demonstrates capabilities allowing the Army to monitor, understand, and control the NAVWAR environment. This requires an integrated approach to Electronic Protection (EP), Electronic Support (ES), and Electronic Attack (EA) to rapidly characterize the NAVWAR environment, deny PNT based capabilities to our adversaries, and maintain Army capabilities.	5.707	-	-
Title: PNT Situational Awareness (SA) Advanced Technology ***Description:*** This effort demonstrates real time PNT Situational Awareness for a Common Operating Picture (COP) on selected Computing Environment (CE); improves fusion algorithms for at least two types of PNT SA sensors (terrestrial, air, space); generates an Interface Control Document (ICD) for PNT SA messages; allow open integration and reference implementation for PNT SA stored data for distribution on various platforms. ***FY 2021 Plans:***	-	2.535	1.927

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AV8 / *Navigation Warfare (NAVWAR) Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Select and demonstrate simulated aggregation of multi-domain sensor data into Computing Environment; improve current emitter characterization techniques/algorithms, and optimize data fusion software. ***FY 2022 Plans:*** Will incorporate high altitude sensor data to take advantage of the unique performance characteristics of existing sensors in different domains. Improve existing PNT Situational Awareness (SA) Initial Capabilities Document (ICD) to make use of multidimensional data fields. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned life cycle of this effort			
Accomplishments/Planned Programs Subtotals	5.707	2.535	1.927

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AW2 / *Autonomous Navigation Advanced 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
AW2: *Autonomous Navigation Advanced Technology*	-	0.280	-	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project will leverage Assured Positioning, Navigation, and Timing (PNT) efforts. It improves localization and decision making of Robotic/Autonomous Systems by optimizing use of sensors on the platform and taking advantage of all available navigation signals.

Work in this Project complements PE 0602146A Project AW1 Autonomous Navigation 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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Autonomous Navigation ***Description:*** This effort leverages Assured PNT efforts and improves localization and decision making of Robotic/Autonomous Systems by optimizing use of sensors on the platform and taking advantage of all available navigation signals.	0.280	-	-
Accomplishments/Planned Programs Subtotals	0.280	-	-

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 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AW4 / *DoD PNT M&S Collaborative Initiative (CI) Adv Tech*			
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**
AW4: *DoD PNT M&S Collaborative Initiative (CI) Adv Tech*	-	2.796	2.888	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Effort concluded in Fiscal Year (FY) 2021. No funding request for FY 2022.

A. Mission Description and Budget Item Justification

This Project matures, demonstrates and performs modeling and simulation (M&S) of Positioning, Navigation, and Timing (PNT) technologies to provide access to trusted PNT information in global positioning system (GPS) denied or degraded environments.

Work in this Project complements PE 0602146A (Network C3I Technology) Project AW3 (DoD PNT M&S Collaborative Initiative 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 U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: DoD PNT M&S Collaborative Initiative (CI)	2.796	2.888	-
Description: This effort matures, demonstrates and performs modeling and simulation (M&S) of PNT technologies to provide access to trusted PNT information in global positioning system (GPS) denied or degraded environments. ***FY 2021 Plans:*** Conduct a final demonstration of the matured system to Tri-Service Stakeholders of a PNT M&S capability performing force effectiveness analysis of candidate PNT technologies. This demonstration documents how the candidate PNT Technologies impacted operational mission effectiveness in a specific scenario. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Effort concludes as planned in FY21.			
Accomplishments/Planned Programs Subtotals	2.796	2.888	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AW4 / *DoD PNT M&S Collaborative Initiative (CI) Adv Tech*

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AW6 / *Modular GPS Independent Sensors Advanced Tech*	

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
AW6: *Modular GPS Independent Sensors Advanced Tech*	-	-	10.684	6.813	-	6.813	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022, funding is realigned to:
Program Element (PE) 0603002A (Medical Advanced Technology) Project MM9 (Tech Base/Enabling Rsrch for Infect Dis Adv Tech).

A. Mission Description and Budget Item Justification

This Project matures and demonstrates a resilient, soldier-integrated precision navigation and timing solution, providing precision geolocation, geospatial survey information, global positioning system (GPS) spoofing awareness and countermeasures to dismounted warfighters in GPS-denied/degraded environments.

Work accomplished under Program Element (PE) 0602146A (Network C3I Technology) Project AW5 (Modular GPS Independent Sensors Technology) complements this effort.

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: Soldier-Integrated PNT	-	10.684	6.813
Description: This effort implements a standards-based, open Positioning, Navigation, and Timing (PNT) architecture solution for rapid commercial of the shelf (COTS) and emerging technology integration; incorporates artificial intelligence approaches to aggregate multiple organic and networked sensor inputs for improved PNT accuracy and reliability; demonstrates Simultaneous Localization and Mapping (SLAM) based-algorithms incorporating alternative PNT inputs; and demonstrates alternative PNT sensors and approaches, including radio frequency time differencing, signals of opportunity, inertial, gravimetric, and imagery.			
FY 2021 Plans: Validate initial Soldier-Integrated PNT technologies based on an open architecture that incorporates multiple sensors and algorithmic approaches; validate and optimize multiple types of alternative PNT sensors sourced through a technology discovery process; optimize a modular, open PNT sensor fusion architecture and algorithm optimization for dismounted soldiers; and			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AW6 / *Modular GPS Independent Sensors Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
integrate and demonstrate modular Soldier-Integrated-PNT technologies and initial interfacing with a soldier form factor display device. ***FY 2022 Plans:*** Will continue to validate, and integrate, initial Soldier-Integrated PNT technologies through technology discovery with Army Applications Lab and maturation of commercial systems. Will mature PNT interfaces and messaging necessary to distribute accurate position and timing across wirelessly-connected soldier-borne component. Will improve the performance of vision aided navigation utilizing artificial intelligence techniques and assess existing spoof-detection algorithms for integration. Will optimize size, weight, and power (SWAP) of anti-jam antennas for dismounted users. Will integrate and demonstrate interoperability of modular, alternative PNT sensors with existing Army dismounted PNT systems. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding was realigned to Program Element (PE) 0603002A (Medical Advanced Technology) Project MM9 (Tech Base/Enabling Rsrch for Infect Dis Adv Tech). Mature techniques to improve position in GPS-denied/degraded environments utilizing radio frequency time differencing will not be accomplished due to the realignment.			
Accomplishments/Planned Programs Subtotals	-	10.684	6.813

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 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) BP4 / *ELECTRONIC WARFARE ADVANCED TECHNOLOGIES (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**
BP4: *ELECTRONIC WARFARE ADVANCED TECHNOLOGIES (CA)*	-	39.000	64.800	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Congressional Interest Item funding provided for Electronic Warfare Advanced Technologies.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Electronic Warfare Advanced Technologies.

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: Unmanned Aerial Systems and Aerostat Operations ***FY 2020 Accomplishments:*** Congressional Interest Item.	4.000	-
Congressional Add: Sensor Advanced Technology ***FY 2020 Accomplishments:*** Congressional Interest Item.	10.000	-
Congressional Add: Assured Position, Navigation, and Timing Technology ***FY 2020 Accomplishments:*** Congressional Interest Item. ***FY 2021 Plans:*** Conduct advanced research in Assured Position, Navigation, and Timing Technology. Work executed by Army Futures Command.	9.000	6.300
Congressional Add: Payload and Ground Segment Research and Development for Small Satellite Science and Security Applications ***FY 2020 Accomplishments:*** Congressional Interest Item.	5.000	-
Congressional Add: Urban Subterranean Mapping Technology	3.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** BP4 / *ELECTRONIC WARFARE ADVANCED TECHNOLOGIES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
FY 2020 Accomplishments: Congressional Interest Item. Program Increase to support advanced research on Urban Subterranean Mapping Technology.		
Congressional Add: Anticipating Threats to Natural Systems ***FY 2020 Accomplishments:*** Congressional Interest Item. Program Increase to support advanced research on Anticipating Threats to Natural Systems.	6.000	-
Congressional Add: Army Visual and Tactical Arctic Reconnaissance ***FY 2020 Accomplishments:*** Congressional Interest Item. Program Increase to support advanced research on Army Visual and Tactical Arctic Reconnaissance. ***FY 2021 Plans:*** Conduct advanced research in Army Visual and Tactical Arctic Reconnaissance. Work executed by Army Futures Command.	2.000	2.000
Congressional Add: Program increase - anticipating threats to natural systems ***FY 2021 Plans:*** Conduct advanced research in Anticipating Threats to Natural Systems. Work executed by Army Futures Command.	-	6.000
Congressional Add: Program increase - S?UAS cyber threat management ***FY 2021 Plans:*** Conduct advanced research in S-UAS Cyber Threat Management. Work executed by Army Futures Command.	-	7.500
Congressional Add: Program increase - sub?surface infrastructure in arctic environments ***FY 2021 Plans:*** Conduct advanced research in Sub-Surface Infrastructure in Arctic Environments. Work executed by Army Futures Command.	-	1.000
Congressional Add: Program increase - mesh network-enabled small satellites ***FY 2021 Plans:*** Conduct advanced research in Mesh Network-Enabled Small Satellites. Work executed by Army Futures Command.	-	10.000
Congressional Add: Program increase - geospatial artificial intelligence analytic tools	-	4.000

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** BP4 / *ELECTRONIC WARFARE ADVANCED TECHNOLOGIES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
FY 2021 Plans: Conduct advanced research in Geospatial Artificial Intelligence Analytical Tools. Work executed by Army Futures Command.		
Congressional Add: Program increase - advanced materials and technologies for command post modernization ***FY 2021 Plans:*** Conduct advanced research in Advanced Materials and Technologies for Command Post Modernization. Work executed by Army Futures Command.	-	10.000
Congressional Add: Program increase - advanced materials for resilient sensors ***FY 2021 Plans:*** Conduct advanced research in Advanced Materials for Resilient Sensors. Work executed by Army Futures Command.	-	8.000
Congressional Add: Program increase - tactical geospatial information capabilities ***FY 2021 Plans:*** Conduct advanced research in Tactical Geospatial Information Capabilities. Work executed by Army Futures Command.	-	10.000
Congressional Adds Subtotals	39.000	64.800

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) CF9 / *Automated IPB Adv Tech*	

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
CF9: *Automated IPB Adv Tech*	-	-	-	0.989	-	0.989	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022 this Project was realigned from Program Element (PE) 0603463A (Network C3I Advanced Technology) Project AU6 (Automated Analytics for Operational Environment AT).

A. Mission Description and Budget Item Justification

This Project will mature and demonstrate advanced algorithms for multi-domain visualization of explicit and implicit relationships between the populace and the theater environment. Capabilities resulting from this effort will directly and substantially support Army and Joint Global Integration Planning requirements, provide a globally accessible web based digital intelligence preparation of the battlefield (IPB) platform supporting collaborative product development, and help facilitate a shared understanding of the operational environment. Automated IPB provides an integrated Intelligence Community planning data platform for Joint Global Integration Planning requirements.

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 U.S. Army Engineer Research and Development Center and coordinated with U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Automated IPB Demonstrations	-	-	0.989
Description: This effort develops and demonstrates a collaborative, adaptive planning capability that allows planners to employ resources leveraging geospatial, terrain, environmental effects, and authoritative data from distributed information databases in order to collaborate in the development and assessment of courses of action, visualize potential outcomes, make decisions and develop and disseminate plans and orders. ***FY 2022 Plans:*** Will design and demonstrate algorithms for advanced, multi-domain visualization of explicit and implicit relationships between the populace and the theater environment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In Fiscal Year (FY) 2022, funding for this effort is realigned fromPE 0603463A Project AU6 (Automated Analytics for Operational Environment AT).			
Accomplishments/Planned Programs Subtotals	-	-	0.989

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** CF9 / *Automated IPB Adv Tech*

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) CI7 / *Mobile & Survivable Command Post (MASCP) Adv Tech*	

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
CI7: *Mobile & Survivable Command Post (MASCP) Adv Tech*	-	-	-	7.809	-	7.809	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022 funding is realigned from:
PE 0603463A (Network C3I Advanced Technology) Projects AQ1 (Spectrum Obfuscation Advanced Technology), AQ5 (Sensor CE-Integrated Sensor Architecture Adv Tech), AQ8 (High Tempo Data Driven Decision Tools Adv Tech), AM9 (Protected SATCOM Advanced Technology)
PE 0602213A (C3 Applied Cyber) Project CY8 (Cyber Security App Research and Exper Partner Tech)
PE 0602146A (Network C3I Technology) Project AV6 (Airborne Engineering Support Technology)

A. Mission Description and Budget Item Justification

The Project matures and demonstrates technologies to support scalable, survivable, mobile Command Posts (CP). Technologies addressed will use the Brigade CP as a baseline while providing the opportunity for solutions to scale up or down to Army tactical echelons. Work in this project includes integrating anti-jam (AJ) and low probability of intercept (LPI)/low probability of detection (LPD) communications focused on enabling the CP to disperse, form & reform, and employ technologies for signal remoting; optimizing power generation and storage for distributed CP operations; reducing computing infrastructure footprint, SWAP, manpower, and complexity; maturing technologies to reduce CP emissions and have situational awareness of those signatures to improve CP node employment; maturing electro-magnetic spectrum (EMS) emulation technologies to improve survivability options; and optimizing emerging electronic-textiles and composite materials for CP structures.

Work in this Project complements PE 0602146A (Network C3I Technology), Project CI3 (Mobile and Survivable Command Post (MASCP) Tech).
The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: CP Modularity and Dispersion Advanced Technology	-	-	3.477
Description: Increases the ability for Commanders to move and disperse the CP through improved intra-CP communications, modular CP hardware to include distributed power systems, and network solutions leveraging open systems architectures to support information flow in distributed, intermittent, and latent (DIL) environments. This effort will eliminate centralized points of failure and critical nodes that constrain CP mobility and survivability. Areas of technology development include be distributed			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** CI7 / *Mobile & Survivable Command Post (MASCP) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
tactical cloud architecture, mesh network security architecture, high performance computing, integrated power, and distributed collaborative technologies. ***FY 2022 Plans:*** Will optimize subsystems of a wireless antenna remoting capability based on the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) Electronic Warfare (EW) Open Suite of Standards (CMOSS); improve the performance of highly directional transport using wireless antenna remoting with AJ and LPD to send and receive information between a command node and the remote site; optimize component design of small power generation, storage technology, and onboard vehicle power technologies to enable distributed command post operations; validate and optimize hardware and software components to support distributed CP computing. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22 funding is realigned from PE 0603463A Projects AQ5 (Sensor CE-Integrated Sensor Architecture Adv Tech), AQ8 (High Tempo Data Driven Decision Tools Adv Tech); PE 0602213A (C3I Applied Cyber) Project CY8 (Cyber Security App Research and Exper Partner Tech); and PE 0602146A (Network C3I Technology) Project AV6 (Airborne Engineering Support Technology).			
Title: Signature Management and Reduction Advanced Technology ***Description:*** Provides advanced technologies to reduce and manage electromagnetic spectrum signatures of CP platforms and command post components. ***FY 2022 Plans:*** Will mature a sensor-based radio frequency (RF) awareness tool that will allow friendly Commanders to see and understand their emission posture; validate the performance of sensors to detect RF emissions; optimize and demonstrate a software application providing situational awareness of CP emission status. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** FY22 funding is realigned from PE 0603463A AM9 (Protected SATCOM Advanced Technology).	-	-	0.407
Title: Advanced Technology Supporting Camouflage, Concealment, and Deception ***Description:*** This effort demonstrates innovative camouflage, concealment and deception technologies, for expeditionary assets (i.e. mission command platforms, battle management centers and supporting equipment), in order to defeat advanced and emerging adversary Intelligence, Surveillance and Reconnaissance (ISR) threats, and to reduce the probability of detection in multi-domain operations. Matures physics-based models for material and system performance that support probability of detection metrics in the multi-domain operational environment. ***FY 2022 Plans:***	-	-	3.925

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** CI7 / *Mobile & Survivable Command Post (MASCP) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will demonstrate the ability to provide electromagnetic shielding for complexed shelters, while maintaining radio frequency shielding performance, large format advanced camouflage solutions, and demonstrator physical asset with signatures; mature inflatable technologies and protection material solutions and demonstrate these capabilities in support of rapidly deployable CPs; mature and integrate mobile camouflage capabilities to mitigate CP vulnerability; mature and demonstrate use of EMS emulations on autonomous systems. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22 funding is realigned from PE 0603463A Project AQ1 (Spectrum Obfuscation Advanced Technology).			
Accomplishments/Planned Programs Subtotals	-	-	7.809

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 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) CJ8 / *Assured PNT Communications Advanced Tech*	

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
CJ8: *Assured PNT Communications Advanced Tech*	-	-	-	16.438	-	16.438	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In FY 2022, funding is realigned to this Project from Program Element (PE) 0603463A (Network C3I Advanced Technology Project AO6 (Tag, Track and Locate Small Satellites Adv Tech).

A. Mission Description and Budget Item Justification

Tactical Land Component Forces require access to Space and High Altitude (HA) capabilities to enable force protection and maneuver during Multi-Domain Operations (MDO). Space and High Altitude sensors provide resilient communications, Assured Positioning, Navigation, and Timing (APNT) and deep sensing capabilities required in the targeting process to enable rapid and responsive sensor-to-shooter applications to engage and defeat Anti-Access/Area Denial (A2/AD) forces.

APNT Communications Advanced Technology PE will provide prototyping, development, and experimentation of HA sensors and Tactical Space Layer (TSL) sensors (electro-optical, synthetic aperture radar (SAR), and radio frequency) which are designed to provide wide-area, responsive deep area sensing required for beyond line of sight (BLOS) targeting and force maneuver, significantly reducing Sensor to Shooter (S2S) timelines. APNT Advanced Technology PE matures, demonstrates, and integrates lightweight materials, hardware components with reduced power consumption, and advanced data collection, processing, and dissemination capabilities. Also improves algorithms that process space and near space sensor data in real and near real time for integration into battlefield operating systems.

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 Space and Missile Defense Command (USASMDC) Technical Center (TC).

Work in this Project complements PE 0602146A (Network C3I Technology) Projects CK1 (Assured PNT Enabling Technologies) and CG3 (Assured PNT Communications Applied Research).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Assured Positioning Navigation and Timing (APNT) Communications Advanced Technology	-	-	16.438
Description: This effort matures and demonstrates technologies required for smaller, more responsive and direct access to space and HA deep-sensing sensors and tactical communication capabilities for soldiers at the tactical edge. Work will augment, improve, exploit, and optimize existing commercial and DoD technologies and networks. Work supports Army Modernization Priorities."			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
This effort will validate software, hardware, and algorithms used to enable Space-Based and HA platform based capabilities in support of the Army's Modernization Priorities. This effort will exploit commercial advances and opportunities in integrating Space/ HA sensors or Deep Sensing capabilities and payload management toward future Army concepts. Develop/demonstrate critical technical elements for a LEO-based global high-speed network backbone enabling highly networked, resilient, and persistent DoD payloads to provide over the horizon sensing, signals, and communication, with continuous surveillance of ground, surface, and air domains. ***FY 2022 Plans:*** Will demonstrate systems during joint exercises; demonstrate a sensor designed to provide space-based situational awareness to the tactical Warfighter; develop and demonstrate small satellite capabilities, which include classified payloads, to provide APNT services to the tactical ground component Warfighters; exploit a constellation of space-based sensors that provide Tactical ISR (Intelligence, Surveillance, and Reconnaissance) and Situational Awareness (SA) to the ground force commander to support MDO; develop and demonstrate optical communications for Quantum Entanglement (QE);develop and demonstrate QE including site-to-site communications from a small satellite in Space or High Altitude platform; and mature the QE technology and demonstrate optical and quantum signals passed between small spacecraft, HA platforms, and/or Space (or HA) to ground. Will complete assembly, integration, testing, and conduct a technology demonstration event; and participate in joint exercises, culminating with TRL 5 payload technology demonstration in an operational environment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funds transitioned from PE 0603463A A06 (Tag, Track and Locate Small Satellites) in FY2022. New start in FY2022.			
Accomplishments/Planned Programs Subtotals	-	-	16.438

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A