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Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army **Date:** April 2022

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603457A / <i>C3I Cyber Advanced Development</i>
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COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
Total Program Element	-	43.357	61.426	41.354	-	41.354	28.720	19.097	34.073	34.361	0.000	262.388
6CY: <i>Autonomous Cyber Advanced Technology</i>	-	5.995	9.304	11.188	-	11.188	7.495	4.603	19.081	22.594	0.000	80.260
8CY: <i>Information Trust Advanced Technology</i>	-	10.900	15.876	20.028	-	20.028	11.138	4.157	-	-	0.000	62.099
9CY: <i>Network Access and Effects Advanced Technology</i>	-	4.464	4.347	8.170	-	8.170	10.087	10.337	14.992	11.767	0.000	64.164
CB4: <i>Offensive Cyber Operations (OCO) Mirror Adv Tech</i>	-	1.998	1.899	1.968	-	1.968	-	-	-	-	0.000	5.865
CB6: <i>C3I Cyber Advanced Development (CA)</i>	-	20.000	30.000	-	-	-	-	-	-	-	0.000	50.000

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates technologies for offensive and defensive cyber operations in tactical environments. Projects optimize devices, techniques, services, software and algorithms to enable cyber situational understanding and Cyber Electromagnetic Activities (CEMA). For offensive cyber, efforts demonstrate integrated electronic attack (EA) and CEMA hardware and software to execute force protection (FP), EA, electronic surveillance (ES), signals intelligence (SIGINT), electronic warfare (EW) and cyber missions in a dynamic, distributed and coordinated fashion. For defensive cyber, efforts demonstrate hardware and software to protect tactical wired and wireless networks against modern cyber attacks and focuses on configuration, operation, monitoring, data integrity, and defense in bandwidth constrained tactical environments while reducing the operator workload required to conduct these functions.

This PE directly supports the Network Army Modernization Priority.

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

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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603457A / <i>C3I Cyber Advanced Development</i>
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B. Program Change Summary (\$ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	43.357	31.426	0.000	-	0.000
Current President's Budget	43.357	61.426	41.354	-	41.354
Total Adjustments	0.000	30.000	41.354	-	41.354
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	30.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	41.354	-	41.354

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

Project: CB6: *C3I Cyber Advanced Development (CA)*

Congressional Add: *Program Increase - High Bandwidth Cryptomodule Enhancements and Certification*

Congressional Add: *Program Increase - Low SWAP Software-Defined MFEW*

Congressional Add Subtotals for Project: CB6

Congressional Add Totals for all Projects

	FY 2021	FY 2022
	10.000	30.000
	10.000	-
	20.000	30.000
	20.000	30.000

Change Summary Explanation

Fiscal Year 2023 (FY23) funding increase reflects the fact that the FY22 President's Budget request did not include out-year funding.

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Exhibit R-2A, RDT&E Project Justification: PB 2023 Army										Date: April 2022		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603457A / C3I Cyber Advanced Development				Project (Number/Name) 6CY / Autonomous Cyber Advanced Technology			
COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
6CY: Autonomous Cyber Advanced Technology	-	5.995	9.304	11.188	-	11.188	7.495	4.603	19.081	22.594	0.000	80.260
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project will demonstrate defensive effects to adversarial use of artificial intelligence (AI) and machine learning (ML) to avoid detection and deceive our automated technologies driving the network decisions. This Project also provides cyber autonomy through science & technology advancements.

Research in this Project complements Program Element (PE) 0602213A (C3I Applied Cyber) / Project CY6 (Autonomous Cyber Technology).

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.

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

	FY 2021	FY 2022	FY 2023
Title: Autonomous Cyber	5.995	9.304	11.188
Description: This effort will develop proof-of-concept sensors that can adapt to and autonomously react to adversary cyber-attack and develop a cyber response course of action decision aid for cyber defenders to validate suitability of actions and to speed response decisions.			
FY 2022 Plans: Will validate the interoperable AI/ML based cyber defense decision aid architecture supporting warfighter planning in a high-fidelity cyber emulation environment; will demonstrate significant performance improvements in cyber response course of action decision aid software while optimizing the ingestion and correlation of event feeds from existing sensors, cybersecurity applications, and services to provide intuitive recommendations to the S6 Cyber Electromagnetic Activities (CEMA) personnel for use in countering adversarial cybersecurity events in a high-fidelity cyber emulation environment. This technology will ease the burden of knowledge, validate correctness of actions, and speed response decisions.			
FY 2023 Plans: Will mature and demonstrate AI/ML based cyber defense decision aid architecture supporting warfighter planning at a soldier run exercise; will mature and demonstrate sensors that can adapt to and autonomously react to adversary cyber-attack at a soldier run exercise; will mature Generative network algorithms and neural network software to simulate adversarial attacks on AI/ML algorithms along with defenses against such attacks to ensure trustworthiness of autonomous decision engines and mitigate			

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Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603457A / C3I Cyber Advanced Development	Project (Number/Name) 6CY I Autonomous Cyber Advanced Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
vulnerable decisions, as well as demonstrate these capabilities in lab and field based demonstrations; will mature cyber machine learning architecture to ensure the machine learning software can interoperate and be updated in tactical environment, which will be demonstrated in lab and field based demonstrations.				
FY 2022 to FY 2023 Increase/Decrease Statement: Planned funding increase of this effort to improve and demonstrate cyber response course of action decision aid software.				
Accomplishments/Planned Programs Subtotals		5.995	9.304	11.188
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 2023 Army										Date: April 2022		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603457A / C3I Cyber Advanced Development				Project (Number/Name) 8CY / Information Trust Advanced Technology			
COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
8CY: Information Trust Advanced Technology	-	10.900	15.876	20.028	-	20.028	11.138	4.157	-	-	0.000	62.099
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project demonstrates enhanced awareness of the information's "provenance" from originator to consumer (e.g. sensor to shooter) in the presence of cyber-attacks, such as an attempt to manipulate data traversing the network.

Research in this Project complements Program Element (PE) 06022213A (C3I Applied Cyber) / Project 2CY (Information Trust Technology) and PE 0602213A (C3I Applied Cyber) / Project CY1 (Information Assurance and Network Resiliency Tech).

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

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

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

	FY 2021	FY 2022	FY 2023
Title: Information Trust Advanced Technology	3.500	4.507	6.532
Description: This Project demonstrates enhanced awareness of the information's "provenance" from originator to consumer (e.g. sensor to shooter) in the presence of cyber-attacks, such as an attempt to manipulate data traversing the network.			
FY 2022 Plans: Will mature and demonstrate the specification based fixed format message checking and machine learning based integrity services that ensure the integrity of a messages data, origin, and chain of custody as it traverses the network; will mature and demonstrate the authentication service proof-of-concept that helps determine and track user trust values within a block chain architecture; will implement and mature technology to create a suitable de-centralized lightweight block chain algorithm that can be leveraged to ensure a secure distributed ledger of messages and associated risk with automated analysis of attempted malicious modification; will optimize user and role-based authentication services and demonstrate within high fidelity cyber emulation environment.			
FY 2023 Plans: Will continue to mature and demonstrate the specification based fixed format message checking and machine learning based integrity services that ensure the integrity of messages data, origin, and chain of custody as it traverses the network; will optimize specification based and machine learning based integrity services and will demonstrate within high fidelity cyber emulation			

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Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022		
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603457A / C3I Cyber Advanced Development	Project (Number/Name) 8CY I Information Trust Advanced Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>environment; will continue to implement and mature technology to create a suitable de-centralized lightweight blockchain algorithm that can be leveraged to ensure a secure distributed ledger of messages and associated risk with automated analysis of attempted malicious modification; will optimize the lightweight blockchain technology within a high fidelity cyber emulation environment; will implement and mature technology to create a trust score architecture that provides a real-time and quantitative analytics based level of trustworthiness upon the data received from the integrity, authentication, and provenance tracker services.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Funding in this effort was increased for demonstration of the authentication service.</p>				
<p>Title: Agile Virtual Enclave</p> <p>Description: This effort matures and demonstrates a Multi-Level Security (MLS) Access Guard to reduce hardware infrastructure required for US Government owned systems and develop a Mission Partner Environment (MPE) transfer cross domain solution (CDS) to enable data sharing with coalition partners.</p> <p>FY 2022 Plans: Will integrate a demonstrable baseline Cross Domain Solution (CDS) which will incorporate MSL Access Guard with the MPE Transfer Guard solution. Will conduct a validation and verification evaluations and field tests, on the final Integrated CDS deliverable in order to prove out the technology. Will mature all supporting documentation generated throughout the length of the Agile Virtual Enclave (AVE) program to include Preliminary Design Reviews (PDRs) and Capabilities Design Document (CDDs) for all the deliverables. Will mature a generalized solution for use on MSL Access Guard platform with potential for adaptation across Armed Forces systems and will incorporate it into the final deliverable.</p> <p>FY 2023 Plans: Will continue development of a software solution for Army Mission Command (MC) systems to achieve secure and operationally adjustable data exchange between US Armed Forces tactical systems and MPE connected systems; will mature Access and Transfer Guard components; will conduct lab and field-based risk reduction activities; will demonstrate and assess technology readiness levels for the integrated solution in a relevant environment and address Program Manager (PM) MC and National Security Agency (NSA) concerns prior to transition.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: Funding in this effort was increased to mature and demonstrate technology to develop a MLS Access Guard for data sharing in a mission partner environment with a reduced hardware footprint.</p>		7.400	11.369	13.496
Accomplishments/Planned Programs Subtotals		10.900	15.876	20.028

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Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603457A / <i>C3I Cyber Advanced Development</i>	Project (Number/Name) 8CY / <i>Information Trust Advanced Technology</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 2023 Army										Date: April 2022		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603457A / C3I Cyber Advanced Development				Project (Number/Name) 9CY / Network Access and Effects Advanced Technology			
COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
9CY: Network Access and Effects Advanced Technology	-	4.464	4.347	8.170	-	8.170	10.087	10.337	14.992	11.767	0.000	64.164
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced mission management tools and workflows, to promote efficient selection and sequencing of effects to support the agile deployment and execution of Offensive Cyber Operations (OCO) / Radio Frequency (RF) Enabled capabilities.

Research in this Project complements Program Element (PE) 0602213A (C3I Applied Cyber) / Project 3CY (Network Access and Effects Technology).

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).

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

	FY 2021	FY 2022	FY 2023
Title: Offensive Cyber Enabling Mission Support	4.464	4.347	8.170
Description: This effort matures and demonstrates advanced mission management tools and workflows, to promote efficient selection and sequencing of effects to support the agile deployment and execution of OCO / RF Enabled capabilities.			
FY 2022 Plans: Will mature and demonstrate OCO/RF enabled access and effects vectors against validated targets of interest; optimize assisted technique development for expedited vulnerability discovery against validated Adversary Command, Control, Communication, Computers, and Intelligence (AC4I) targets of interest; and mature decision aids for optimization of RF enabled techniques in support of the Commander's desired intent.			
FY 2023 Plans: Will demonstrate assisted technique development to reduce time to vector discovery via software transition. Will mature and demonstrate OCO/RF enabled effect technologies against priority target of interest. Will optimize the use of OCO/RF firing platforms against near-peer targets of interest with a scaled process while minimizing manual processing and operator burden.			
FY 2022 to FY 2023 Increase/Decrease Statement:			

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Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603457A / C3I Cyber Advanced Development	Project (Number/Name) 9CY / Network Access and Effects Advanced Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
Funding increase to mature and demonstrate technologies for higher ranked priorities for Offensive Cyber capability development and deployment.				
Accomplishments/Planned Programs Subtotals		4.464	4.347	8.170
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 2023 Army										Date: April 2022		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603457A / C3I Cyber Advanced Development				Project (Number/Name) CB4 / Offensive Cyber Operations (OCO) Mirror Adv Tech			
COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
CB4: <i>Offensive Cyber Operations (OCO) Mirror Adv Tech</i>	-	1.998	1.899	1.968	-	1.968	-	-	-	-	0.000	5.865
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates methods, tools and techniques to enable rapid instantiation of an operationally relevant cyberspace environment supporting critical Offensive Cyber Operations (OCO) mission functions to include but not limited to development, exercise, mission rehearsal and provide technical reach back to units during operations.

Research in this Project complements Program Element (PE) 0602213A (C3I Applied Cyber) / Project 5CY (Offensive Cyber Operations (OCO) Mirror Technology).

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.

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

	FY 2021	FY 2022	FY 2023
Title: Offensive Cyber Operations Mirror	1.998	1.899	1.968
Description: This effort matures and demonstrates methods, tools and techniques to enable rapid instantiation of an operationally relevant cyberspace environment supporting critical OCO mission functions to include but not limited to development, exercise, mission rehearsal and provide technical reach back to units during operations.			
FY 2022 Plans: Will mature and demonstrate incremental modeling and simulation (M&S) software and optimize fidelity driven Development Security Operations (DevSecOps) with exemplar OCO/Radio Frequency (RF) firing platforms; demonstrate information operations social influence mission functions within relevant environment; and optimizes the ?body of evidence? necessary to achieve an accredited rapid response enclave in support of DevSecOps utilization of tactical OCO/RF Enabled platforms at mission speed.			
FY 2023 Plans: Will demonstrate OCO Mirror Rev 3 product at annual Cyber Blitz test event. Will transition OCO Mirror product Rev 3 at technology readiness level (TRL) 6. All OCO Mirror products will receive authorization to operate (ATO) on Top Secret level information systems.			
FY 2022 to FY 2023 Increase/Decrease Statement:			

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Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603457A / C3I Cyber Advanced Development	Project (Number/Name) CB4 / Offensive Cyber Operations (OCO) Mirror Adv Tech

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2021	FY 2022	FY 2023
Funding change reflects planned life cycle of effort			
Accomplishments/Planned Programs Subtotals	1.998	1.899	1.968

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 2023 Army										Date: April 2022		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603457A / C3I Cyber Advanced Development			Project (Number/Name) CB6 / C3I Cyber Advanced Development (CA)				
COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
CB6: C3I Cyber Advanced Development (CA)	-	20.000	30.000	-	-	-	-	-	-	-	0.000	50.000
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note
Congressional Interest Item funding provided for C3I Cyber Advanced Development.

A. Mission Description and Budget Item Justification
Congressional Interest Item funding provided for C3I Cyber Advanced Development.

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 2021	FY 2022
Congressional Add: Program Increase - High Bandwidth Cryptomodule Enhancements and Certification	10.000	30.000
FY 2021 Accomplishments: Conducted advanced research in High Bandwidth Cryptomodule Enhancements and Certification. Work executed by Army Futures Command.		
FY 2022 Plans: Congressional Interest Item funding provided for High Bandwidth Cryptomodule Enhancements and Certification		
Congressional Add: Program Increase - Low SWAP Software-Defined MFEW	10.000	-
FY 2021 Accomplishments: Conducted advanced research in Low SWAP Software-Defined MFEW. Work executed by Army Futures Command.		
Congressional Adds Subtotals	20.000	30.000

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

N/A

Remarks

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D. Acquisition Strategy
N/A