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**Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Army** **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army / BA 3: Advanced Technology Development (ATD)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / <i>C3I Cyber Advanced Development</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	-	0.000	23.769	23.357	-	23.357	28.773	31.113	17.039	12.373	0.000	136.424
6CY: <i>Autonomous Cyber Advanced Technology</i>	-	0.000	6.000	5.995	-	5.995	7.993	8.451	5.106	5.391	0.000	38.936
7CY: <i>Decoy and Deterrence Advanced Technology</i>	-	0.000	2.135	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.135
8CY: <i>Information Trust Advanced Technology</i>	-	0.000	2.203	10.900	-	10.900	14.269	15.593	4.951	0.000	0.000	47.916
9CY: <i>Network Access and Effects Advanced Technology</i>	-	0.000	1.431	4.464	-	4.464	4.513	5.071	4.962	4.962	0.000	25.403
CB4: <i>Offensive Cyber Operations (OCO) Mirror Adv Tech</i>	-	0.000	2.000	1.998	-	1.998	1.998	1.998	2.020	2.020	0.000	12.034
CB6: <i>C3I Cyber Advanced Development (CA)</i>	-	0.000	10.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.000

**Note**

In Fiscal Year (FY) 2020 this Program Element (PE) was previously funded, with continuity of effort realigned from the following PEs:

\* 0603270A Electronic Warfare Technology

\* 0603794A C3 Advanced Technology

**A. Mission Description and Budget Item Justification**

This PE matures and demonstrates technologies for offensive and defensive cyber operations in tactical environments. Efforts 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.

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

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

**UNCLASSIFIED**

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<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>
Previous President's Budget	0.000	13.769	18.795	-	18.795
Current President's Budget	0.000	23.769	23.357	-	23.357
Total Adjustments	0.000	10.000	4.562	-	4.562
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	10.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	4.562	-	4.562

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

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

Congressional Add: *Program Increase*

	<b>FY 2019</b>	<b>FY 2020</b>
	-	10.000
Congressional Add Subtotals for Project: CB6	-	10.000
Congressional Add Totals for all Projects	-	10.000

**Change Summary Explanation**

FY20 increase related to FY20 Congressional Add.

FY21 increase due to Science & Technology portfolio restructure.

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 3	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / C3I Cyber Advanced Development	<b>Project (Number/Name)</b> 6CY / Autonomous Cyber Advanced Technology
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
6CY: Autonomous Cyber Advanced Technology	-	0.000	6.000	5.995	-	5.995	7.993	8.451	5.106	5.391	0.000	38.936

**Note**

In Fiscal Year 2020 (FY20) this Project was realigned from:  
 Program Element (PE) 06030794A C3 Advanced Technology:  
 \* Project EL5 Secure Tactical Information Integration

**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 provides cyber autonomy through science & technology advancements.

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

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

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

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

<b>Title:</b> Autonomous Cyber	FY 2019	FY 2020	FY 2021
<b>Description:</b> 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 correctness of actions and to speed response decisions.	-	6.000	5.995
<b>FY 2020 Plans:</b> Will develop proof-of-concept sensors that can adapt to and autonomously react to adversary cyber-attack; develop a cyber response course of action decision aid for cyber defenders to validate correctness of actions and to speed response decisions.			
<b>FY 2021 Plans:</b> Will mature and demonstrate proof-of-concept cyber response course of action decision aid software that will ingest and correlate event feeds from existing sensors, cybersecurity applications, and services to provide intuitive recommendations to the S6 Cyber			

**UNCLASSIFIED**

<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 3	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / C3I Cyber Advanced Development	<b>Project (Number/Name)</b> 6CY / Autonomous Cyber Advanced Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
Electromagnetic Activities (CEMA) personnel for use in countering adversarial cybersecurity events. This technology will ease the burden of knowledge, validate correctness of actions, and speed response decisions.				
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding change reflects planned lifecycle of this effort.				
<b>Accomplishments/Planned Programs Subtotals</b>		-	6.000	5.995
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 3	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / C3I Cyber Advanced Development	<b>Project (Number/Name)</b> 7CY I Decoy and Deterrence Advanced Technology
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
<i>7CY: Decoy and Deterrence Advanced Technology</i>	-	0.000	2.135	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.135

**Note**

In Fiscal Year (FY) 2020 this Project was realigned from:  
 Program Element (PE) 0603794A C3 Advanced Technology:  
 \* Project EL5 Secure Tactical Information Integration

In FY21 this Project is Eliminated.

**A. Mission Description and Budget Item Justification**

This Project demonstrates disruption of enemy cyber attacked through the use of cyber decoy applications with realistic user behavior algorithms, such as software that creates fake users, applications, systems, documents, networks, and communication traffic. Work in this Project complements PE 0602213A C3I Applied Cyber, Project CY9 Decoy and Deterrence Technology.

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

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

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

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

<b>Title:</b> Decoy and Deterrence Advanced Technology	FY 2019	FY 2020	FY 2021
<b>Description:</b> This Project demonstrates disruption of enemy cyber attacked through the use of cyber decoy applications with realistic user behavior algorithms, such as software that creates fake users, applications, systems, documents, networks, and communication traffic.	-	2.135	-
<b>FY 2020 Plans:</b> Develop additional techniques incorporating application diversity to control and vary the network attack surface to inhibit the cyber attacker's ability to detect and exploit pre-placed cyber decoys.			
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b>			

**UNCLASSIFIED**

<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020
<b>Appropriation/Budget Activity</b> 2040 / 3	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / C3I Cyber Advanced Development	<b>Project (Number/Name)</b> 7CY / Decoy and Deterrence Advanced Technology

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
This Project is eliminated in FY21.			
<b>Accomplishments/Planned Programs Subtotals</b>	-	2.135	-

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

N/A

**Remarks**

**D. Acquisition Strategy**

N/A

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 3	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / C3I Cyber Advanced Development	<b>Project (Number/Name)</b> 8CY / Information Trust Advanced Technology
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
8CY: Information Trust Advanced Technology	-	0.000	2.203	10.900	-	10.900	14.269	15.593	4.951	0.000	0.000	47.916

**Note**

In Fiscal Year (FY) 2020 this Project was realigned from:  
 Program Element (PE) 0603794A C3 Advanced Technology:  
 \* Project EL5 Secure Tactical Information Integration

**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. Work in this Project complements PE 06022213A C3I Applied Cyber, Project 2CY Information Trust Technology.

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

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

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

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

<b>Title:</b> Information Trust Advanced Technology	FY 2019	FY 2020	FY 2021
<b>Description:</b> 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.	-	2.203	3.500
<b>FY 2020 Plans:</b> Develop a suitable trust score architecture that can provide real time analytics of the data through distributed processing and minimization of network traffic.			
<b>FY 2021 Plans:</b> Will mature and demonstrate the authentication service that helps determine and track user trust values within a block chain architecture.			
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b>			

**UNCLASSIFIED**

<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 3	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / C3I Cyber Advanced Development	<b>Project (Number/Name)</b> 8CY I Information Trust Advanced Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
Planned increase for demonstration of the authentication service.				
<b>Title:</b> Agile Virtual Enclave		-	-	7.400
<b>Description:</b> To develop 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.				
<b>FY 2021 Plans:</b> Will mature, optimize and demonstrate a MLS access guard implementation that leverages virtual container techniques to allow users to access different levels of classified data from a common hardware platform; mature and demonstrate a Transfer Guard implementation that supports MPEs and allows access to common services and mission command as part of a network package that is reliable, protected and configurable to mission requirements for multiple security classification information requirements that enable seamless preparation and conduct of unified land operations.				
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding 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.				
<b>Accomplishments/Planned Programs Subtotals</b>		-	2.203	10.900
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 3	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / C3I Cyber Advanced Development	<b>Project (Number/Name)</b> 9CY / Network Access and Effects Advanced Technology
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
9CY: Network Access and Effects Advanced Technology	-	0.000	1.431	4.464	-	4.464	4.513	5.071	4.962	4.962	0.000	25.403

**Note**

In Fiscal Year (FY) 2020 this Project was realigned from:  
 Program Element (PE) 060270A C3 Advanced Technology:  
 \* Project CY3 Offensive Cyber Operations Mirror Adv Tech

**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 / Radio Frequency (RF) Enabled capabilities.

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

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

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

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

<b>Title:</b> Offensive Cyber Enabling Mission Support	FY 2019	FY 2020	FY 2021
<b>Description:</b> 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 Offensive Cyber Operations/Radio Frequency(RF) Enabled capabilities.	-	1.431	4.464
<b>FY 2020 Plans:</b> Will mature and demonstrate protocol-based access and Deny, Degrade, and Disrupt, Destroy, and manipulate (D4M) off-net techniques from tactical Radio Frequency (RF) enabled platforms against emerging hybrid commercial/military technologies used for Adversary Command, Control, Communication, Computers, and Intelligence (AC4I); mature decision aid tools for selection and optimization of RF enabled techniques in support of the Commander's desired intent.			
<b>FY 2021 Plans:</b>			

**UNCLASSIFIED**

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<b>Appropriation/Budget Activity</b> 2040 / 3	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / C3I Cyber Advanced Development	<b>Project (Number/Name)</b> 9CY I Network Access and Effects Advanced Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
Will mature and optimize protocol-based access offensive cyber operations techniques and demonstrate D4M effects launched from tactical RF platforms against specific targets of interest in an suitable environment				
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Increased funding supports high priority offensive cyber operations research, accelerates time to deployment for cyber effects, and begins the process of automatic vulnerability discovery via the decision aid tools.				
<b>Accomplishments/Planned Programs Subtotals</b>		-	1.431	4.464
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 3	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / C3I Cyber Advanced Development	<b>Project (Number/Name)</b> CB4 / Offensive Cyber Operations (OCO) Mirror Adv Tech
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
CB4: <i>Offensive Cyber Operations (OCO) Mirror Adv Tech</i>	-	0.000	2.000	1.998	-	1.998	1.998	1.998	2.020	2.020	0.000	12.034

**Note**

In Fiscal Year 2020 (FY20) this Project was realigned from:  
 Program Element (PE) 0603270A Electronic Warfare Technology:  
 \* Project CY3 Offensive Cyber Operations Mirror Adv Tech

**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.

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

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

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

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

<b>Title:</b> Offensive Cyber Operations Mirror	FY 2019	FY 2020		FY 2021
<b>Description:</b> 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.	-	2.000		1.998
<b>FY 2020 Plans:</b> Mature and demonstrate technologies and real world behavioral models of sufficient fidelity to replicate Offensive Cyber Operations environments (for cyber development, deployment, exercises, and mission rehearsal) to reduce risk for critical offensive cyber mission functions.				
<b>FY 2021 Plans:</b>				

**UNCLASSIFIED**

<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 3	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / C3I Cyber Advanced Development	<b>Project (Number/Name)</b> CB4 / Offensive Cyber Operations (OCO) Mirror Adv Tech		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
Will mature and demonstrate initial increment of an interactive modeling and simulation capability within rapid response environment; and mature and demonstrate validated mirror capabilities within an interactive, behavior based modeling and simulation environment.  <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding change reflects planned lifecycle of this effort.				
<b>Accomplishments/Planned Programs Subtotals</b>		-	2.000	1.998
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 3	<b>R-1 Program Element (Number/Name)</b> PE 0603457A / C3I Cyber Advanced Development	<b>Project (Number/Name)</b> CB6 / C3I Cyber Advanced Development (CA)
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
CB6: C3I Cyber Advanced Development (CA)	-	0.000	10.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.000

**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>B. Accomplishments/Planned Programs (\$ in Millions)</b>	FY 2019	FY 2020
<b>Congressional Add:</b> Program Increase	-	10.000
<b>FY 2020 Plans:</b> Program Increase		
<b>Congressional Adds Subtotals</b>	-	10.000

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

**Remarks**

**D. Acquisition Strategy**  
N/A