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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army **Date:** March 2024

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>
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COST (\$ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	27.444	3.024	3.039	-	3.039	3.043	3.075	3.109	3.140	0.000	45.874
CF4: <i>Robotic Combat Vehicle (RCV) NGCV-CFT</i>	-	27.444	-	-	-	-	-	-	-	-	0.000	27.444
FD9: <i>Robotics Systems</i>	-	-	3.024	3.039	-	3.039	3.043	3.075	3.109	3.140	0.000	18.430

A. Mission Description and Budget Item Justification

This Program Element contains multiple projects. CF4: Robotic Combat Vehicle (RCV) NGCV-CFT and FD9: Robotic Systems.

CF4: The Robotic Combat Vehicle (RCV) has transitioned from a family of light, medium, and heavy variants to a single vehicle approach with a common chassis. The Army has decided to field a common platform that will pair elements of the previous RCV medium concept with the RCV common chassis. The development programs, which include a RCV Middle-Tier Acquisition Rapid Prototyping (MTA-RP) and a RCV Software Acquisition Pathway (SWP) program, will produce unmanned ground combat vehicle prototypes to inform Concepts of Operations (CONOPS) and Tactics, Techniques, and Procedures (TTP) maturation, Capabilities Development Document (CDD) development, acquisition and integration of secure advanced autonomy and artificial intelligence algorithms, force design updates, robotic and autonomous systems (RAS) doctrine development, and follow-on production and fielding decisions.

The RCV program will enhance the Human Machine Integration (HMI) effort by soliciting early Soldier feedback to reduce risk to the MTA-RP and SWP acquisition pathways. The RCV MTA-RP program will perform three complementary lines of effort (LOE): 1) Surrogate Prototypes (SP); 2) Full System Prototypes (FSP); 3) and Manned Control Vehicles (MCV), while leveraging the software developed in the SWP to perform incremental capability releases.

The RCV SP LOE utilizes RCV experimental prototypes and new build SP vehicles in an iterative design-upgrade-test approach that includes integration of software updates from the RCV SWP and follow-on Capability Releases (CR) from the RCV SWP. The SP LOE includes recurring design-upgrade-test cycles from FY 2023-2025 that conclude with FORSCOM operational pilots to collect Soldier feedback and demonstrate improved capabilities related to demonstrate improved capabilities to sensors, autonomous software, system safety, control architecture, and network resiliency. Each design-upgrade-test cycle will culminate in a Knowledge Point (KP) to review program progress and determine SP architectures or capabilities ready for incorporation into the FSP LOE. The SP LOE will also serve to validate user requirements, assist in finalization of the RCV Capabilities Development Document (CDD) and inform DOTMLPF-P and force design considerations.

The RCV FSP LOE will leverage mature capabilities from previous RCV experimentation and SP development efforts and integrate additional embedded software, perception sensors, user control interfaces, and communication links that will permit autonomous movement, tele-op movement, and increased battlefield situational awareness. The FSP acquisition strategy includes a robust competition through Other Transaction Authority (OTA) that selected four vendors to deliver platform prototypes to inform down select to a single vendor for prototype build. Developmental testing of prototypes will include safety, Reliability, Availability and Maintainability (RAM), lethality, survivability, and Electromagnetic Environmental Effects (E3) testing. Additionally, Operational Testing (OT) in the form of Prototype Operational Demonstration (POD) will be executed to evaluate system suitability and effectiveness.

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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>	
<p>The MCV focuses on Control Station hardware and Human Systems Integration into host platforms for RCV operations.</p> <p>The RCV SWP focuses on embedded software development and sustainment activities including RCV autonomy software, control station software, and payload control software. A system integration laboratory (SIL) will be used in conjunction with RCV systems to verify and validate software capabilities in both virtual and live test environments. The RCV SWP will provide software capabilities to the SP and FSP LOEs for integration. The RCV SWP will incorporate Soldier and integrator feedback into product roadmaps to guide the development and maturation of critical software capabilities.</p> <p>The Robotic Combat Vehicle (RCV) development program directly aligns with the Next Generation Combat Vehicle (NGCV) Army Modernization Priority and includes the RCV Middle-Tier Acquisition Rapid Prototyping and a RCV Software Pathway.</p> <p>The projected total cost of the RCV MTA Rapid Prototyping program is \$497.81 million (then-year dollars) RDT&E from FY 2022 to FY 2027. The remainder of the RCV MTA Rapid Prototyping program is fully funded across the Future Years Defense Program.</p> <p>FD9: Robotics Development (RD) improves robotic and autonomous program acquisition schedules by supporting the development of integrated and synchronized capability documents (e.g. JCIDS, Department Directed, etc.) and by maturing / transitioning technology. Research Development Technology Evaluation (RDTE) funds enable support to capability development of emerging requirements. Activities include studies, assessments, and document development such as Technology Readiness Levels, Manufacturing Readiness Levels, Analysis of Alternatives / Letter of Sufficiency determinations, draft acquisition documents, and draft contract documents. Efforts include robotics and autonomous systems technology maturation / transition from Science & Technology (S&T) projects and Robotic Enhancement Program (REP) initiatives, Milestone Decision Documentation (MDD), and activities leading up to formal program initiation at Milestone B or C. The pre-acquisition activities conducted under this line intend to reduce acquisition cost, schedule, and performance risk by conducting market surveys, technical risk assessments, developing performance specifications, scopes of work, acquisition strategies, systems engineering plans, test and evaluation master plans, lifecycle sustainment plans, engaging in early test planning, and prototype development activities. This line is for large robotic systems that are transported by vehicle, maneuver under their own power, or are installed as robotic applique kits.</p> <p>RD expands Modeling and Simulation (M&S) including Continuous Autonomy Simulation Test Laboratory Environment (CASTLE) capability to include Live/Virtual capability and to test and evaluate Manned Unmanned teaming, combat scenarios or other emerging Robotics requirement needs. RD funding will utilize the M&S environment to mature and evaluate S&T for inclusion to program requirements, Engineering Change Proposals (ECPs) and/or technical insertions, utilize gaming technology in conjunction with Autonomy Software to develop Training, Tactics and Procedures (TTPs), requirements and Concepts of Operations (CONOPS). RD supports Program Management activities including inter-service support, travel, conducting Analysis of Alternative (AoA), draft performance specifications, prototype demos, payload demos, future payload maturation for Robotic Platforms and pre-MS B activities. Funding supports transition of legacy S&T autonomy software into the GVSC ROS and RTK repositories.</p> <p>RD also supports modernization of the current Ground Robotic fleets and current Army vehicles by investigating technology insertions including, but not limited to condition-based maintenance, vetronics, Robotic Architecture, autonomous operations and other emerging technologies. This project supports developing initial</p>		

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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>
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prototypes to enable refinement of Operational Requirements and early user feedback to support future sustainment and operational movement operating concepts. Funds will be utilized for infrastructure to support cloud-based tools for development and deployment of Autonomy and Artificial Intelligence/Machine learning (AI/ML) software, tools to support automated testing of Autonomy Software in a DEVSECOPS process and transition of prior program software modules to the Robotic Technology Kernel (RTK) and Robotic Operating System (ROS) library for future reuse.

FY 2025 Base RDTE funds in the amount of \$3.039 million supports extending current Modeling and Simulation (M&S) for development and testing of autonomous systems. Addresses Manned/Unmanned Teams capabilities including Live/Virtual testing to reduce the number of needed physical assets and to increase safety on the test range/course. Funding will also be used to evaluate and mature Artificial Intelligence and Machine Learning (AI/ML) algorithms for potential use in future robotic programs and to develop a radio modeling capability and cyber resiliency products. Funding supports systems engineering activities for emerging programs.

B. Program Change Summary (\$ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	26.555	3.024	3.033	-	3.033
Current President's Budget	27.444	3.024	3.039	-	3.039
Total Adjustments	0.889	0.000	0.006	-	0.006
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.858	-			
• SBIR/STTR Transfer	-0.969	-			
• Adjustments to Budget Years	-	-	0.006	-	0.006

Change Summary Explanation

Slight increase accounts for small increase in system software capability upgrade costs.

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Appropriation/Budget Activity 2040 / 4					R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>				Project (Number/Name) CF4 / <i>Robotic Combat Vehicle (RCV) NGCV-CFT</i>			
COST (\$ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CF4: <i>Robotic Combat Vehicle (RCV) NGCV-CFT</i>	-	27.444	-	-	-	-	-	-	-	-	0.000	27.444
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2024, the funding in PE 0604017A/ Robotics Development, CF4 / Robotic Combat Vehicle (RCV) NGCV-CFT (BA4) transitions to Program Element 0604641A / Tactical Unmanned Ground Vehicle (TUGV), CF5 / Robotic Combat Vehicle NGCV-CFT (BA5)

A. Mission Description and Budget Item Justification

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The RCV FSP LOE will leverage mature capabilities from previous RCV experimentation and SP development efforts and integrate additional embedded software, perception sensors, user control interfaces, and communication links that will permit autonomous movement, tele-op movement, and increased battlefield situational awareness. The FSP acquisition strategy includes a robust competition through Other Transaction Authority (OTA) that selected four vendors to deliver platform prototypes to inform down select to a single vendor for prototype build. Developmental testing of prototypes will include safety, Reliability, Availability and Maintainability (RAM), lethality, survivability, and Electromagnetic Environmental Effects (E3) testing. Additionally, Operational Testing (OT) in the form of Prototype Operational Demonstration (POD) will be executed to evaluate system suitability and effectiveness.

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Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>	Project (Number/Name) CF4 / <i>Robotic Combat Vehicle (RCV)</i> NGCV-CFT

The MCV focuses on Control Station hardware and Human Systems Integration into host platforms for RCV operations.

The RCV SWP focuses on embedded software development and sustainment activities including RCV autonomy software, control station software, and payload control software. A system integration laboratory (SIL) will be used in conjunction with RCV systems to verify and validate software capabilities in both virtual and live test environments. The RCV SWP will provide software capabilities to the SP and FSP LOEs for integration. The RCV SWP will incorporate Soldier and integrator feedback into product roadmaps to guide the development and maturation of critical software capabilities.

The Robotic Combat Vehicle (RCV) development program directly aligns with the Next Generation Combat Vehicle (NGCV) Army Modernization Priority and includes the RCV Middle-Tier Acquisition Rapid Prototyping and a RCV Software Pathway.

The projected total cost of the RCV MTA Rapid Prototyping program is \$497.81 million (then-year dollars) RDT&E from FY 2022 to FY 2027. The remainder of the RCV MTA Rapid Prototyping program is fully funded across the Future Years Defense Program.

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2023	FY 2024	FY 2025
Title: Surrogate Prototype (SP) - Product Development Description: Engineering design and development of the Surrogate Prototypes (SPs), to include integration of software capability updates from the Software Acquisition Pathway (SWP) line of effort. SP Product development also includes the design and integration of improvements for safety, cybersecurity, perception sensors, and reliability to support the Soldier user experiments and modeling and simulation (M&S) efforts. Additionally, SP Product Development provides engineering support to prototype build, in addition to on-site Field Service Representative (FSR) support and new equipment training (NET) for all phases of SP testing.	25.376	-	-
Title: Program Management Description: Government project management to RCV development programs. Includes salaries, travel, training, supplies, facilities, and equipment.	2.068	-	-
Accomplishments/Planned Programs Subtotals	27.444	-	-

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2023	FY 2024	FY 2025	FY 2025	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	Cost To	Total Cost
			Base	OCO	Total					Complete	
• 0604641A: <i>Tactical Unmanned Ground Vehicle (TUGV)</i>	107.975	142.125	92.540	-	92.540	140.898	136.879	142.311	142.322	0.000	905.050

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

<u>Line Item</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u> <u>Base</u>	<u>FY 2025</u> <u>OCO</u>	<u>FY 2025</u> <u>Total</u>	<u>FY 2026</u>	<u>FY 2027</u>	<u>FY 2028</u>	<u>FY 2029</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
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Remarks
 Robotic Combat Vehicle development and RCV Software Acquisition Pathway (SWP) efforts are continued in program element 0604641A / Tactical Unmanned Ground Vehicle (TUGV), CF5 / Robotic Combat Vehicle (BA5) NGCV-CFT.

D. Acquisition Strategy

RCV development includes a RCV Middle-Tier Acquisition (MTA) Rapid Prototyping program as well as a Software Acquisition Pathway (SWP) program.

RCV Acquisition Strategy:
 On 10 February 2022, the Army Acquisition Executive (AAE) approved the execution of RCV Rapid Prototyping program under authorities granted under Section 804 of the 2016 NDAA (PL 114-92). The RCV MTA Rapid Prototyping program will be accomplished in two complementary lines of effort (LOE), Surrogate Prototypes (SP), and Full System Prototypes (FSP).

The SP LOE will utilize existing Other Transaction Authority (OTA) task assignment with QinetiQ North America and Textron Systems to both update existing RCV experimental prototypes to Surrogate Prototype configuration as well as procure new build Surrogate Prototypes. The Surrogate Prototypes will support recurring design-upgrade-test cycles from FY 2023-2024 that include FORSCOM operational pilots to collect Soldier feedback and demonstrate improved capabilities related to autonomous software, system safety, and network capabilities, and integrated architecture validation. Each design-upgrade-test cycle will culminate in a Knowledge Point (KP) to review program process and determine SP capabilities ready for incorporation into the FSP LOE.

The FSP acquisition strategy includes a full and open competition that will select up to four vendors, delivering two demonstrators each, to inform down select to a single vendor for prototype build and testing. Developmental testing of FSPs will include safety, Reliability, Availability and Maintainability (RAM), lethality, survivability, and Electromagnetic Environmental Effects (E3) testing. Additionally, Operational Testing (OT) in the form of Prototype Operational Demonstration (POD) will be executed to evaluate system suitability and effectiveness.

Upon successful completion of the RCV Rapid Prototyping program, an MTA Outcome Determination (OD) will determine if the program will transition to a MTA Rapid Fielding effort aimed at fielding RCV FSPs to selected unit(s) for Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities, and Policies (DOTMLPF-P) analysis and integration of Human-Machine Integration formations.

Software Acquisition Pathway (SWP) Acquisition Strategy:
 The SWP Acquisition Decision Memorandum (ADM), signed 3 August 2021, directs the use of the draft Cross Functional Team (CFT) Next Generation Combat Vehicle (NGCV) Robotic and Optionally Manned Autonomous (ROMA) Capabilities Needs Statement (CNS) as the base user capabilities document from which to derive capabilities for the RCV SWP. The RCV SWP will provide government furnished software to RCV SP and FSP LOEs. The RCV SWP will implement a Government - Contractor hybrid development approach to mature, integrate, and secure software capabilities from the science and technology base. The RCV SWP will incorporate

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software contracting best practices to support the transition of software capabilities into secure code base required for the resilient operation of RCVs in contested environments. On 25 January 2023, the AAE approved Software Acquisition Pathway entrance into the Execution Phase.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Army **Date:** March 2024

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Management Services (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Program Management	MIPR	Various : Various	22.842	2.068	Nov 2022	-		-		-		-	0.000	24.910	-
Subtotal			22.842	2.068		-		-		-		-	0.000	24.910	N/A

Product Development (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Development Engineering	Various	GVSC; Various : Warren, MI; Various	69.116	25.376	Nov 2022	-		-		-		-	0.000	94.492	-
RCV Medium	SS/FFP	Textron Systems; Howe & Howe; ; Hunt Valley, MD; Waterboro, ME	20.000	-		-		-		-		-	0.000	20.000	-
Subtotal			89.116	25.376		-		-		-		-	0.000	114.492	N/A

Test and Evaluation (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Modeling and Simulation	MIPR	GVSC; Various : Warren, MI; Various	4.954	-		-		-		-		-	0.000	4.954	-
Test and Evaluation	MIPR	Various : Various	40.997	-		-		-		-		-	0.000	40.997	-
Subtotal			45.951	-		-		-		-		-	0.000	45.951	N/A

			Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			157.909	27.444	-	-	-	-	0.000	185.353	N/A

Remarks
FY 2023 funding for Development Engineering supports Surrogate Prototype Product Development efforts.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Army							Date: March 2024			
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	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
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FY 2023 Program Management efforts include Government engineering, financial management, acquisition planning, risk assessment and mitigation, contract management, and operations support necessary to manage Surrogate Prototype Product Development.

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Exhibit R-4, RDT&E Schedule Profile: PB 2025 Army		Date: March 2024
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Event Name	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Surrogate Prototype (SP) Design/Build	[Bar]																											
	SP Design/Build																											
Surrogate Prototype (SP) Design/Upgrade/Test					[Bar]																							
					SP Design/Upgrade/Test #2																							
Surrogate Prototype (SP) FORSCOM Pilots					[Bar]																							
					SP FORSCOM Pilots																							
Robotic Combat Vehicle (RCV) Knowledge Point (KP) #1					▲ 3																							
					RCV(L) KP #1																							
Robotic Combat Vehicle (RCV) Knowledge Point (KP) #2									▲ 7																			
									RCV(L) KP #2																			
Full System Prototype (FSP) Solicitation Development	[Bar]																											
	FSP Solicitation Development																											
Full System Prototype (FSP) Request for Prototype Propos...	▲ 2																											
	FSP RPP Release Phase I																											
Full System Prototype (FSP) Selection Evaluation Board (...)	[Bar]																											
	FSP SEB Phase I																											
Full System Prototype (FSP) Prototype Contract Award (CA...	▲ 4																											
	FSP Prototype CA Phase I																											
Full System Prototype (FSP) Design/Build Phase I					[Bar]																							
					FSP Design/Build Phase I																							
Full System Prototype (FSP) Test Phase I									[Bar]																			
									FSP Test Phase I																			
Full System Prototype (FSP) Request for Prototype Propos...					▲ 6																							
					FSP RPP Release Phase II																							
Full System Prototype (FSP) Selection Evaluation Board (...)					[Bar]																							
					FSP SEB Phase II																							

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Exhibit R-4, RDT&E Schedule Profile: PB 2025 Army		Date: March 2024
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Event Name	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Full System Prototype (FSP) Contract Award Phase II									8 FSP CA Phase II																			
Full System Prototype (FSP) Design/Build Phase II									FSP Design/Build Phase II																			
Full System Prototype (FSP) Test Phase II									FSP Test Phase II																			
RCV(L) Outcome Determination (OD)																	11 RCV(L) OD											
Software Acquisition Pathway (SWP) Planning Phase																	SWP Planning Phase											
Software Acquisition Pathway (SWP) Execution Phase																	1 SWP Execution Phase											
Software Acquisition Pathway (SWP) Software (SW) Design/...	SWP SW Design/Build/Test																											
Software Acquisition Pathway (SWP) Minimum Viability Cap...					5 SWP MVCR																							
Software Acquisition Pathway (SWP) Capability Release (C...					9 SWP CR #1																							
Software Acquisition Pathway (SWP) Capability Release (C...					10 SWP CR #2																							
Software Acquisition Pathway (SWP) Capability Release (C...													12 SWP CR #3															
Software Acquisition Pathway (SWP) Capability Release (C...													13 SWP CR #4															
Software Acquisition Pathway (SWP) Capability Release (C...													14 SWP CR #5															

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Exhibit R-4A, RDT&E Schedule Details: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>	Project (Number/Name) CF4 / <i>Robotic Combat Vehicle (RCV) NGCV-CFT</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
DEVCOM Experimental Prototype Build	1	2021	2	2021
DEVCOM Experimental Prototype Testing	3	2021	3	2022
Soldier Operational Experiment (SOE) II	3	2022	4	2022
Surrogate Prototype (SP) OTA Contract Development/Modification	2	2021	4	2021
Surrogate Prototype (SP) Contract Build #1	4	2021	4	2021
Surrogate Prototype (SP) Design/Build	4	2021	4	2023
Middle-Tier Acquisition Rapid Prototyping (MTA-RP) Start	2	2022	2	2022
Surrogate Prototype (SP) Design/Upgrade/Test	2	2023	4	2024
Surrogate Prototype (SP) FORSCOM Pilots	4	2023	4	2024
Robotic Combat Vehicle (RCV) Knowledge Point (KP) #1	4	2023	4	2023
Robotic Combat Vehicle (RCV) Knowledge Point (KP) #2	4	2024	4	2024
Full System Prototype (FSP) Solicitation Development	1	2023	2	2023
Full System Prototype (FSP) Request for Prototype Proposal (RPP) Release Phase I	2	2023	2	2023
Full System Prototype (FSP) Selection Evaluation Board (SEB) Phase I	3	2023	4	2023
Full System Prototype (FSP) Prototype Contract Award (CA) Phase I	4	2023	4	2023
Full System Prototype (FSP) Design/Build Phase I	1	2024	4	2024
Full System Prototype (FSP) Test Phase I	4	2024	1	2025
Full System Prototype (FSP) Request for Prototype Proposal (RPP) Release Phase II	3	2024	3	2024
Full System Prototype (FSP) Selection Evaluation Board (SEB) Phase II	4	2024	1	2025
Full System Prototype (FSP) Contract Award Phase II	2	2025	2	2025
Full System Prototype (FSP) Design/Build Phase II	2	2025	2	2026
Full System Prototype (FSP) Test Phase II	2	2026	2	2027

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Exhibit R-4A, RDT&E Schedule Details: PB 2025 Army **Date:** March 2024

Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>	Project (Number/Name) CF4 / <i>Robotic Combat Vehicle (RCV)</i> NGCV-CFT
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Events	Start		End	
	Quarter	Year	Quarter	Year
RCV(L) Outcome Determination (OD)	2	2027	2	2027
Software Acquisition Pathway (SWP) Planning Phase	3	2021	2	2023
Software Acquisition Pathway (SWP) Execution Phase	2	2023	2	2023
Software Acquisition Pathway (SWP) Software (SW) Design/Build/Test	4	2022	4	2029
Software Acquisition Pathway (SWP) Minimum Viability Capability Release (MVCR)	3	2024	3	2024
Software Acquisition Pathway (SWP) Capability Release (CR) #1	3	2025	3	2025
Software Acquisition Pathway (SWP) Capability Release (CR) #2	1	2026	1	2026
Software Acquisition Pathway (SWP) Capability Release (CR) #3	3	2027	3	2027
Software Acquisition Pathway (SWP) Capability Release (CR) #4	3	2028	3	2028
Software Acquisition Pathway (SWP) Capability Release (CR) #5	3	2029	3	2029

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024		
Appropriation/Budget Activity 2040 / 4					R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>				Project (Number/Name) FD9 / <i>Robotics Systems</i>			
COST (\$ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
FD9: <i>Robotics Systems</i>	-	-	3.024	3.039	-	3.039	3.043	3.075	3.109	3.140	0.000	18.430
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Robotics Development (RD) improves robotic and autonomous program acquisition schedules by supporting the development of integrated and synchronized capability documents (e.g. JCIDS, Department Directed, etc.) and by maturing / transitioning technology. Research Development Technology Evaluation (RDTE) funds enable support to capability development of emerging requirements. Activities include studies, assessments, and document development such as Technology Readiness Levels, Manufacturing Readiness Levels, Analysis of Alternatives / Letter of Sufficiency determinations, draft acquisition documents, and draft contract documents. Efforts include robotics and autonomous systems technology maturation / transition from Science & Technology (S&T) projects and Robotic Enhancement Program (REP) initiatives, Milestone Decision Documentation (MDD), and activities leading up to formal program initiation at Milestone B or C. The pre-acquisition activities conducted under this line intend to reduce acquisition cost, schedule, and performance risk by conducting market surveys, technical risk assessments, developing performance specifications, scopes of work, acquisition strategies, systems engineering plans, test and evaluation master plans, lifecycle sustainment plans, engaging in early test planning, and prototype development activities. This line is for large robotic systems that are transported by vehicle, maneuver under their own power, or are installed as robotic applique kits.

RD expands Modeling and Simulation (M&S) including Continuous Autonomy Simulation Test Laboratory Environment (CASTLE) capability to include Live/Virtual capability and to test and evaluate Manned Unmanned teaming, combat scenarios or other emerging Robotics requirement needs. RD funding will utilize the M&S environment to mature and evaluate S&T for inclusion to program requirements, Engineering Change Proposals (ECPs) and/or technical insertions, utilize gaming technology in conjunction with Autonomy Software to develop Training, Tactics and Procedures (TTPs), requirements and Concepts of Operations (CONOPS). RD supports Program Management activities including inter-service support, travel, conducting Analysis of Alternative (AoA), draft performance specifications, prototype demos, payload demos, future payload maturation for Robotic Platforms and pre-MS B activities. Funding supports transition of legacy S&T autonomy software into the GVSC ROS and RTK repositories.

RD also supports modernization of the current Ground Robotic fleets and current Army vehicles by investigating technology insertions including, but not limited to condition-based maintenance, vetronics, Robotic Architecture, autonomous operations and other emerging technologies. This project supports developing initial prototypes to enable refinement of Operational Requirements and early user feedback to support future sustainment and operational movement operating concepts. Funds will be utilized for infrastructure to support cloud-based tools for development and deployment of Autonomy and Artificial Intelligence/Machine learning (AI/ML) software, tools to support automated testing of Autonomy Software in a DEVSECOPS process and transition of prior program software modules to the Robotic Technology Kernel (RTK) and Robotic Operating System (ROS) library for future reuse.

FY 2025 Base RDTE funds in the amount of \$3.039 million supports extending current Modeling and Simulation (M&S) for development and testing of autonomous systems. Addresses Manned/Unmanned Teams capabilities including Live/Virtual testing to reduce the number of needed physical assets and to increase safety on the test range/course. Funding will also be used to evaluate and mature Artificial Intelligence and Machine Learning (AI/ML) algorithms for potential use in future robotic programs and to develop a radio modeling capability and cyber resiliency products. Funding supports systems engineering activities for emerging programs.

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>	Project (Number/Name) FD9 / <i>Robotics Systems</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2023	FY 2024	FY 2025
<p>Title: Emerging Robotics Systems</p> <p>Description: Validation and verification of incremental system software capability upgrades for emerging robotic requirements through M&S Software-in-the-loop (SIL) and Hardware-in-the-loop (HIL) allowing for transition into Program of Record.</p> <p>FY 2024 Plans: Funds Modeling and Simulation (M&S) to support the development and test of autonomous systems. Addresses Manned/Unmanned Teams capabilities including Live/Virtual testing to reduce the number of needed physical assets and to increase safety on the test range/course. Funding will also be used to evaluate and mature Artificial Intelligence and Machine Learning (AI/ML) algorithms for potential use in future robotic programs. Funding supports systems engineering activities for emerging programs.</p> <p>FY 2025 Plans: FY 2025 plans continue efforts from FY 2024 to fund Modeling and Simulation (M&S) to support the development and test of autonomous systems. Funding addresses Manned/Unmanned Teams capabilities including Live/Virtual testing to reduce the number of needed physical assets and to increase safety on the test range/course. Funding will also be used to evaluate and mature Artificial Intelligence and Machine Learning (AI/ML) algorithms for potential use in future robotic programs. Funding supports systems engineering activities for emerging programs.</p> <p>FY 2024 to FY 2025 Increase/Decrease Statement: Increase accounts for slight increase in system software capability upgrade costs.</p>	-	3.024	3.039
Accomplishments/Planned Programs Subtotals	-	3.024	3.039

<p>C. Other Program Funding Summary (\$ in Millions) N/A</p> <p>Remarks Pre-acquisition program activities funded by this line transition to a separate Program Element and Project prior to their first program acquisition Milestone (B or C).</p> <p>D. Acquisition Strategy Robotics Development (RD) is designed to facilitate the transition of robotics and autonomous systems technology from Science and Technology (S&T) projects into programs of record. It informs the acquisition process early in the development cycle allowing key stakeholders the ability to make integration decisions and affordability trades while writing requirements.</p> <p>Efforts include Capabilities Document input, capture technical and test data, close analysis of OTD activities that feed cost estimates, provide test support, develop Modeling and Simulation (M&S) capabilities, and develop a Software Integration Lab (SIL). Will support Rapid prototyping to inform emerging requirements and other Army systems. A "buy/lease, try and inform" methodology may be used to evaluate Government Off the Shelf (GOTS), Commercial Off the Shelf (COTS), and Non-</p>
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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>	Project (Number/Name) FD9 / <i>Robotics Systems</i>
<p>Developmental Item (NDI) robotics products that have the potential to enhance Soldier combat effectiveness. Actual operational user feedback and evaluation results obtained will inform emerging capabilities and requirements documents in support of a return on investment to support future Army decision making.</p> <p>Combat Capabilities Development Command (CCDC) Ground Vehicle Systems Center (GVSC) funding allows the Army to demonstrate and operationally assess an unmanned vehicle capability with operational units and users to validate the technology. The Army will build, and test prototype systems for safety release, Soldier use, and further technology maturation. Funds will be used to further mature demonstrated capabilities and to create training and maintenance documentation for rapid insertion to PoR.</p>		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Army **Date:** March 2024

Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>	Project (Number/Name) FD9 / <i>Robotics Systems</i>
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Product Development (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Software Integration Lab / Modeling & Simulation	MIPR	Multiple : Various	1.266	-		0.600	Dec 2023	0.300	Dec 2024	-		0.300	0.000	2.166	-
VANE Development Support	MIPR	Army Corp of Engineer (ERDC) : Vicksburg, Mississippi	0.462	-		0.300	Jan 2024	0.300	Jan 2025	-		0.300	0.000	1.062	-
CASTLE / VANE Accreditation Support Plan and Validation	MIPR	Data Analysis Center (DEVCOM) : Aberdeen Proving Grounds, MD	0.519	-		0.200	Jan 2024	0.200	Feb 2025	-		0.200	0.000	0.919	-
Cybersecurity for Robotic and Autonomous Systems Hardening	MIPR	Ground Vehicle Robotics : Warren, MI	0.050	-		0.300	Mar 2024	-		-		-	0.000	0.350	-
CASTLE Immersive Simulation Support	MIPR	Software Engineering Center (GVSC) : Warren, MI	0.406	-		0.300	Mar 2024	0.300	Mar 2025	-		0.300	0.000	1.006	-
CASTLE Automated Testing Development	MIPR	Software Engineering Center (GVSC) : Warren, MI	0.246	-		0.250	Mar 2024	0.250	Mar 2025	-		0.250	0.000	0.746	-
Automated Testing of Manned/Unmanned Teaming Ops Development	MIPR	Software Engineering Center (GVSC) : Warren, MI	-	-		0.300	Jan 2024	0.300	Feb 2025	-		0.300	0.000	0.600	-
Artificial Intelligence/ Machine Learning	TBD	TBS : TBD	-	-		0.400	Jan 2024	0.400	Jan 2025	-		0.400	0.000	0.800	-
Robotic Capability Maturation Cell	TBD	GVSC : Warren, MI	-	-		-		0.606	Mar 2025	-		0.606	0.000	0.606	-
Subtotal			2.949	-		2.650		2.656		-		2.656	0.000	8.255	N/A

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Exhibit R-4, RDT&E Schedule Profile: PB 2025 Army **Date:** March 2024

Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>	Project (Number/Name) FD9 / <i>Robotics Systems</i>
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Event Name	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
RD MODELING & SIMULATION (M&S) cont.					RD M&S																							
RD Artificial Intelligence/Machine Learning					RD AI/ML																							

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Exhibit R-4A, RDT&E Schedule Details: PB 2025 Army **Date:** March 2024

Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / <i>Robotics Development</i>	Project (Number/Name) FD9 / <i>Robotics Systems</i>
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Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Robotics Development	1	2017	4	2022
RD (ERP, CBRN, CRS-LR, etc.)	1	2021	4	2021
RD MODELING & SIMULATION (M&S)	1	2017	4	2022
RD MODELING & SIMULATION (M&S) cont.	1	2024	4	2028
RD Artificial Intelligence/Machine Learning	1	2024	4	2028