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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army											Date: March 2023	
Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 2: Applied Research					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology							
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	161.759	212.115	81.618	-	81.618	83.477	75.474	67.432	70.609	0.000	752.484
AM6: Modular RF Communications Technology	-	-	-	5.986	-	5.986	8.318	-	-	-	0.000	14.304
AM8: Protected SATCOM Technology	-	1.639	-	6.599	-	6.599	11.997	3.652	2.234	-	0.000	26.121
AN3: Non Traditional Waveforms Technology	-	0.474	3.415	14.000	-	14.000	5.487	9.846	7.456	2.026	0.000	42.704
AN7: COE - Every Receiver is a Sensor Technology	-	2.401	2.543	1.044	-	1.044	-	-	2.120	2.143	0.000	10.251
AN9: UNT - Every Receiver is a Sensor Technology	-	1.891	2.074	2.115	-	2.115	2.115	2.118	-	-	0.000	10.313
AO2: Stand-In Advanced RF Effects (STARE)	-	1.899	-	-	-	-	-	-	-	-	0.000	1.899
AO4: Energy Efficient Devices Technology	-	5.501	5.480	5.589	-	5.589	5.645	5.652	5.656	5.717	0.000	39.240
AP5: Electronic Warfare Technology	-	2.821	5.246	5.355	-	5.355	5.389	2.873	2.874	2.906	0.000	27.464
AQ2: EW Techniques Technology	-	0.476	0.532	0.541	-	0.541	3.694	3.699	-	-	0.000	8.942
AQ7: High Tempo Data Driven Decision Tools Technology	-	-	1.289	1.306	-	1.306	2.351	2.354	4.157	7.664	0.000	19.121
AR1: Robust, Resilient and Intelligent C3I Technology	-	10.127	-	-	-	-	-	-	-	-	0.000	10.127
AR3: Intelligent Environmental Battlefield Awareness	-	2.947	-	-	-	-	-	-	-	-	0.000	2.947
AR5: Understanding the Environment as a Threat Technology	-	1.884	1.314	-	-	-	0.404	3.314	2.149	1.647	0.000	10.712

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2040: Research, Development, Test & Evaluation, Army / BA 2: Applied Research					PE 0602146A / Network C3I Technology							
AR7: Sensing in Contested Environments Technology	-	1.149	-	-	-	-	-	-	-	-	0.000	1.149
AR9: Persistent Geophysical Sensing-Infrasound Tech	-	3.290	-	-	-	-	-	-	-	-	0.000	3.290
AT7: Network-Enabled GeoSpatial-GEOINT Services Tech	-	4.466	3.137	2.555	-	2.555	3.537	2.091	-	-	0.000	15.786
AT9: Tactical GeoSpatial Information Capabilities Techn	-	1.711	0.518	2.717	-	2.717	2.065	1.906	2.523	5.550	0.000	16.990
AV3: Foundational S&T for Network C3I Technology	-	4.487	0.743	-	-	-	-	-	-	-	0.000	5.230
AV5: Protective Technologies	-	7.273	6.428	6.553	-	6.553	6.620	6.628	6.632	6.704	0.000	46.838
AV7: Atmospheric Modeling and Meterological Technology	-	5.714	-	-	-	-	-	-	-	-	0.000	5.714
AV9: Advanced PNT for GPS Independent Environments Tech	-	9.747	8.850	9.022	-	9.022	8.796	8.754	8.759	8.854	0.000	62.782
AW1: Autonomous Navigation Technology	-	1.990	2.052	-	-	-	-	-	1.007	4.823	0.000	9.872
AW5: Modular GPS Independent Sensors Technology*	-	-	-	-	-	-	2.064	8.265	7.264	7.917	0.000	25.510
BP2: Sensor and Electronic Network Initiatives (CA)	-	80.300	148.000	-	-	-	-	-	-	-	0.000	228.300
CG3: Assured PNT Communications Applied Research	-	1.709	5.486	5.652	-	5.652	5.858	4.755	4.817	4.869	0.000	33.146
CI3: Mobile and Survivable Command Post (MASCP) Tech	-	6.008	5.728	3.268	-	3.268	0.610	0.611	0.612	0.618	0.000	17.455
CK1: Assured PNT Enabling Technologies	-	1.855	-	-	-	-	-	-	-	-	0.000	1.855
CU6: Adaptive Information Mediation and Analytics	-	-	7.089	7.226	-	7.226	7.273	7.282	7.287	7.366	0.000	43.523

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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>											
<i>CV4: Pathfinder 3D Applied Technology</i>	-	-	2.191	2.090	-	2.090	1.254	1.674	1.885	1.805	0.000	10.899

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2024

A. Mission Description and Budget Item Justification

This Program Element (PE) is aligned to the Network and Assured Positioning, Navigation, & Timing (APNT) Army Modernization Priorities. This PE investigates technologies, techniques, components and tools to provide an Army tactical network and enabling infrastructure that support Multi-Domain operations in contested, congested, degraded, and/or denied environments. This is accomplished through the design and development of technologies and components (e.g., electronic components, software and protocols) that provide unified transport and are supportable; mobile, and survivable, and robust mission command on the move; assured and secure positioning, navigation, and timing in all environments; converged and coordinated cyber and electronic warfare activities; resilient communication and intelligence, surveillance, and reconnaissance payloads for tactical space and high-altitude platforms, and the collection, processing, and dissemination of intel/ops information into a common operating environment. Commercial technologies are continuously investigated and leveraged where possible.

Work in this PE complements 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 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), PE 0603466A (Air and Missile Defense Advanced Technology), PE 0603463A (Network C3I Advanced Technology).

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

Work in this performed by the United States Army Futures Command, the United States Army Space and Missile Defense Command and the Army Engineer Research and Development Center.

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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	164.804	64.115	81.095	-	81.095
Current President's Budget	161.759	212.115	81.618	-	81.618
Total Adjustments	-3.045	148.000	0.523	-	0.523
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	148.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-3.045	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	0.523	-	0.523

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: BP2: *Sensor and Electronic Network Initiatives (CA)*

Congressional Add: *Program Increase - Energy Efficient Devices*

Congressional Add: *Program Increase: Urban Subterranean Mapping Technology*

Congressional Add: *Program Increase: Mobile Environmental Contaminant Sensors*

Congressional Add: *ALTNAV*

Congressional Add: *Program Increase - Anti-Tamper Technology*

Congressional Add: *Backpackable COMINT System*

Congressional Add: *Distributed Radio Frequency and Sensor Technology Development*

Congressional Add: *Program Increase EW and Advanced Sensing*

Congressional Add: *Program Increase - Integrated Photonics for Contested RF Environments*

Congressional Add: *Mass-Distributed Acoustic Surveillance Network*

Congressional Add: *Social Network Analysis*

Congressional Add: *Program Increase - BEYOND-LINE-OF-SIGHT NETWORKING ENHANCEMENT*

Congressional Add: *Program Increase - INERTIAL NAVIGATION SYSTEMS*

Congressional Add: *Program Increase - KU-BAND PHASED-ARRAY RADAR EMPLOYING 5G TECHNOLOGY*

Congressional Add: *Program Increase - MAN PORTABLE DOPPLER RADAR*

	FY 2022	FY 2023
	5.000	10.000
	4.000	-
	5.000	-
	13.800	-
	5.000	25.000
	5.000	-
	8.000	-
	6.500	6.500
	15.000	14.000
	8.000	-
	5.000	5.000
	-	5.000
	-	11.500
	-	1.000
	-	10.000

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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>
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<u>Congressional Add Details (\$ in Millions, and Includes General Reductions)</u>	FY 2022	FY 2023
Congressional Add: <i>Program Increase - SECURE ELECTRONIC PACKAGING</i>	-	10.000
Congressional Add: <i>Program Increase - SPECTRUM SHARING AND MANAGEMENT WITH ADAPTIVE AND RECONFIRURABLE TECHNOLOGY</i>	-	5.000
Congressional Add: <i>Program Increase - WAVEFORM DIVERSITY EXPERIMENTAL RESEARCH FOR SENSORS</i>	-	5.000
Congressional Add: <i>Program Increase - BIOLOGICAL SENSORS FOR REMOTE ENVIRONMENTS</i>	-	9.000
Congressional Add: <i>Program Increase - ALTERNATIVE POSITION, NAVIGATION, AND TIMING</i>	-	19.000
Congressional Add: <i>Program Increase - MASS-DISTRIBUTED ACOUSTIC SURVEILLANCE NETWORK</i>	-	8.000
Congressional Add: <i>Program Increase - URBAN SUBTERRANEAN MAPPING TECHNOLOGIES</i>	-	4.000
Congressional Add Subtotals for Project: BP2	80.300	148.000
Congressional Add Totals for all Projects	80.300	148.000

Change Summary Explanation

Increased funding due to revised economic assumptions.

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) AM6 / Modular RF Communications Technology
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AM6: Modular RF Communications Technology	-	-	-	5.986	-	5.986	8.318	-	-	-	0.000	14.304

Note

Modular RF Communications Technology is a new start within the Network C3I Technology program in FY 2024.

In Fiscal Year (FY) 2024 this Project is a New Start.

A. Mission Description and Budget Item Justification

This Project investigates and develops techniques, methods, and standards for automation and intelligence to optimally broadcast data among available radio frequency (RF) and networking technologies. This Project adds resiliency to the network through diversity and automation techniques to make automated network decisions (e.g., automated Primary, Alternate, Contingency, and Emergency (PACE)) for the tactical Army to maintain operation in continually changing environments.

Work in this Project complements Program Element (PE) 0603463A Network C3I Advanced Technology / Project AM7 (Modular RF Communications Advanced Technology).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Predictive Intelligent Network (PIN)	-	-	5.986
Description: The PIN project enhances the Automated PACE plan capability by developing predictive algorithms and using various sources of information to create a resilient and adaptive network configuration that allows continued and secure communications in Anti-Access/Area Denial (A2AD) environments. The PIN predictive algorithms will plan the optimal network topology and configuration by leveraging information on network loads, cyber activities, terrain, weather, movement, and RF situational awareness. In addition, this effort will leverage and disseminate RF sensing electronic support information for use by operational forces, to coordinate and enable continued communications through electronic and navigation warfare effects.			
FY 2024 Plans: Will investigate the use of Artificial Intelligence/ Machine Learning (AI/ML) techniques to proactively respond to negative network anomalies before they occur by monitoring and processing information such as traffic patterns, congestion conditions, routing patterns and routing stability, movement patterns, and RF information from various sensors and detected cyber events; perform			

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AM6 / <i>Modular RF Communications Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>a simulation study to inform decisions on applying detected cyber activities to influence the selection of transports or selection of radio modalities to further protect communications in challenging environments; investigate the use of the prediction and automated PACE decision engines to provide resilient communications for aspects of electronic and navigation warfare missions, to include electronic protection, electronic support and electronic attack; investigate the use of the automated PACE capability to facilitate the transmission of electronic support data to planning and management tools; investigate use cases in which the predictive and automated PACE decision engines can enable continued communications through electronic attack and disseminate electronic support information for use by operational forces.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> Funding increase reflects planned initiation of this effort.</p>				
Accomplishments/Planned Programs Subtotals		-	-	5.986
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AM8 / Protected SATCOM Technology			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AM8: Protected SATCOM Technology	-	1.639	-	6.599	-	6.599	11.997	3.652	2.234	-	0.000	26.121

A. Mission Description and Budget Item Justification

This Project investigates resiliency of Wideband Satellite Communications (SATCOM) in contested and congested electromagnetic environments. Wideband SATCOM is the primary high-bandwidth Beyond Line of Sight (BLOS) communications used by the tactical Army. This Project designs and develops technologies and components, such as interference cancellation, to increase availability and reliability of Wideband SATCOM in spectrum-challenged environments.

Work in this Project complements PE 0603463A (Network C3I Advanced Technology) / AM9 (Protected SATCOM Advanced Technology).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Protected Satellite Communication Technology</p> <p>Description: This effort designs and develops technologies and components to increase resiliency of Wideband SATCOM in contested and congested electromagnetic environments. This effort develops resiliency through science and technology investigation.</p>	1.639	-	-
<p>Title: Multi-Orbit Modem (MOM)</p> <p>Description: This effort designs and develops Satellite Communications (SATCOM) ground terminal modem and management technology components to enable operation over multiple satellite constellations to increase performance and resiliency of wideband SATCOM in contested and congested electromagnetic environments. Modem components will include a software based terminal controller for modem management, repository of modem waveforms, and supporting network management. This effort develops resiliency through a flexible modem technology investigation and is complementary with Protected SATCOM efforts focused on antenna development.</p> <p>FY 2024 Plans: Will investigate a SATCOM Multi-Orbit-Modem system of systems architecture through modeling and simulations that improves size, weight, and power requirements to access current SATCOM orbit constellations and integrate with SATCOM aperture technologies; validate modem architecture in relevant test events coordinated with stakeholders for initial single beam operations capabilities; investigate Multi-Orbit-Modem system, to determine initial requirements for simultaneous multi-beam capabilities</p>	-	-	6.599

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AM8 / <i>Protected SATCOM Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
both current and emerging SATCOM constellation; validate an integrated modem system to include an integrated virtual software environment with hardware based integrated circuit.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> Funding increase reflects planned initiation of this effort.			
Accomplishments/Planned Programs Subtotals	1.639	-	6.599

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) AN3 / Non Traditional Waveforms Technology
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AN3: Non Traditional Waveforms Technology	-	0.474	3.415	14.000	-	14.000	5.487	9.846	7.456	2.026	0.000	42.704

A. Mission Description and Budget Item Justification

This Project investigates non-traditional protocols and technologies to provide spectrum efficiency, high bandwidth, low latency, lower spectrum footprint, and/or anti-jam capabilities to tactical networks. This Project develops network resiliency for the dismounted and vehicular units through science & technology investigation.

Work in this Project complements Program element (PE) 0603463A (Network C3I Advanced Technology) / Project AN4 (Non Traditional Waveforms Advanced Technology).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: 5G Technologies</p> <p>Description: This effort investigates the use of 5G communication services and associated technologies to support high bandwidth, low latency communications for tactical environments with mobile infrastructures.</p> <p>FY 2023 Plans: Design and begin implementation of tactically relevant 5G capabilities in support of expeditionary and highly mobile communications by leveraging the results of the Fiscal Year 2022 (FY22) investigations. Incorporate anti-jam and LPI / LPD and increase network robustness through spectrum diversity and efficiency across dispersed nodes and different terrain types.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding decrease reflects administrative realignment to task Tactical Application of Advanced Comms within this project</p>	0.474	3.290	-
<p>Title: SBIR/STTR Transfer</p> <p>Description: Funding transferred in accordance with Title 15 USC §638</p> <p>FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	-	0.125	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AN3 / <i>Non Traditional Waveforms Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
Funding transferred in accordance with Title 15 USC §638				
<p>Title: Tactical Application of Advanced Comms</p> <p>Description: This effort investigates the use of commercial communication services and associated technologies to support high bandwidth, low latency communications for tactical environments with mobile infrastructures.</p> <p>FY 2024 Plans: Will investigate tactically relevant advanced communications capabilities for air-to-ground and mature communications components such as antennas and waveforms. Will continue incorporation of anti-jam and LPI / LPD and increase network robustness through spectrum diversity and efficiency across dispersed nodes and different terrain types.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects administrative realignment from task 5G Technologies within this project to continue the maturation of advanced communications components.</p>		-	-	2.946
<p>Title: Spectrum Superstorm</p> <p>Description: This effort investigates the use of obfuscation and technical effects in the radio frequency spectrum using distributed and dispersed techniques to coordinate signal effects against adversaries from distant transmitters.</p> <p>FY 2024 Plans: Will investigate the use of distributed techniques, such as coherent and adaptive beamforming for technical effects. Will develop methods of obfuscating the spectrum while providing awareness and coordination with spectrum activities of blue forces. Will research multiple-input multiple-output (MIMO) algorithms aiming to have single obfuscation nodes appears as many systems on the battlefield.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects planned initiation of this effort.</p>		-	-	1.857
<p>Title: Relay for Aerial to Non-line-of-sight Ground Environments (RANGE)</p> <p>Description: This effort investigates the use of aerial platforms as communications relays ensuring communications coverage is maintained in non-line-of-sight (NLOS) environments, while considering communications resiliency such as anti-jam and low probability of detection. This effort will mature covert, multiband, and embedded antenna elements using new antenna materials for compact antenna aperture designs.</p> <p>FY 2024 Plans:</p>		-	-	6.580

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AN3 / <i>Non Traditional Waveforms Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Will investigate small form factor aerial relay communications payloads capable of enabling both low-band (e.g. L-band (1-2 GHz)/ S-band (2-4 GHz)/C-band (4-8 GHz)) and high-band (e.g. millimeter-wave (30-300 GHz)) operations. Will mature directional communications components and determine applicability of novel waveforms and antennas for aerial relay. Will develop novel software and hardware for tracking and steering directional links. Will design and develop new antenna apertures. Will validate spatial low probability of detection is effective versus the threat using modeling and simulation. Will investigate impact of directional communications on spectrum re-use in congested and contested frequency bands.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects planned initiation of this effort.</p>				
<p>Title: Quantum Sensing</p> <p>Description: This effort investigates the use of novel quantum-enhanced spectral receivers capable of wideband sensing of extremely low power signals at very large standoff distances. This effort matures quantum component technologies for use in very high receiver sensitivity. This effort designs and develops tactically relevant quantum sensors, considering form-factor, size, weight, power, and receiver performance.</p> <p>FY 2024 Plans: Will investigate Josephson Junction (JJ) and Rydberg receiver quantum sensor technologies via modeling and simulation. Will begin development of classical auxiliary components to support and enable quantum sensors for tactical Army applications. Will validate range of frequencies in which Rydberg sensors can reliably detect signals. Will investigate optimal frequency bands for both Rydberg and JJ quantum receivers. Will investigate methods to continue to improve the sensitivity to detect even weaker signals and expand detection protocols for more complicated waveforms.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects planned initiation of this effort.</p>		-	-	2.617
Accomplishments/Planned Programs Subtotals		0.474	3.415	14.000
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) AN7 / COE - Every Receiver is a Sensor Technology
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AN7: COE - Every Receiver is a Sensor Technology	-	2.401	2.543	1.044	-	1.044	-	-	2.120	2.143	0.000	10.251

A. Mission Description and Budget Item Justification

This Project investigates, designs, and codes advanced 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 Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AN8 (COE - Every Receiver is a Sensor Advanced Tech) and PE 0602146A (Network C3I Technology) / Project AN9 (UNT - Every Receiver is a Sensor Technology).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Intelligence Surveillance and Recognizance (ISR) Optimization for MDO Support Technology	2.401	2.450	1.044
Description: This effort investigates and designs Intelligence Surveillance and Reconnaissance (ISR) collection management technologies and analytics to enhance performance and optimize use of Army ISR resources during multi-domain operations (MDO). Efforts focus on developing the analytics necessary to increase situational awareness of non-organic collections across all domains (Air, Land, Maritime, Space, Cyber and Electromagnetic spectrum), determine highest payoff use of tactical ISR assets, and optimize sensor selection and placement to answer unit intelligence requirements.			
FY 2023 Plans: Investigate sensor scheduling optimization to include sensor selection and routing; conduct experiment to support an initial capability to task full spectrum ISR sensor availability to units across the army; investigate how to integrate national and Joint ISR capabilities via advanced sensor frameworks.			
FY 2024 Plans: Will develop threat forecasting technologies to validate derivation of prioritized collection requirements to optimize application of Army ISR resources during MDO in contested environments.			
FY 2023 to FY 2024 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AN7 / <i>COE - Every Receiver is a Sensor Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
Funding decrease reflects conclusion of preliminary collection optimization technology investigation which began in FY22.				
Title: SBIR/STTR Transfer		-	0.093	-
Description: Funding transferred in accordance with Title 15 USC §638				
FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638				
FY 2023 to FY 2024 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC §638				
Accomplishments/Planned Programs Subtotals		2.401	2.543	1.044
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AN9 / UNT - Every Receiver is a Sensor Technology			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AN9: UNT - Every Receiver is a Sensor Technology	-	1.891	2.074	2.115	-	2.115	2.115	2.118	-	-	0.000	10.313

A. Mission Description and Budget Item Justification

This Project develops algorithms that enable every communication receiver in the tactical environment to operate as a sensor while maintaining the systems' original networking capability. This Project matures standards and protocols to expand the Cyber-Electromagnetic Activity (CEMA) situational understanding.

Work in this Project complements Program element (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 Technology).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Multi Intelligence Modernization Components and Architecture</p> <p>Description: This effort investigates underlying architectures for dynamic resource management and technology underpinnings for advanced signal processing, exploitation, and novel sensor hardening to better understand our ability to detect, intercept, identify, and geo-locate radiated radio frequency (RF) energy to command our use of the electromagnetic spectrum while denying its use to our adversaries.</p>	1.891	-	-
<p>Title: Multi-Int Modernization Combined Architecture (MIMCA)</p> <p>Description: This effort investigates optimization of radio frequency transmit and receive resources to conduct simultaneous electronic warfare (EW), signals intelligence (SIGINT) and offensive cyber missions.</p> <p>FY 2023 Plans: Investigate and assess existing commercial investments in Simultaneous transmit and receive (STAR) technology for integration into EW/Cyber/SIGINT Army systems.</p> <p>FY 2024 Plans: Will leverage interference mitigation techniques primarily designed for low power systems and investigate their feasibility to support multifunction operations; investigate applications for sensor assets that operate in the same portion of the spectrum.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	-	1.998	2.115

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) AN9 / UNT - Every Receiver is a Sensor Technology

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Funding increase reflects planned lifecycle of this effort			
Title: SBIR/STTR Transfer	-	0.076	-
Description: Funding transferred in accordance with Title 15 USC §638			
FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638			
FY 2023 to FY 2024 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	1.891	2.074	2.115

C. Other Program Funding Summary (\$ in Millions) N/A
Remarks
D. Acquisition Strategy N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology			Project (Number/Name) AO2 / Stand-In Advanced RF Effects (STARE)				
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AO2: Stand-In Advanced RF Effects (STARE)	-	1.899	-	-	-	-	-	-	-	-	0.000	1.899

Note
In Fiscal Year (FY) 2023 funding is realigned to Program Element (PE) 0602146A (Network C3I Technology) / Project AP5 (Electronic Warfare Technology).

A. Mission Description and Budget Item Justification

This Project investigates distributed and synchronized electronic warfare (EW) techniques and applications for future distributed Army operations in complex environments, designs algorithms for synchronization, and investigates stable radio frequency transceivers and techniques for information distribution across dynamic channels.

Work in this Project complements PE 0603463A (Network C3I Advanced Technology) / Project AO3 (Stand-In Advanced RF Effects (STARE) Adv Tech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

Title: STAND-IN Advanced RF Effects	FY 2022	FY 2023	FY 2024
Description: This effort investigates emerging technologies to enable EW applications in a grey environment. The goal is to develop software and reconfigurable radio frequency (RF) hardware in a low size, weight, and power form factor for distributed EW and communications.	1.899	-	-
Accomplishments/Planned Programs Subtotals	1.899	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>				Project (Number/Name) AO4 / <i>Energy Efficient Devices Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AO4: <i>Energy Efficient Devices Technology</i>	-	5.501	5.480	5.589	-	5.589	5.645	5.652	5.656	5.717	0.000	39.240

A. Mission Description and Budget Item Justification

This Project addresses sustainment operations by unburdening the Soldier and reducing logistics requirements (e.g., fewer batteries) for communications, computing, and sensing. The objective is to improve the underlying energy efficiency of supply and demand for Soldier-portable and distributed sensor electronics to enable the dismounted Soldier to maintain communications, freedom of movement, and increase mission duration. The majority of the electronics power used by the dismounted Soldier and by distributed electronics is attributable to radio frequency (RF) communications. In addition, freedom of movement and action during sustained and high tempo operations requires seamless battery recharging. To address these challenges, energy efficient electronics research includes RF and optoelectronic circuits, devices, materials and wireless power (and data) transfer.

Work in this Project complements Program Element (PE) 0602146A (Network C3I Technology) / Project AN3 (Non Traditional Waveforms Technology), PE 0602143A (Soldier Lethality Technology) / Project BD8 (Soldier & Sm Unit Tactical Energy Tech), and PE 0601102A (Defense Research Sciences) / Project AA9 (Information and 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 United States Army Futures Command.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Energy Efficient Electronic and Photonic Components	5.501	5.280	5.589
Description: This effort investigates energy efficiency improvements in support of four key areas: RF component devices, optoelectronic devices for alternative communications modes, long-lived and high efficiency power sources, and efficient wireless power and data transfer technologies. These components enable energy-efficient communications and networked energy, specifically leading to increased Soldier mission duration and long-lived networked electronics.			
FY 2023 Plans: Investigate aluminum gallium nitride semiconductors as Ultraviolet (UV) sources for communications; investigate piezoelectric transformer performance with integrated circuit envelope detectors at 100-500 MHz frequencies; determine coupled magnetic acoustic matching for efficient wireless power transfer; investigate novel energy efficient transceiver architectures for radar applications; investigate novel silicon based field programmable neural array circuits for efficient computation close to the network edge.			
FY 2024 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) AO4 / Energy Efficient Devices Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Will investigate approaches to increase efficiency in Ultraviolet (UV) sources for communications; conduct research of 'time folding' radio frequency (RF) circuits for efficient operation of small size, weight and power (SWaP) systems, encompassing techniques for increasing the RF power in short pulses, while utilizing charging from a small battery; investigate power density limitations of textured silicon carbide betavoltaic devices coupled with nickel-63 radioisotope beta emission; design piezoelectric transformer for temperature robustness as well as model and experimentally assess wake-up receiver sensitivity as a function of operation frequency and power draw; continue to investigate novel silicon based field programmable neural array circuit with in-memory computing for efficient computation close to the network edge.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects planned lifecycle of this effort.</p>				
<p>Title: SBIR/STTR Transfer</p> <p>Description: Funding transferred in accordance with Title 15 USC §638</p> <p>FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC §638</p>		-	0.200	-
Accomplishments/Planned Programs Subtotals		5.501	5.480	5.589
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AP5 / Electronic Warfare Technology			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AP5: <i>Electronic Warfare Technology</i>	-	2.821	5.246	5.355	-	5.355	5.389	2.873	2.874	2.906	0.000	27.464

A. Mission Description and Budget Item Justification

This Project investigates emerging technologies related to Electronic Warfare (EW) applications, non-kinetic survivability/lethality, and emerging concepts of employment in the increasingly contested and congested electromagnetic environment, with the goal of enhancing the survivability/lethality of Army platforms through Electronic Attack (EA), electronic warfare support (ES), and Electronic Protection (EP).

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AO7 (EW for Maneuver Operations (EMO) Adv Tech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Electronic Warfare Technology Research</p> <p>Description: This research investigates emerging Electromagnetic Warfare technologies and novel approaches to apply distributed and combined effects to a broader class of threats, with a goal of adequately degrading threat performance.</p> <p>FY 2023 Plans: Validate concepts with multi-channel hardware-in-the-loop (HIL) experiments using low-cost distributed hardware; implement algorithms for spectrum analysis for low SWaP platforms; validate techniques for dynamic RF emitter characterization; design experiments and validate complex and cognitive radar threats with research HIL environment; implement distributed and complex scenario generation tools with research HIL environment.</p> <p>FY 2024 Plans: Will investigate cognitive countermeasures to emerging complex and cognitive radar threats whereby reducing reliance on human operators and a priori information; validate effects in multi-channel Hardware-in-the-Loop (HIL) environment thus increasing scenario complexity to enable distributed electronic warfare applications while incorporating a high-level of operational realism; validate indoor HIL simulated results in a relevant outdoor test environment.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects planned lifecycle of this effort.</p>	2.206	2.416	2.499
<p>Title: Electronic Warfare Assessment Technologies</p>	0.615	0.675	0.686

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army	Date: March 2023
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AP5 / <i>Electronic Warfare Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
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<p>Description: This research investigates emerging technologies related to EW applications (e.g., digital RF memory, software defined radios, cognitive radars) and electromagnetic-enabled cyberspace operations in the increasingly contested and congested environment. Research is focused on near-peer and future threats to enhance survivability/lethality, and discover critical vulnerabilities, of Army technologies and systems through cyber and electromagnetic activities (CEMA).</p> <p>FY 2023 Plans: Initiate development of distributed EA within hardware-in-the-loop capability to analyze distributed EA operation and measures of effectiveness; investigate and develop EW capabilities for assessment and analysis of advanced electromagnetic attack; initiate measures of effectiveness for advanced EW analytical capabilities in network and horizontal integrated technologies and systems that assess defensive and cognitive EW in controlled environments; use AFC sponsored events such NetModX and PC to execute developed EA techniques and identify candidates for distributed EA operation.</p> <p>FY 2024 Plans: Will develop EW techniques and processes for use as cognitive countermeasures for emerging complex and cognitive radar threats; conduct laboratory, HIL, and field experimentation for assessment of developing technology; mature techniques for low-cost emitting targets and countermeasure assets.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects planned lifecycle of this effort.</p>			
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<p>Title: Combined and Distributed Electromagnetic Warfare (CDEW)</p> <p>Description: This research investigates emerging Electromagnetic Warfare technologies and novel approaches to apply distributed and combined effects to a broader class of threats, with a goal of adequately degrading threat performance.</p> <p>FY 2023 Plans: Investigate, develop and assess stable transceiver architecture designs suitable for high carrier frequency and large signal bandwidth with optimal component technologies; validate techniques for scalable synchronization and multi-aperture beamforming from RF transceivers agnostic of use case; research methods for rapid technique generation and design reconfigurable transceiver hardware to enable a widely-applicable architecture; validate modeling and simulation framework with hardware experiments for scalability and synchronization for large-scale effects.</p> <p>FY 2024 Plans: Will investigate, develop, and assess EW techniques requiring the use of distributed apertures; investigate combined and distributed techniques against emerging multi-static emitters; refine and assess a 2-node synchronization technique that includes</p>	-	2.139	2.170
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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army	Date: March 2023
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AP5 / <i>Electronic Warfare Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
feedback electronics to correct node phase in real-time; assess multi-aperture beam-forming performance for improved pointing-angle for electronic support and electronic attack. FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects planned lifecycle of this effort.			
Title: SBIR/STTR Transfer Description: Funding transferred in accordance with Title 15 USC §638 FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638 FY 2023 to FY 2024 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC §638	-	0.016	-
Accomplishments/Planned Programs Subtotals	2.821	5.246	5.355

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army	Date: March 2023
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Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AQ2 / EW Techniques Technology			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AQ2: EW Techniques Technology	-	0.476	0.532	0.541	-	0.541	3.694	3.699	-	-	0.000	8.942

A. Mission Description and Budget Item Justification

This Project develops countermeasures against adversarial counter-fire systems that obscure and create distractive blue force locations.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AO7 (EW for Maneuver Operations (EMO) Adv Tech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Simultaneous Counter Measures (CM) for Active Reconnaissance and Surveillance (SCARS)</p> <p>Description: This effort will provide investments in Electronic Warfare (EW), against advancing counter-fire sensors. This effort will investigate highly synchronized techniques to achieve advanced effects.</p> <p>FY 2023 Plans: Validate electronic decoy techniques using advanced signal apertures via modeling and simulation. Research techniques and waveforms for counter radar applications.</p> <p>FY 2024 Plans: Will validate reduced efficacy of adversary counterfire systems to target friendly forces via modeling and simulation; overlay counter ISR and counterfire applications to assess the impact decoy techniques have on adversarial targeting capabilities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects planned lifecycle of project.</p>	0.476	0.513	0.541
<p>Title: SBIR/STTR Transfer</p> <p>Description: Funding transferred in accordance with Title 15 USC §638</p> <p>FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	-	0.019	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army	Date: March 2023
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AQ2 / <i>EW Techniques Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	0.476	0.532	0.541

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) AQ7 / High Tempo Data Driven Decision Tools Technology
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
<i>AQ7: High Tempo Data Driven Decision Tools Technology</i>	-	-	1.289	1.306	-	1.306	2.351	2.354	4.157	7.664	0.000	19.121

A. Mission Description and Budget Item Justification

This Project investigates and develops data driven decision tools that increase operational tempo and allow commanders to dominate decision spaces over adversaries. The tools will provide the commander with contextually relevant data and adaptive decision models. Information and recommendations will be made and disseminated to commander and staff in a cognitively appropriate manner.

Work in this Project complements Program Element (PE) 0603463A Network C3I Advanced Technology / Project AQ8 (High Tempo Data Driven Decision Tools Adv Tech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: RoadRunner</p> <p>Description: This effort investigates and develops stakeholder prioritized capabilities that fuse intel and ops perspectives that drive decisions to enable dominance in complex Multi-Domain Operations.</p> <p>FY 2023 Plans: Conduct basic software development help Commanders and staff manage time constraints and cognitive limitations in the synchronization of Warfighting functions to maintain dominance in evolving and compressed / complex decision spaces. Research and develop digital battle damage assessments and after action reports to automatically update proposed force structures and operations. Investigate the use of battlespace data and intelligence information to adjust running estimates, in order to continually analyze the changing battlespace and drive friendly Observe, Orient, Decide, and Act (OODA) loops that outpace the enemy.</p> <p>FY 2024 Plans: Will develop fused intel and ops software assisting Commanders and staff by managing time constraints and cognitive limitations to synchronize warfighter functions; validate battle damage assessments and after action reports automatically with proposed force structures and operations; conduct experiments with live and simulated battlespace data and intelligence information, adjusting running estimates by analyzing the changing battlespace OODA loops.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	-	1.242	1.306

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AQ7 / <i>High Tempo Data Driven Decision Tools Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
Funding increase reflects planned lifecycle of this effort.				
Title: SBIR/STTR Transfer		-	0.047	-
FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638				
FY 2023 to FY 2024 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC §638				
Accomplishments/Planned Programs Subtotals		-	1.289	1.306
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>				Project (Number/Name) AR1 / <i>Robust, Resilient and Intelligent C3I Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AR1: <i>Robust, Resilient and Intelligent C3I Technology</i>	-	10.127	-	-	-	-	-	-	-	-	0.000	10.127

A. Mission Description and Budget Item Justification

This Project develops and characterizes machine learning and artificial intelligence methods for processing, analysis and provisioning control of smart, distributed, networked sensors and devices. It provides situational understanding and decision support to enable fast, adaptive and interoperable Command, Control, Communications and intelligence (C3I) network-integrated applications, resilient to adversarial activity in contested and complex environments. Effective use of distributed networked sensors, autonomous agents and automated decision support tools is critical to address threats posed by peer competitors and more capable asymmetric forces, particularly in complex environments where traditional sensors provide an incomplete understanding of the tactical situation due to adversarial activity, occluded sightlines and small fields of regard.

Work in this Project complements Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology) / Project BF8 (Artificial Intelligence & Machine Learning Tech), PE 0603463A (Network C3I Advanced Technology) / Project AQ5 (Sensor CE - Integrated Sensor Architecture Adv Tech) and Project AN8 (COE - Every Receiver is a Sensor), and PE 0602146A (Network C3I Technology) / Project AN7 (COE- Every Receiver is a Sensor Technology).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Intelligent Signal and Image Analytics for C3I</p> <p>Description: This effort designs and characterizes technologies for multi-modal (Electro-Optical/Infra-Red (EO/IR) imaging, acoustic, seismic, infrasound, electric and magnetic (E/H) field, and passive radio frequency (RF), low-cost networked sensors to enhance persistent sensing capabilities for increased probability of target localization, tracking, classification, and reduced false alarms. These combined sensors have unique capabilities that enable passive discrimination from deception and decoys, detection of electrical equipment operation, underground facilities, vehicles, weapons launch, gunfire, and explosions. The work includes development of learning algorithms to improve situational understanding.</p>	3.132	-	-
<p>Title: Smart Networks and Distributed Sensing for C3I</p> <p>Description: This effort will develop and assess a concept to link physical sensors and information sources to Soldiers and small units. Specifically, the research focuses on (1) multi-modal sensor fusion for detection and classification of human activities and infrastructures such as personnel, vehicles, machinery, RF emissions, chemicals, and computers in hidden and confined</p>	5.067	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AR1 / <i>Robust, Resilient and Intelligent C3I Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
spaces, (2) interoperability and networking of disparate sensors and information sources, (3) distributed information for decision-making, and (4) approaches for fusing results of processed outputs of multi-modal sensors, such as visible, infrared (IR), and hyperspectral imagers, and acoustic, magnetic, and electric field sensors.			
Title: Information Processing and Analysis Description: This effort investigates techniques that integrate local and external information sources and applies machine learning and artificial reasoning approaches to support automated intelligence analysis, command/control, and decision-making. The goal is to enable tactical users to cooperatively interact with relevant and timely tactical information supported by methods that are network-aware/adaptive and deliver transparent and uniform transport.	1.928	-	-
Accomplishments/Planned Programs Subtotals	10.127	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AR3 / Intelligent Environmental Battlefield Awareness			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AR3: <i>Intelligent Environmental Battlefield Awareness</i>	-	2.947	-	-	-	-	-	-	-	-	0.000	2.947

A. Mission Description and Budget Item Justification

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

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AR4 (Intelligent Env Battlefield Awareness Adv Tech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Arctic Threat	0.824	-	-
Description: This effort delivers a geospatial decision aid to United States Army units conducting expeditionary operations to anticipate threats, hazards and dependencies posed by terrain and weather extremes in cold regions.			
Title: Predictive Geographic Information System (GIS) Mapping (physical)	0.731	-	-
Description: This effort develops a comprehensive GIS tool that integrates predictive models of soil, vegetation, hydrology, and permafrost conditions outside the continental U.S. (OCONUS) dark sites from the statistical analysis of known datasets and the application of geophysical principles.			
Title: Hydrology Mapping	1.392	-	-
Description: This effort provides data tools and models to support high-fidelity battlefield overlay maps that accurately show hydrologic/soil moisture threats (soil, hydrology, and snow/ice) not captured by current terrain mapping capabilities.			
Accomplishments/Planned Programs Subtotals	2.947	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) AR3 / Intelligent Environmental Battlefield Awareness

C. Other Program Funding Summary (\$ in Millions)

Remarks

N/A

D. Acquisition Strategy

N/A

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) AR5 / Understanding the Environment as a Threat Technolo
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AR5: <i>Understanding the Environment as a Threat Technolo</i>	-	1.884	1.314	-	-	-	0.404	3.314	2.149	1.647	0.000	10.712

A. Mission Description and Budget Item Justification

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

Work in this Project complements Program element (PE) 0603463A (Network C3I Advanced Technology) / Project AR6 (Understanding the Environment as a Threat Adv Tech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Subsurface Forensics</p> <p>Description: This effort will prepare Soldiers for the risks of deliberate or accidental release of toxic industrial chemicals and materials by investigating and developing methods to collect data to characterize and predict the fate and transport of hazards of concern.</p> <p>FY 2023 Plans: Develop techniques to achieve ultra-low detection levels of explosive constituents and non-weaponized radiological hazards for reverse-point sourcing threats.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding decrease reflects planned lifecycle of this effort as applied research products are transferred to PE 0603463A Project AR6.</p>	1.812	1.297	-
<p>Title: SBIR/STTR Transfer</p> <p>Description: Funding transferred in accordance with Title 15 USC §638</p> <p>FY 2023 Plans:</p>	0.072	0.017	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023			
Appropriation/Budget Activity 2040 / 2		R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AR5 / <i>Understanding the Environment as a Threat Technolo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024	
Funding transferred in accordance with Title 15 USC §638					
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i>					
Funding transferred in accordance with Title 15 USC §638					
Accomplishments/Planned Programs Subtotals		1.884	1.314	-	
C. Other Program Funding Summary (\$ in Millions)					
N/A					
Remarks					
N/A					
D. Acquisition Strategy					
N/A					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AR7 / Sensing in Contested Environments Technology			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AR7: Sensing in Contested Environments Technology	-	1.149	-	-	-	-	-	-	-	-	0.000	1.149

A. Mission Description and Budget Item Justification

This Project characterizes through direct or inferential methods the identification of non-weaponized biological hazards posed to Soldiers in operational environments by advancing sensor technologies and software modules that will detect and characterize hazards including water quality, heavy metals in soils, breath-ability, and non-weaponized radiological hazards within confined environments. This Project supports the Common Operating Environment program.

Work in this Project complements PE 0603463A (Network C3I Advanced Technology) / Project AR8 (Sensing in Contested Environments Adv Tech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Non-Traditional Threat Detection in Contested Environment	1.106	-	-
Description: This effort identifies, examines and prioritizes commercial of the shelf (COTS) capabilities from multiple sources that can accurately detect biological hazards relevant to operations in subterranean environments from point of ingress/egress to evaluate exposure potential and affects.			
Title: SBIR/STTR Transfer	0.043	-	-
Description: Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals			
	1.149	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

N/A

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AR9 / Persistent Geophysical Sensing-Infrasound Tech			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AR9: Persistent Geophysical Sensing-Infrasound Tech	-	3.290	-	-	-	-	-	-	-	-	0.000	3.290

A. Mission Description and Budget Item Justification

This Project designs and develops algorithms, software, and hardware components to enable near-real-time battlespace awareness to 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 designs and develops methodologies to assign maneuver relevant engineering attributes to geospatial feature data such as bridge load classification, road condition, and bathymetry.

Work in this Project complements PE 0603463A (Network C3I Advanced Technology) / Project AS9 (Persistent Geophysical Sensing-Infrasound Adv Tech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Battlefield Intelligence by Geophysical Sensing (BIGS)	3.166	-	-
Description: This effort develops a suite of geophysical and geo-sensing technologies to persistently assess battlefield elements to include infrastructure and additional sources of interest such as explosive and fires events and various air platforms; refines terrain, topography, and meteorological models related to acoustic propagation detected by the employed sensor suite as well as detection and classification signal processing algorithms for a broader range of sources and/or threats.			
Title: SBIR/STTR Transfer	0.124	-	-
Description: Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	3.290	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AR9 / <i>Persistent Geophysical Sensing-Infrasound Tech</i>

D. Acquisition Strategy
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AT7 / Network-Enabled GeoSpatial-GEOINT Services Tech			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AT7: Network-Enabled GeoSpatial-GEOINT Services Tech	-	4.466	3.137	2.555	-	2.555	3.537	2.091	-	-	0.000	15.786

A. Mission Description and Budget Item Justification

This Project investigates and develops an integrated capability to rapidly share mission critical 3-dimensional (3D) information that supports planning and execution at the Soldier level. This will be achieved through the maturation of next-generation geospatial analytical models for 3D complex urban environment data, delivering enriched understanding of dynamic Operational Environments and distributed to a tactical Common Operating Environment. This Project will result in improved situational awareness and autonomy at low echelons, contributing to increased maneuver and mobility during manned and unmanned teaming operations.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AT8 (Network-Enabled GeoSpatial and GEOINT Services AdvTech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Geo-registration, Analytical Tool Development and Visualization	2.238	-	-
Description: This effort investigates the design and formulation of new urban terrain data models, frameworks and processes to automate the geo-registration of 3D and 2-dimensional (2D) source data (e.g. light detection and ranging (LiDAR), imagery, Open Street Maps, and full motion video derived data) to new model constructs for rapid alerting to changes in the Operational Environment of interest.			
Title: Geospatial Data for Tactical Visualization	2.228	1.057	-
Description: This effort develops 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 2023 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AT7 / <i>Network-Enabled GeoSpatial-GEOINT Services Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Develop the geospatial extraction and protocols to allow position-navigation self-localization capability on end-user systems. Advance development of computer visual navigation, fusion, error modeling and dissemination tools for rigorous position, orientation and navigation that would support targeting and maneuver.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: This applied research effort completes in Fiscal Year 2023 as technologies are transferred to PE 0603463A Network C3I Advanced Technology, Project AT8 Network-Enabled GeoSpatial-GEOINT Services AdvTech.</p>				
<p>Title: Geospatial - Intelligence Community Merge Research</p> <p>Description: This effort researches different approaches to automatically search Intelligence Community databases to discover and then extract relevant attributes to be added as new metadata to adaptively scaled 3D terrain features and/or geographic areas. Geospatial and relevant intelligence data will be merged together, discoverable, and capable of user-selected query from a single computing environment. An enhanced 3D common operating picture will be developed.</p> <p>FY 2023 Plans: Investigate automated approaches for designation of geospatial search terms followed by discovery and extraction from intelligence community (IC) data bases; will design a revised schema for geospatial data stored within the 3D data repository Program of Record (POR)-- GRiD-- to enable IC attributes to be adaptively appended as new metadata with view options from individual 3D terrain features scalable to regional and larger geographic areas.</p> <p>FY 2024 Plans: Will develop an automated approach for connectivity and integration of enriched specific geospatial products and selected Intelligence community (IC) databases/schemas for the purpose of developing and refining situational understanding of a triggered or selected situation.?Will investigate automated approaches for designation of intelligence search terms that will spawn discovery, or automated processing, of geospatial/GeoINT products that improve situational understanding.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects the planned milestones and deliverables for enriched 3D terrain by additional attribution and features.</p>		-	1.062	1.675
<p>Title: Geospatially Relevant Intuitive Propagation Services Technology</p> <p>Description: This effort researches a novel expert propagation model to integrate battlefield sensor data with environmental predictive modeling (weather and terrain influences). The resulting technology will optimize collection asset employment against adversaries as well as providing situational awareness of friendly units' multi-modal signature footprint (e.g. radio frequency, thermal, acoustic) and will reduce analyst cognitive load.</p> <p>FY 2023 Plans:</p>		-	1.018	0.880

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AT7 / <i>Network-Enabled GeoSpatial-GEOINT Services Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
Investigate workflows within common operating environment to enable automated extraction of physical and operational parameters used in sensor performance analyses. <i>FY 2024 Plans:</i> Will design realistic use cases within the Common Operating Environment to evaluate and gather relevant data and submit sensor performance analysis requests to optimize collection assets. <i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> Funding decrease reflects completion of workflows.				
Accomplishments/Planned Programs Subtotals		4.466	3.137	2.555
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AT9 / Tactical GeoSpatial Information Capabilities Techn			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AT9: Tactical GeoSpatial Information Capabilities Techn	-	1.711	0.518	2.717	-	2.717	2.065	1.906	2.523	5.550	0.000	16.990

A. Mission Description and Budget Item Justification

This Project investigates and develops next generation geospatial analytical tools for 3-dimensional complex environments for low echelon and tactical edge exploitation. Research focuses on improving geospatial and Geospatial Intelligence (GEOINT) aspects of situational awareness at the tactical edge in the complex environment by exploiting new data sources, automating analytical tasks, and testing new collection technologies, including interiors of infrastructure. Research develops capabilities to enhance/update provisioned (baseline) standard, sharable, geospatial foundation (SSGF) data through automated analytics on multi-sourced spatial data resulting in streamlined, enhanced 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 Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AU1 (Tactical GeoSpatial Information Capabilities ATech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: 3D Terrain Analysis	1.646	-	-
Description: This effort investigates and develops 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.			
Title: Geospatial Analytics and Prediction Technology	-	0.499	2.717
Description: This effort designs and develops automated/semi-automated geospatial tools implementing spatial/temporal data analysis, creation of predictive scenarios, anomaly detection and cross-scale and local scale analysis of terrain.			
FY 2023 Plans: Investigate optimized workflows for 3-Dimensional data from collection through product generation for building interiors and subterranean spaces.			
FY 2024 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AT9 / <i>Tactical GeoSpatial Information Capabilities Techn</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
Will develop a high resolution 3-Dimensional workflow from building interiors and subterranean spaces. Will investigate temporal nature of landscape and anomaly detection and cross-scale analysis of terrain.				
FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects the planned milestones for development of cloud based automated/semi-automated geospatial tools.				
Title: SBIR/STTR Transfer				
Description: Funding transferred in accordance with Title 15 USC §638		0.065	0.019	-
FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638				
FY 2023 to FY 2024 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC §638				
Accomplishments/Planned Programs Subtotals		1.711	0.518	2.717
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
N/A				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AV3 / Foundational S&T for Network C3I Technology			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AV3: Foundational S&T for Network C3I Technology	-	4.487	0.743	-	-	-	-	-	-	-	0.000	5.230

Note

In Fiscal Year (FY) 2024 this Project is Terminated.

A. Mission Description and Budget Item Justification

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

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

Research in this project is done in coordination with PE 0603463A (Network C3I Advanced Technology) / Project AV4 (Foundational S&T for Network C3I Advanced Tech).

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Development of Disruptive, Innovative Research for Emerging (DIRE) Applied Network Capabilities</p> <p>Description: This effort develops innovative network capabilities using a rapid and agile methodology to examine feasibility of incorporation into Army network problem sets.</p> <p>FY 2023 Plans: Completing innovative technology pilot for discovering and developing innovative and disruptive network capabilities in the space of network resiliency, artificial intelligence, and autonomy.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding decrease to support Army high priority effort for agile acceleration of Directed Energy in the Air and Missile Defense Advanced Technology (0603466A) Project CV6.</p>	4.487	0.716	-
<p>Title: SBIR/STTR</p> <p>Description: Funding transferred in accordance with Title 15 USC §638</p>	-	0.027	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AV3 / <i>Foundational S&T for Network C3I Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<i>FY 2023 Plans:</i> Funding transferred in accordance with Title 15 USC §638			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	4.487	0.743	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AV5 / Protective Technologies			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AV5: Protective Technologies	-	7.273	6.428	6.553	-	6.553	6.620	6.628	6.632	6.704	0.000	46.838

A. Mission Description and Budget Item Justification

This Project develops Anti-Tamper tools, devices, and techniques to protect acquisition program systems and Critical Program Information (CPI) from evolving adversarial 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 United States Army Futures Command.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Protective Technologies</p> <p>Description: This effort develops tools, devices, and techniques to protect acquisition program systems and (CPI) from adversarial threats.</p> <p>FY 2023 Plans: Develop advanced packaging microelectronics security solutions for anti-tamper application through continued rigor development and analysis. Investigate and evaluate new protective technologies for integration in Army and DoD systems to protect critical technology with improved resilience to exploitation.</p> <p>FY 2024 Plans: Will continue to explore the latest exploitation threats faced by DoD and Army weapons systems and focus design and development efforts toward new protective technologies to be made available to Army and DoD weapons system programs and their developers in meeting their Ant-Tamper requirements.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects planned lifecycle of this effort programmed in coordination with the DoD Executive Agent for Anti-Tamper.</p>	7.273	6.236	6.553
<p>Title: SBIR/STTR Transfer</p> <p>Description: Funding transferred in accordance with Title 15 USC §638</p> <p>FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	-	0.192	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army	Date: March 2023
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AV5 / <i>Protective Technologies</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	7.273	6.428	6.553

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) AV7 / Atmospheric Modeling and Meteorological Technology
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
<i>AV7: Atmospheric Modeling and Meteorological Technology</i>	-	5.714	-	-	-	-	-	-	-	-	0.000	5.714

A. Mission Description and Budget Item Justification

This Project develops tactical atmospheric sensing, modeling, and decision support technologies. New atmospheric sensing technologies are developed that enable near-real-time, high-resolution measurements of atmospheric parameters via light-weight systems that can be employed in tactical domains. Efforts include high-resolution local assessments and forecasts of meteorological conditions that can accommodate the effects of dense urban and complex, mountainous terrain. Both physics-based and rule-based decision support systems are developed for assessing the impacts of weather/atmosphere across a spectrum of friendly and threat weapons systems, sensors, platforms, and operations. It provides detailed model applications for various effects of the atmosphere on electro-optical and acoustic target detection, location, and identification. Information can be applied to mission planning and execution, battlefield visualization, reconnaissance, surveillance, and target acquisition, route planning to maximize stealth and efficiency, web-enabled tactical decision aids, long-range precision fires, and modeling of environmental impacts for combat simulations and war games.

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

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Atmospheric Characterization, Modeling, and Impacts	5.714	-	-
Description: This effort develops environmental situational understanding enabled through coupled sensing, modeling, and decision support technologies for data-sparse, computationally-limited, and network-constrained domains.			
Accomplishments/Planned Programs Subtotals	5.714	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AV7 / <i>Atmospheric Modeling and Meterological Technology</i>

D. Acquisition Strategy
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AV9 / Advanced PNT for GPS Independent Environments Tech			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AV9: Advanced PNT for GPS Independent Environments Tech	-	9.747	8.850	9.022	-	9.022	8.796	8.754	8.759	8.854	0.000	62.782

A. Mission Description and Budget Item Justification

This Project develops technologies that will enable precise and assured Positioning, Navigation, and Timing (PNT) in Global Positioning System (GPS)-denied environments by addressing the PNT's toughest Scenario - Scenario 4 (no available GPS signal during the mission duration) with a goal of enabling Soldier missions of up to seven days in a GPS denied environment. This is achieved by researching advanced quantum timing circuits, advanced inertial measurement unit (IMU) components, multi-sensor modalities, perception techniques, geo-location data, vision aided navigation sensors, and available radio frequency (RF) signals.

This work also addresses the PNT Scenario 1 (GPS operations that start well and have degraded GPS signals throughout the mission duration) through Scenario 3 (GPS operations that have bad or limited availability of GPS signals throughout the entire mission). This is achieved by investigating the ability to transmit jam-resistant, precision timing synchronized signals using optical fibers, free-space using lasers, and in the RF domain using innovative RF antenna concepts to extend the reach of Soldier compatible capabilities in heavily contested GPS environments.

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

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Precision Measurement Technology for Contested Environments	2.968	3.260	3.309
Description: This effort will develop technologies that will enable precise and assured PNT in GPS-denied environments for up to 1 hour. This research will improve the accuracy while also focusing on size, weight, power, cost (SWAP-C) of current IMUs through the design, fabrication, and assessment of novel micro-electromechanical system (MEMS) sensor designs and materials and the integration of multiple sensor modalities with the IMUs using sensor fusion and perception techniques to reduce drift and increase positional accuracy. Research will also include the ability to transmit jam-resistant precision position, navigation, and timing signals via electro-optical and/or RF transmission methods.			
FY 2023 Plans: Develop chip embodiment of the self-stabilization circuitry for frequency stabilization of linked micro-resonator optical frequency combs; mature and optimize novel MEMS inertial sensors using advanced MEMS materials and micro-structures to develop path			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AV9 / <i>Advanced PNT for GPS Independent Environments Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>to low-cost, navigation-grade MEMS IMU accuracy and improved drift correction techniques tested over temperature; continue to validate performance of chip-scale, low-noise stabilized frequency sources and integrated frequency combs for low SWAP-C clocks; validate and optimize algorithms to process RF signals of opportunity and multi-sensor/multi- waveband vision-based geo-localization.</p> <p>FY 2024 Plans: Will fabricate, characterize, and optimize micro-electromechanical systems (MEMS) gyroscopes and accelerometers with novel self-calibration techniques; apply inertial measurement unit (IMU) system-level modeling techniques to determine expected performance improvements due to novel materials and calibration techniques; validate inertial sensor performance improvements with integrated control electronics; design, fabricate, and characterize performance of resonators and inertial sensors leveraging novel piezoelectric materials.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects the planned lifecycle of this effort.</p>				
<p>Title: Quantum Effects for Assured PNT in Zero-GPS Environments</p> <p>Description: This effort will conduct research on SWAP-C quantum based timing sub-systems, incorporating advanced sensors, RF signals (beyond GPS), navigation databases, and advanced algorithms. This effort incorporates advanced quantum timing circuits, advanced IMU components, multi-sensor modalities, perception techniques, geolocation data, vision aided navigation sensors, and available RF signals in order to increase precise and assured PNT operations in a GPS denied environments for up to seven days.</p> <p>FY 2023 Plans: Assess rackmount atomic clock under relevant environments and optimize design for ruggedization and clock manufacturing considerations; assess and optimize gyro and accelerometer performance with novel self-calibration techniques; validate hybrid, modular multi-sensor fusion engine with continuous Inertial Navigation System (INS) calibration capable of interfacing with the Department of Defense PNT Open Architecture standards; develop and optimize novel algorithms and architecture for sensor fusion state estimation.</p> <p>FY 2024 Plans: Will validate and integrate novel PNT sensors with hybrid, modular multi-sensor fusion engine; develop and optimize novel algorithms and architecture for sensor fusion state estimation; continue to develop self-stabilization circuitry for frequency stabilization of micro-resonator optical frequency combs; design and develop integration techniques for micro-resonator optical</p>		6.779	5.569	5.713

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) AV9 / Advanced PNT for GPS Independent Environments Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
frequency combs, injection-locked laser, and self-stabilization circuit that enable low-SWAP chip-scale optical clocks/oscillators; develop low SWAP-C optical transmit/receive unit for free-space optical positioning and time transfer. FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects the planned lifecycle of this effort.				
Title: SBIR/STTR Transfer Description: Funding transferred in accordance with Title 15 USC §638 FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638 FY 2023 to FY 2024 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC §638		-	0.021	-
Accomplishments/Planned Programs Subtotals		9.747	8.850	9.022
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) AW1 / Autonomous Navigation Technology			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
AW1: Autonomous Navigation Technology	-	1.990	2.052	-	-	-	-	-	1.007	4.823	0.000	9.872

A. Mission Description and Budget Item Justification

This Project investigates use of sensors on the platform and available navigation signals to the localization and decision making of Robotic/Autonomous Systems. Additionally, it examines the use of machine learning algorithms for cooperative navigation to aid in a Positioning, Navigation and Timing (PNT) solution. This will enable the user to achieve operational overmatch in a Global Positioning System (GPS) impeded environment as well as enhanced navigation (reducing dependence on GPS) through challenging terrains. This project investigates and develops techniques and algorithms to provide assured access to PNT in degraded electromagnetic (jamming), space, or cyber environments and notify Soldiers, Systems, and Platforms when PNT cannot be trusted for mission duration

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AV8 (Navigation Warfare (NAVWAR) Advanced Technology).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Intelligent Electronic Protect (IEP)</p> <p>Description: This effort provides assured access to PNT in degraded electromagnetic (jamming), space, or cyber environments; notifies Soldiers, Systems, and Platforms when PNT cannot be trusted for mission duration; provides Soldiers, Systems, and Platforms a reduction in the likelihood of being spoofed for mission duration; provides unhindered access to military GPS level of accuracy when access to military GPS is unavailable; and facilitates graceful degradation of PNT systems when military GPS is denied or degraded.</p> <p>FY 2023 Plans: Continue to mature techniques to detect and identify RF signals. Conduct lab based experiments to validate the maturity and feasibility of algorithmic approach in GPS challenged environments.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding change reflects planned life cycle conclusion of this effort.</p>	1.990	1.977	-
<p>Title: SBIR/STTR Transfer</p> <p>Description: Funding transferred in accordance with Title 15 USC §638</p>	-	0.075	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army	Date: March 2023
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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) AW1 / <i>Autonomous Navigation Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<i>FY 2023 Plans:</i> Funding transferred in accordance with Title 15 USC §638			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	1.990	2.052	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) BP2 / Sensor and Electronic Network Initiatives (CA)			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
BP2: Sensor and Electronic Network Initiatives (CA)	-	80.300	148.000	-	-	-	-	-	-	-	0.000	228.300

Note
Congressional Interest Item funding provided for Sensor and Electronic Network Initiatives.

A. Mission Description and Budget Item Justification
Congressional Interest Item funding provided for Sensor and Electronic Network Initiatives.

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

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023
Congressional Add: Program Increase - Energy Efficient Devices FY 2022 Accomplishments: Congressional Interest Item funding provided for Energy Efficient Devices FY 2023 Plans: Congressional Interest Item funding provided for Energy Efficient Devices	5.000	10.000
Congressional Add: Program Increase: Urban Subterranean Mapping Technology FY 2022 Accomplishments: Congressional Interest Item funding provided for Urban Subterranean Mapping Technologies	4.000	-
Congressional Add: Program Increase: Mobile Environmental Contaminant Sensors FY 2022 Accomplishments: Congressional Interest Item funding provided for Mobile Environmental Contaminant Sensors	5.000	-
Congressional Add: ALTNAV FY 2022 Accomplishments: Congressional Interest Item funding provided for ALTNAV	13.800	-
Congressional Add: Program Increase - Anti-Tamper Technology FY 2022 Accomplishments: Congressional Interest Item funding provided for Anti-Tamper Technology FY 2023 Plans: Congressional Interest Item funding provided for Anti-Tamper Technology	5.000	25.000
Congressional Add: Backpackable COMINT System	5.000	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) BP2 / Sensor and Electronic Network Initiatives (CA)
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: Congressional Interest Item funding provided for Backpackable COMINT System		
Congressional Add: Distributed Radio Frequency and Sensor Technology Development	8.000	-
FY 2022 Accomplishments: Congressional Interest Item funding provided for Distributed Radio Frequency and Sensor Technology Development		
Congressional Add: Program Increase EW and Advanced Sensing	6.500	6.500
FY 2022 Accomplishments: Congressional Interest Item funding provided for EW and Advanced Sensing		
FY 2023 Plans: Congressional Interest Item funding provided for EW and Advanced Sensing		
Congressional Add: Program Increase - Integrated Photonics for Contested RF Environments	15.000	14.000
FY 2022 Accomplishments: Congressional Interest Item funding provided for Integrated Photonics for Contested RF Environments		
FY 2023 Plans: Congressional Interest Item funding provided for Integrated Photonics for Contested RF Environments		
Congressional Add: Mass-Distributed Acoustic Surveillance Network	8.000	-
FY 2022 Accomplishments: Congressional Interest Item funding provided for Mass-Distributed Acoustic Surveillance Network		
Congressional Add: Social Network Analysis	5.000	5.000
FY 2022 Accomplishments: Congressional Interest Item funding provided for Social Network Analysis		
FY 2023 Plans: Congressional Interest Item funding provided for Social Network Analysis		
Congressional Add: Program Increase - BEYOND-LINE-OF-SIGHT NETWORKING ENHANCEMENT	-	5.000
FY 2023 Plans: Congressional Interest Item funding provided for BEYOND-LINE-OF-SIGHT NETWORKING ENHANCEMENT		
Congressional Add: Program Increase - INERTIAL NAVIGATION SYSTEMS	-	11.500
FY 2023 Plans: Congressional Interest Item funding provided for Inertial Navigation System		
Congressional Add: Program Increase - KU-BAND PHASED-ARRAY RADAR EMPLOYING 5G TECHNOLOGY	-	1.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) BP2 / Sensor and Electronic Network Initiatives (CA)

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023
FY 2023 Plans: Congressional Interest Item funding provided for KU-BAND PHASED-ARRAY RADAR EMPLOYING 5G TECHNOLOGY		
Congressional Add: Program Increase - MAN PORTABLE DOPPLER RADAR	-	10.000
FY 2023 Plans: Congressional Interest Item funding provided for MAN PORTABLE DOPPLER RADAR		
Congressional Add: Program Increase - SECURE ELECTRONIC PACKAGING	-	10.000
FY 2023 Plans: Congressional Interest Item funding provided for SECURE ELECTRONIC PACKAGING		
Congressional Add: Program Increase - SPECTRUM SHARING AND MANAGEMENT WITH ADAPTIVE AND RECONFIRURABLE TECHNOLOGY	-	5.000
FY 2023 Plans: Congressional Interest Item funding provided for SPECTRUM SHARING AND MANAGEMENT WITH ADAPTIVE AND RECONFIRURABLE TECHNOLOGY		
Congressional Add: Program Increase - WAVEFORM DIVERSITY EXPERIMENTAL RESEARCH FOR SENSORS	-	5.000
FY 2023 Plans: Congressional Interest Item funding provided for WAVEFORM DIVERSITY EXPERIMENTAL RESEARCH FOR SENSORS		
Congressional Add: Program Increase - BIOLOGICAL SENSORS FOR REMOTE ENVIRONMENTS	-	9.000
FY 2023 Plans: Congressional Interest Item funding provided for BIOLOGICAL SENSORS FOR REMOTE ENVIRONMENTS		
Congressional Add: Program Increase - ALTERNATIVE POSITION, NAVIGATION, AND TIMING	-	19.000
FY 2023 Plans: Congressional Interest Item funding provided for Alternative Position, Navigation, and Timing		
Congressional Add: Program Increase - MASS-DISTRIBUTED ACOUSTIC SURVEILLANCE NETWORK	-	8.000
FY 2023 Plans: Congressional Interest Item funding provided for Mass-Distributed Acoustic Surveillance Network		
Congressional Add: Program Increase - URBAN SUBTERRANEAN MAPPING TECHNOLOGIES	-	4.000
FY 2023 Plans: Congressional Interest Item funding provided for Urban Subterranean Mapping Technologies		
Congressional Adds Subtotals	80.300	148.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) BP2 / <i>Sensor and Electronic Network Initiatives (CA)</i>

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) CG3 / Assured PNT Communications Applied Research			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CG3: Assured PNT Communications Applied Research	-	1.709	5.486	5.652	-	5.652	5.858	4.755	4.817	4.869	0.000	33.146

A. Mission Description and Budget Item Justification

Tactical Land Component Forces require access to Space and High Altitude (HA) capabilities to enable force projection and maneuver during Multi-Domain Operations (MDO). The capability need is documented in the Abbreviated Capability Description Document (A-CDD) for Middle Tier Acquisition for Army Tactical Space Layer which was validated on 17 April 2021 and in the Combatant Command Integrated Priority Lists under the following Gap Identification numbers: 2021-SPACE COMMAND-11 (SPACECOM) for Positioning Navigation and Timing (PNT) Resilience; 2021-SPACECOM-12 for Persistent Intelligence and Reconnaissance (ISR) for Mobile Counter Space System Defeat; and 2021 NORTHERN COMMAND-22 for PNT. Space and HA payloads provide persistent/deep sensing to increase the number of actionable targets, decrease target discovery time, extend the range of Army sensing capabilities, improve commander's situational understanding of the Electromagnetic Spectrum and enable lethal and non-lethal fires, and increase/accelerate improved MDO data to assist Commander's decision making process.

Project designs and develops technologies for Space-Based and HA applications to support Army tactical ground forces. Focus is on advanced technology development in support of Army objectives for Joint Operating Environment 2035. Investigations conducted leverage other Department of Defense (DoD) space science and technology applications to support Army space force enhancement and cooperative satellite payload development. Efforts include, but not limited to, research to mature current technologies in quantum sciences based communications, sensing, and data teleportation for small spacecraft and high altitude applications.

Work in this Project complements PE 0603463A (Network C3I Advanced Technology) / Project CJ8 (Assured PNT Communications 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 United States Army Space and Missile Defense Command.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Assured PNT Communications Applied Research	1.709	5.333	5.652
Description: This effort will design, develop, and validate Space and High Altitude technologies, components, and tools that lead to smaller, lighter, more responsive payloads and applications. These technologies will allow for the rapid integration and development of tactical payloads in support of responsive Space or High Altitude environments.			
FY 2023 Plans: Expand capability development across multiple channel domains starting with fiber connectivity, followed by open transmission in a configuration supporting nonmoving platforms, and then to a configuration to track, lock, and maintain connectivity in open			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) CG3 / Assured PNT Communications Applied Research

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
transmission supporting moving platforms (ground, air, and space vehicles). Extend quantum science technologies to warfighter needs such as opportunities in ground launched systems. FY 2024 Plans: Will develop High Altitude (HA) testbed environment. Will continue classified capability development. Will validate Quantum Entanglement (QE) in the lab. FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects planned lifecycle of this effort.			
Title: SBIR/STTR Transfer FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638 FY 2023 to FY 2024 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC §638	-	0.153	-
Accomplishments/Planned Programs Subtotals	1.709	5.486	5.652

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) CI3 / Mobile and Survivable Command Post (MASCP) Tech
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CI3: Mobile and Survivable Command Post (MASCP) Tech	-	6.008	5.728	3.268	-	3.268	0.610	0.611	0.612	0.618	0.000	17.455

A. Mission Description and Budget Item Justification

This Project develops and investigates emerging communications, tactical cloud, distributed computing, power management and storage, and shielding materials necessary to improve Command Post (CP) survivability and effectiveness for near-peer Multi-Domain Operations (MDO) engagements.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project CI7 (Mobile and Survivable Command Post (MASCP) Adv Tech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: CP Modularity and Dispersion Technology	3.994	2.554	2.657
Description: Funds research to enable CP's to reconfigure and reconstitute at speeds consistent with a near-peer MDO engagement. Investigates emerging low probability of interception (LPI)/low probability of detection (LPD) radio technologies, distributed computing, tactical data and security architectures, and distributed collaboration methods. Initiates analysis to develop mobile, and integrated power systems that enable CP's to disperse geographically and create extended at-the-halt and on-the-move command and control.			
FY 2023 Plans: Research concepts refined from gap and threat analysis of peer competitors; investigate technology solutions applicable to CP survivability (e.g., resilient communications, adaptable computing infrastructure, advanced energy sources and smart distribution); conduct analysis and begin development of component level technologies to increase resiliency of Command Post specific communications systems.			
FY 2024 Plans: Will mature technology solutions applicable to CP survivability (e.g., resilient communications, adaptable computing infrastructure, advanced energy sources and smart distribution); design and develop dispersed Command Post node communications with			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) CI3 / <i>Mobile and Survivable Command Post (MASCP) Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
resilient (e.g. anti-jam, low probability of detection (LPD)) and redundant (e.g. spectrum agile, multiple transport path) capabilities; investigate directional antennas and components for each command post node for spatial LPD and improved frequency reuse. FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects planned lifecycle of this effort				
Title: Signature Management and Reduction Technology Description: Investigates and develops electromagnetic spectrum (EMS) management tools to model CP signatures and optimize the employment of CP nodes and communication assets. FY 2023 Plans: Continue validation of the software model for visualizing CP emissions to incorporate automatic recognition and learning of CP radio frequency signatures. FY 2023 to FY 2024 Increase/Decrease Statement: Funding decrease reflects planned conclusion of this effort and transition to PE 0603463 / Project CI7 (Mobile & Survivable Command Post (MASCP) Adv Tech)		1.341	2.409	-
Title: Technology Supporting Camouflage, Concealment, and Deception Description: This effort matures innovative camouflage, concealment and deception technologies for expeditionary high-value assets to defeat advanced current 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, assisting in closing the capability gap between current camouflage, concealment and deception technologies and defeating enemy sensorial capabilities in future operating environments. FY 2023 Plans: Validate natural fiber camouflage material performance based on analysis of alternatives; perform trade space analysis for concealment properties from ISR threats; conduct experiments to validate concealment properties for command post survivability; perform capability assessments of command post structure and enclosure mobility. FY 2024 Plans: Will validate the performance of biomimetic camouflage materials or other solutions (Fibers, Coatings, and Pigments) based on analysis of alternatives; perform trade space analysis for concealment properties from ISR threats; conduct investigations to validate concealment properties for command post survivability. FY 2023 to FY 2024 Increase/Decrease Statement:		0.673	0.577	0.611

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) C13 / Mobile and Survivable Command Post (MASCP) Tech

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Funding increase reflects planned lifecycle of this effort.			
Title: SBIR/STTR Transfer	-	0.188	-
Description: Funding transferred in accordance with Title 15 USC §638			
FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638			
FY 2023 to FY 2024 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	6.008	5.728	3.268

C. Other Program Funding Summary (\$ in Millions) N/A
Remarks
D. Acquisition Strategy N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) CK1 / Assured PNT Enabling Technologies			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CK1: Assured PNT Enabling Technologies	-	1.855	-	-	-	-	-	-	-	-	0.000	1.855

Note

In Fiscal Year 2023 (FY23) this Project is realigned to Program Element (PE) 0602182A (C3I Applied Research) / Project CZ6 (Assured PNT Enabling Applied Technology).

A. Mission Description and Budget Item Justification

Tactical Land Component Forces require access to Space and High Altitude capabilities to enable force projection and maneuver during Multi-Domain Operations. 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.

This Project investigates and matures technologies for Space-Based and High Altitude (HA) applications for Army tactical ground forces. Efforts include the development of sensors and electronic components for communications, signal and information processing, target acquisition, position/ navigation, and threat warning within Space and High Altitude environments. Investigations leverage other Department of Defense (DoD) space science and technology applications to support Army space force enhancement and cooperative satellite payload development. Efforts include research to mature current technologies in quantum sciences based communications, sensing, and data teleportation for small spacecraft applications.

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

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

Work in this Project is performed by the United States Army Space and Missile Defense Command in Huntsville, AL.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Assured PNT Enabling Technologies	1.784	-	-
Description: This effort supports validation of hardware and software components and models to further anchor laboratory capabilities enabling Space/HA sensor or Deep Sensing capabilities, payload design and development.			
Title: SBIR/STTR Transfer	0.071	-	-
Description: Funding transferred in accordance with Title 15 USC 638.			
Accomplishments/Planned Programs Subtotals	1.855	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) CK1 / <i>Assurred PNT Enabling Technologies</i>

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>				Project (Number/Name) CU6 / <i>Adaptive Information Mediation and Analytics</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CU6: <i>Adaptive Information Mediation and Analytics</i>	-	-	7.089	7.226	-	7.226	7.273	7.282	7.287	7.366	0.000	43.523

A. Mission Description and Budget Item Justification

This Project develops techniques to accelerate decision-making at lower echelons where data, information systems (IS), and Soldiers are distributed across complex and hostile environments. With robust multi-modal distributed information analytics and adaptive information mediation, decision makers can share understanding across echelons through a cross-reality information interaction. Research focuses on operational issues and gaps concerning decision uncertainty, at-the-edge situational awareness/understanding, and secure low-Size, Weight, and Power (SWAP) IS that support converged capabilities. These capabilities are critical in overcoming limitations in traditional uni-modal machine learning architectures that depend on extensive training data and stove-piped Command and Control systems that cannot provide a shared, adaptive common operating picture across echelons.

Work in this Project complements Program Element (PE) 0603462 (Next Generation Combat Vehicle Advanced Technology) / Project BF4 (Combat Vehicle Robotics Adv Tech) and Program Element (PE) 0603463 (Network C3I Advanced Technology) / Project AQ8 (High Tempo Data Driven Decision Tools Adv 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 Army Futures Command.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Adaptive Cross Reality Information Mediation	-	2.038	2.146
Description: This effort investigates and develops techniques that intelligently integrate local and external data sources across different interaction modalities to enable enhanced situational awareness, shared understanding between echelons, augmented information representations, and accelerated decision-making. It provides techniques that support at-the-edge situational awareness and accelerate decision-making among distributed humans and agents. Specifically, the research focuses on improving decentralized, yet collaborative decision-making agents through intelligent mediation and delivery of tactical information to dynamic immersive, augmented, and conventional displays that are adaptive to the user and context.			
FY 2023 Plans: Examine methods for intelligent information mediation and adaptive information representation that explore information selection and filtering approaches such as policy-based Value-of-Information/Quality-of-Information (VoI/QoI); investigate the utilization of ubiquitous Internet of Things (IoT) (smart) sensors to augment situational awareness and understanding and hence, increase effectiveness of military operations; investigate methods for resilient information network and processing which integrate			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>heterogeneous IoT sensors, autonomous systems, and Command and Control (C2) systems and platforms, perform analytics, and deliver critical information with value-based selection, prioritization, and dissemination of information reliably over constrained tactical networks; explore methods for improving an immersive Common Operating Picture (COP) by designing cross reality technology to support synthetic data.</p> <p>FY 2024 Plans: Will explore a framework for prioritized data management, filtering, processing, and dissemination; investigate knowledge-based strategies and methods for quantifying the value of information to provide the right information to the right people at the right time; develop a framework for seamless integration with program of records and heterogeneous Internet of Things (IoT) smart sensors to enable a Common Operating Picture (COP) and Situational Awareness (SA) via information representation and visualization in an immersive environment; explore cross-echelon and cross-reality information exchange in secure and controlled Joint Action Partner and Multi Domain Operation (MDO) environments.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects the planned lifecycle of this effort.</p>				
<p>Title: Multi-Domain Information Analytics (MDIA)</p> <p>Description: This effort develops Artificial Intelligence/Machine Learning (AI/ML) approaches for providing Situational Awareness (SA) across echelons that are robust to compromised, corrupted, or limited data and networks in contested and unpredictable battlespace environments. These approaches will provide increased probability of discernment of true vs. false targets, and incorporate uncertainty-aware neuro-symbolic AI/ML to calibrate confidence in algorithm predictions. Research will incorporate multimodal analysis with multi-view scene understanding from heterogeneous sensor systems for context-aware inference, utilize transfer learning techniques to bridge domain gap between real and synthetic data for improved machine learning, and employ Size, Weight and Power-Time (SWaP-T) constrained processing at the edge on emerging low power secure compute architectures through neural network pruning and compression. Simulations of Command and Control (C2) strategies will incorporate the MDIA approaches.</p> <p>FY 2023 Plans: Develop aided target recognition (AiTR) algorithms for real-time detection and recognition of military vehicles and dismount target sets on small unmanned aerial vehicles (UAVs); develop synthetic data generation approaches to generate inherently labeled synthetic electro-optical infrared (EO/IR) data of vehicles and dismounts to substantially augment the limited availability of real training data; validate the AiTR algorithms using collected field data; investigate algorithm-architecture co-optimization frameworks with Field Programmable Gate Arrays (FPGAs) to increase neural network inference speed through optimal algorithm mapping to hardware; explore how machine learning algorithms implemented on size, weight, power and cost (SWaP-C) constrained devices can overcome uncertainty and limited network connectivity for battlefield sensors and Assured Position Navigation and Time (A-</p>		-	4.792	5.080

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>PNT) uses; research and develop event-triggered consensus-based distributed learning methods that are robust to adversarial manipulation for machine learning models meeting constraints of low SWaP computing devices; research techniques to develop and characterize synthetic data sets that include novel synthetic objects and backgrounds; experiment with larger and more varied synthetic augmentations to traditional training data sets; identify and correlate effects of synthetic training data augmentation to trained object classifier performance; develop methodologies to enhance classification performance against uncommon targets with synthetic training data augmentation; develop methods for incorporating synthetic scenes, real scenes, and SA in AI-driven multi-echelon C2 simulations.</p> <p>FY 2024 Plans: Will develop enhanced aided target recognition (AiTR) and scene understanding algorithms for both ground based (manned and unmanned ground vehicles) and unmanned aerial vehicles (UAVs) applications; mature synthetic data generation techniques for simulation of militarily-relevant targets and environments, and optimize algorithm training through hybrid datasets of real and synthetic target data for both electro-optical/visible and infrared spectral bands; explore artificial intelligence (AI) for command and control approaches, integrating real-time in situ cursor on target information for course of action generation by an artificial commander; conduct holistic experiments of developed AiTR models and decision aid/command and control software at large scale Army field experimentation events to validate the efficacy of approaches and inform further technology development and maturation; develop uncertainty-aware evidential reasoning methods for processing over light weight SWaP computing devices and assess their robustness due to limited training data and adversarial manipulations; develop neuro-symbolic complex event processing algorithms for recognition of complex events.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increase reflects the planned lifecycle of this effort.</p>			
<p>Title: SBIR/STTR Transfer</p> <p>FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC §638</p>	-	0.259	-
Accomplishments/Planned Programs Subtotals	-	7.089	7.226

C. Other Program Funding Summary (\$ in Millions) N/A
Remarks

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D. Acquisition Strategy
N/A

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Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology				Project (Number/Name) CV4 / Pathfinder 3D Applied Technology			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CV4: Pathfinder 3D Applied Technology	-	-	2.191	2.090	-	2.090	1.254	1.674	1.885	1.805	0.000	10.899

A. Mission Description and Budget Item Justification

This Project investigates and develops a geospatial rapid position and navigation solution in Global Positioning System (GPS) degraded and denied environments. Research focuses on using onboard sensors and high-resolution digital terrain geospatial alternative solution based upon Visual Three-Dimensional (3-D) Terrain Referencing and Navigation (VTRAN). This Project will result in the linkage of air and ground assets integrating sensory and (One World Terrain and Reference) geospatial data within the modular GPS Independent Sensors architecture. This Project provides critical alternatives to maneuver forces for position and navigation in a multi-domain operational environment.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project DB6 (PATHFINDER 3D Adv Tech).

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

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: PATHFINDER 3-D Navigation Technology</p> <p>Description: This effort will design and develop enhanced feature classification for improved position navigation performance and will improve 3-D data extraction techniques to reduce computation.</p> <p>FY 2023 Plans: Advance development in testing integrated foundation geospatial intelligence (GEOINT), sensory sources (from both air and ground) to derive state estimation for a semi-autonomous robotic system; investigate routing capabilities, sensors and a basic inertial accuracy for VTRAN Geospatial solutions.</p> <p>FY 2024 Plans: Will develop algorithms and methods to generate position/orientation from geospatially-based Visual Terrain Reference and Navigation and onboard sensors in the absence of GPS as an assured position navigation technology.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding decrease reflects the planned lifecycle of this effort.</p>	-	2.111	2.090
<p>Title: SBIR/STTR Transfer</p> <p>Description: Funding transferred in accordance with Title 15 USC §638</p>	-	0.080	-

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / <i>Network C3I Technology</i>	Project (Number/Name) CV4 / <i>Pathfinder 3D Applied Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<i>FY 2023 Plans:</i> Funding transferred in accordance with Title 15 USC §638			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	-	2.191	2.090

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A