Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army	Date: April 2022
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 1: *Basic Research*	**R-1 Program Element (Number/Name)** PE 0601601A *I Artificial Intelligence and Machine Learning Basic Research*

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	-	-	15.183	10.456	-	10.456	10.661	10.230	12.293	12.290	0.000	71.113
CL3: *AI/ML Basic Research Hub*	-	-	15.183	10.456	-	10.456	10.661	10.230	12.293	12.290	0.000	71.113

A. Mission Description and Budget Item Justification

This Program Element (PE) executes intramural and extramural basic research in artificial intelligence (AI) and machine learning (ML) to support an AI-enabled Multi-Domain Operations (MDO) Force. The PE includes Projects that perform basic research in AI/ML with the potential to impact areas such as: Target Detection using Multiple Cooperative Autonomous Sensors (MCAS); more effective and quicker leader decision-making through use of AI-enhanced Common Operating Procedure (COP); replication of tactical behaviors to enable autonomous capabilities for maneuver; predictive maintenance; Intel support for Operations (specifically in support of long range precision fires); AI-enabled network/cybersecurity; intelligent business and process automation; and medical support. The Army's Artificial Intelligence Integration Center (AI2C) will provide strategic guidance and coordination of these basic research efforts in AI/ML across the Army Modernization enterprise.

Work in this PE contributes to the Army Science and Technology (S&T) portfolio and is fully coordinated with efforts in PE 0602180A Artificial Intelligence Technologies and PE 0603040A Artificial Intelligence Advanced Technologies.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering S&T focus areas, the Army Modernization Strategy and the Joint Artificial Intelligence Center (JAIC).

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

B. Program Change Summary ($ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	0.000	10.183	0.000	-	0.000
Current President's Budget	0.000	15.183	10.456	-	10.456
Total Adjustments	0.000	5.000	10.456	-	10.456
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	5.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	10.456	-	10.456

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Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2021	FY 2022
Project: CL3: *AI/ML Basic Research Hub*		
Congressional Add: *Extreme Events in Structurally Evolving Materials (CA)*	-	5.000
Congressional Add Subtotals for Project: CL3	-	5.000
Congressional Add Totals for all Projects	-	5.000

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.

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 1	R-1 Program Element (Number/Name) PE 0601601A / *Artificial Intelligence and Machine Learning Basic Research*	Project (Number/Name) CL3 / *AI/ML Basic Research Hub*	

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
CL3: *AI/ML Basic Research Hub*	-	-	15.183	10.456	-	10.456	10.661	10.230	12.293	12.290	0.000	71.113

A. Mission Description and Budget Item Justification

The Artificial Intelligence / Machine Learning (AI/ML) Basic Research Hub is a consortium of industry, government, and academia focused on AI basic research originating from world leaders in academic research pertaining to AI/ML breakthrough technologies for future application to Army-relevant areas such as object recognition using Multiple Cooperative Autonomous Sensors, leader decision-making, replication of tactical behaviors to enable autonomous capabilities for maneuver, predictive maintenance, Intel support for Operations, network and cybersecurity, AI-enhanced common operating picture, intelligent business and process automation, and medical support. Collaboration between academia, industry, and government is a key element of the Hub concept as each member brings with it a distinctly different approach to research. Academia is known for its cutting-edge innovation; the industrial partners are able to leverage existing research results for transition and to deal with technology bottlenecks; and Army AI researchers keep the program oriented toward solving complex Army technology problems.

Work in this PE contributes to the Army Science and Technology (S&T) portfolio and is fully coordinated with efforts in PE 0602180A Artificial Intelligence Technologies and PE 0603040A Artificial Intelligence Advanced Technologies.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering S&T focus areas, the Army Modernization Strategy and the Joint Artificial Intelligence Center (JAIC) mission initiatives.

Work 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: Intelligence support to Operations	-	1.450	1.600
Description: Research AI / ML methodologies to perform object detection on imagery to augment operations. Investigate meeting the challenge of recognition of surrogate targets in S&T test ranges that are not absolute visual representations, using AI capabilities trained on real operational objects. Perform basic research in the area of intelligence support for operations in support of long range precision fires.			
FY 2022 Plans: Will research the ability to model, animate, and render synthetic data to train algorithms using a high-altitude electro-optical (EO) imagery training set comprised of synthetic data created from open source imagery and limited real-world data. Will also research new low-shot object detection and recognition techniques for small sample learning, and unsupervised computer vision approaches to improve battlespace awareness.			
FY 2023 Plans:			

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Appropriation/Budget Activity 2040 / 1	**R-1 Program Element (Number/Name)** PE 0601601A / *Artificial Intelligence and Machine Learning Basic Research*	**Project (Number/Name)** CL3 / *AI/ML Basic Research Hub*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will continue research in methodologies and technologies to advance artificial intelligence (AI) for situational awareness and its connection to command and coordination in support to operations. Will investigate approaches for novel detection and recognition algorithm training to realize rapid, reliable computer vision and informed decision making. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned life cycle of effort.			
Title: Artificial Intelligence Hub ***Description:*** The AI Hub is located at Carnegie Mellon University as a consortium of industry, government, and academia focused on building and optimizing the Army's AI and ML initiatives with the goal of accelerating the fielding of capability. The AI Hub will utilize the Army Artificial Intelligence Innovation Institute (A2I2) data and AI/ML algorithms and software tools to investigate AI and ML capabilities to address the Army's unique problems. The AI Hub will focus on research into AI technologies for future application to Army-relevant areas such as, but not limited to, replication of tactical behaviors to enable autonomous capabilities for maneuver, robotics, predictive maintenance, multi-domain Command, Control, Communications, and Computers (C4), network resiliency and cybersecurity, AI-enhanced common operating picture (CoP), intelligent business and process automation, decision support, AI-enabled collaborative data infrastructure platform, medical support and force protection. ***FY 2022 Plans:*** Will investigate new ways of streamlining collaborative AI development with approaches that improve developer productivity and application robustness; research AI-enabled cyber security methodologies in adversarial AI/counter AI, cyber intrusion, and ML-based anomaly detection with counter-actions that are robust to enemy deception; research into safe manned-unmanned vehicle teaming to improve system performance; research to improve the understanding and use of reinforcement learning for studying strategic and cooperative interactions in multi-agent systems and improve decision support. ***FY 2023 Plans:*** Will continue investigation to streamline collaborative AI development that can scale to enterprise level. Will research AI-enabled cyber security methodologies in adversarial AI/counter AI, cyber intrusion, and ML-based anomaly detection with counter-actions that are robust to enemy deception. Research into safe manned-unmanned vehicle teaming to improve system performance. Will conduct research to improve the understanding and use of reinforcement learning for studying strategic and cooperative interactions in multi-agent systems and improve decision support. Will conduct research in other novel artificial intelligence (AI) enabling technologies across multiple capability areas, to include, but are not limited to, computing, data management, machine learning, modeling, decision support, and ethics. ***FY 2022 to FY 2023 Increase/Decrease Statement:***	-	5.361	5.547

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Funding change reflects planned lifecycle of this effort.			
Title: ATR-MCAS ***Description:*** Combat Formations require the ability to autonomously maneuver to identify threats and enable friendly forces to disintegrate and exploit enemy forces in the close and deep maneuver areas. This effort researches AI-based, multi-system approaches to aided threat recognition (ATR) using a combination of autonomous air & ground sensors to build a more accurate operating picture when given zone recon missions. ATR and situational awareness is improved through the direct cooperation & autonomous mobility of the sensors. ***FY 2022 Plans:*** Will research emerging AI-based, multi-system ground and air vehicle-based object recognition strategies based on autonomous collection, integration, and analysis of information from myriad sensors/systems; will further investigate AI methods that raise the level and number of tasks that can be executed autonomously or semi-autonomously by vehicles in the fleet; will perform research into advanced algorithms for autonomous ground and air platform movement with obstacle detection/avoidance in GPS-denied, dense urban and low/no- light environments; will research AI-enabled tactical maneuver of ground platforms by using terrain and vegetation to avoid enemy detection. ***FY 2023 Plans:*** Will continue foundational research in emerging artificial intelligence (AI)-based autonomy that scale and connect sensors/ systems for shared perception and communication to maneuver in complex environments to include, but not limited to, varied terrain, dense urban, low-no light, and GPS-denied environments. Will investigate novel approaches in AI/human teaming for maneuver and force application in multi-domain operations. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	-	3.000	3.309
Title: SBIR/STTR Transfer ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.372	-
Accomplishments/Planned Programs Subtotals	-	10.183	10.456

	FY 2021	FY 2022
Congressional Add: Extreme Events in Structurally Evolving Materials (CA)	-	5.000

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	FY 2021	FY 2022
FY 2022 Plans: Congressional Interest Item funding provided for Extreme Events in Structurally Evolving Materials. Congressional Add to be executed by Army Futures Command.		
Congressional Adds Subtotals	-	5.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A