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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2022 Army **Date:** May 2021

<b>Appropriation/Budget Activity</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army / BA 2: Applied Research</i>	<b>R-1 Program Element (Number/Name)</b> PE 0602181A / <i>All Domain Convergence Applied Research</i>
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	-	-	-	25.967	-	25.967	-	-	-	-	-	-
CM7: <i>Collaborative Convergence Applied Research</i>	-	-	-	25.967	-	25.967	-	-	-	-	-	-

**Note**

This is a new start in FY 2022.

This is a new start in Fiscal Year 2022 (FY22).

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

The Program Element (PE) executes research as part of a campaign of learning to assess feasibility of technologies in an operational environment, learning from early failure and re-scope research to improve speed of response, scalability, interoperability and range of engagement. This program element will enable integration of technologies from sensor to shooter in near real-time, from tactical to strategic level, taking a system design approach. It will enable optimal lethal and non-lethal effects across all domains using artificial intelligence and machine learning to improve how we recognize threats, augment and enhance leader decision-making, replicate tactical behaviors to enable autonomous capabilities, and design system engineering architectures to validate interoperability of technologies.

Work in this PE complements PE 0602145A (Next Generation Combat Vehicle Technology).

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

Work is performed by the United States Army Futures Command.

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<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022 Base</b>	<b>FY 2022 OCO</b>	<b>FY 2022 Total</b>
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	25.967	-	25.967
Total Adjustments	0.000	0.000	25.967	-	25.967
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	25.967	-	25.967

**Change Summary Explanation**

New Program Element in Fiscal Year (FY) 2022 established for applied research being advanced in support of Project Convergence, an effort to connect all sensors to all shooters to enable an all domain kill web.

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**Exhibit R-2A, RDT&E Project Justification:** PB 2022 Army **Date:** May 2021

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602181A / All Domain Convergence Applied Research	<b>Project (Number/Name)</b> CM7 / Collaborative Convergence Applied Research
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
CM7: Collaborative Convergence Applied Research	-	-	-	25.967	-	25.967	-	-	-	-	-	-

**Note**

This is a new start in FY 2022.

In Fiscal Year 2022 (FY22). This is a new start Project.

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

This Project supports research required to oppose adversary technologies in the threat based early operational environment. Focus is on those technologies that will aid in reducing the sensors to shooters timelines. This is accomplished using Artificial Intelligence (AI) algorithm decision agent design architectures, advanced methods for processing data, and improved AI performance. Additionally, this Project will research technologies and solutions necessary to enable mission command in multi-domain operations. The project will accelerate emerging research to achieve sensor to shooter dominance.

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 effort is performed by the United States (US) Army Futures Command.

Work in this Project supports Next Generation Combat Vehicle, Network, Future Vertical Lift, and Long Range Precision Fires Army Modernization Priorities.

This work is done in coordination with PE 0603041A (All Domain Convergence Advanced Technology).

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

<b>Title:</b> AI-Enabled Decision Support in Distributed Networks	FY 2020	FY 2021	FY 2022
<b>Description:</b> This effort researches techniques to understand and model complex multi-platform tactical networks in Multi-Domain Operational environments to develop training data sets for AI-enabled tactical decision support capabilities. This effort leverages Army research informed by Army Doctrine on data value, consensus, uncertainty, human-agent teaming and network science to optimize decision support training data production. Supports AI-enabled decision support capabilities for Next Generation Combat Vehicle, Network, Future Vertical Lift, and Long Range Precision Fires Army Modernization Priorities.	-	-	5.594
<b>FY 2022 Plans:</b>			

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p>Will collect Machine Learning (ML) training data such as imagery, quantitative confidence, speed, accuracy, and process data from sensor to shooter experimental tactical engagements for curation and distribution; develop tactical engagement models and training data sets for AI-enabled decision support tools in complex, multi-domain tactical networks.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> In FY 2022, this is a new start.</p>				
<p><b>Title:</b> Synthetic Data for AI-Enabled Decision Support</p> <p><b>Description:</b> This effort researches approaches to incorporate synthetic data to augment Army training data sets and optimize AI performance for uncommon Multi-Domain Operations (MDO) targets and environments. This effort investigates efficacy and optimal application of synthetic training data developed using multiple technical methods, including physics-based models and generative adversarial techniques. This effort will experiment with artificially augmented data sets to enable classification of rare targets and cost-effective enterprise-level training data generation. Supports AI-enabled decision support capabilities for Next Generation Combat Vehicle, Network, Future Vertical Lift, and Long Range Precision Fires Army Modernization Priorities.</p> <p><b>FY 2022 Plans:</b> Will investigate techniques to develop and characterize state-of-the-art synthetic data sets; research methods to incorporate synthetic data into target classification algorithm training sets and understand its effects on target classification performance against uncommon high priority MDO targets; experiment with artificially augmented data sets to enable classification of rare targets and cost-effective enterprise-level data generation.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> In FY 2022, this is a new start.</p>		-	-	6.295
<p><b>Title:</b> Data Characterization for AI-Enabled Decision Support</p> <p><b>Description:</b> This effort will investigate techniques for data management, characterization, curation, labeling, and classification to enable repeatable, robust performance of trained AI-enabled decision support capabilities for complex, multi-platform tactical networks in varied tactical Multi-Domain Operations (MDO) environments. Supports AI-enabled decision support capabilities for Next Generation Combat Vehicle, Network, Future Vertical Lift, and Long Range Precision Fires Army Modernization Priorities.</p> <p><b>FY 2022 Plans:</b> Will explore and assess methodologies for efficient, effective training data set development, characterization, and curation; develop and deploy Army's curated training data sets on network-enabled development platforms for joint collaborative research on training methods for object classifiers, AI-enabled decision support tools, and autonomy.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b></p>		-	-	5.390

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
In FY 2022, this is a new start.				
<p><b>Title:</b> Lethality Architecture</p> <p><b>Description:</b> Designs networked lethality role-based architecture to support automated decision aids and target handoff capability for combined arms operations. Designs a hybrid distributed architecture that will ingest real-time, prioritized data for decision agents to support scalable operations with reduced processing time.</p> <p><b>FY 2022 Plans:</b> Will develop an architecture to support time and space synchronization of fires and distributed lethality. Will determine required communications, data interfaces, and digital sensor to shooter planning for fires execution. Will also de-conflict between various sensors and weapon systems in combined arms maneuver to reduce sensor to shooter timelines. Will develop methods to use local distributed world model coordinates for input to decision aids when network is degraded and when network bandwidth is optimal.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> In FY22, this is a New Start.</p>		-	-	6.250
<p><b>Title:</b> Algorithms and Environment</p> <p><b>Description:</b> Designs and develops a data model for commander decision aided algorithms to support integrated direct &amp; indirect fires; defines the process and data structure to automate decision aids and target handoff for simultaneous engagements to air/ground platforms; and designs decentralized data structures and hybrid databases that can scale to echelons and user selectable input.</p> <p><b>FY 2022 Plans:</b> Will investigate simulation requirements for tactical fires of multiple company formations, which will include coordinating decentralized operations in different terrain models.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> In FY22, this is a New Start.</p>		-	-	0.500
<p><b>Title:</b> Fires Coordination</p> <p><b>Description:</b> Designs and develops integrated direct/indirect effects coordination and execution. Investigates autonomous cooperative engagement methods by modeling adversary behavior to determine the optimal shooter(s) for a large number of targets to achieve tactical overmatch. Design learning behaviors capable of incorporating commander's guidance and based on enemy data and historic performance.</p>		-	-	1.938

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p><b><i>FY 2022 Plans:</i></b> Will investigate and validate AI based algorithms process design for Fires synchronization. Will design and validate courses of analysis integrated capability using AI based approaches. Will investigate algorithms for predicting adversary behaviors and investigate how these patterns can impact recommendations for optimal shooter scenarios.</p> <p><b><i>FY 2021 to FY 2022 Increase/Decrease Statement:</i></b> IN FY22, this is a New Start.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>	-	-	25.967

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

N/A

**Remarks**

**D. Acquisition Strategy**

N/A