Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army											Date: March 2023	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*					R-1 Program Element (Number/Name) PE 0604017A / *Robotics Development*							
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	-	78.309	26.555	3.024	-	3.024	3.033	3.037	3.069	3.103	0.000	120.130
CF4: *Robotic Combat Vehicle (RCV) NGCV-CFT*	-	75.661	26.555	-	-	-	-	-	-	-	0.000	102.216
FD9: *Robotics Systems*	-	2.648	-	3.024	-	3.024	3.033	3.037	3.069	3.103	0.000	17.914

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

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

CF4: Robotic Combat Vehicle (RCV) NGCV- CFT: The Robotic Combat Vehicle (RCV) development efforts will produce unmanned ground combat vehicle prototypes to aid Concepts of Operations (CONOPS) and Tactics, Techniques, and Procedures (TTP) development, integrate and secure advanced autonomy and artificial intelligence algorithms, and inform follow-on production and fielding decisions. RCV will transition from Manned Unmanned Teaming (MUM-T) experimentation to deliberate hardware and software focused development programs to include a RCV Light (L) Middle-Tier Acquisition (MTA) Rapid Prototyping program as well as a Software Acquisition Pathway (SWP) program.

RCV Experimentation, which concluded in 4Q FY2022, included initial hardware and software integration as well as Soldier Operational Experiments (SOE) to train, test, and evaluate the ability of Soldiers to perform missions using Mission Enabling Technology-Demonstrators (METDs) and Robotic Combat Vehicles (RCVs). Information gathered from the SOEs will be used to further inform MUM-T and which RCV(L) capabilities to develop.

To solicit early Soldier feedback, the RCV(L) MTA Rapid Prototyping program will be accomplished through two complimentary lines of effort (LOE) - Surrogate Prototypes (SP) and Full System Prototypes (FSP). The RCV(L) Surrogate Prototypes (SP) LOE utilizes updated RCV experimental prototypes and new build SPs in an iterative design-upgrade-test approach that includes integration of a Minimum Viable Capability Release (MVCR) and follow-on Capability Releases (CR) from the RCV Software Acquisition Pathway (SWP) program. The SP LOE includes annual design-upgrade-test cycles, each culminating in a Knowledge Point (KP) to review program process and determine SP capabilities ready for incorporation into the FSP LOE. The RCV(L) Full System Prototypes (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 Robotic Combat Vehicle (RCV) Software Acquisition Pathway (SWP) focuses on embedded software development and sustainment activities including RCV autonomy software, control station software, and payload control software. The RCV SWP will provide software capabilities to the Surrogate Prototypes (SP) and Full

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army	Date: March 2023
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604017A *I Robotics Development*

System Prototype (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 total cost of the RCV(L) MTA Rapid Prototyping program is $508.3 million (then-year dollars) RDT&E from FY 2022 to FY 2027. The RCV(L) MTA Rapid Prototyping program is fully funded across the Future Years Defense Program.

Robotic Combat Vehicle (RCV) funding in this program element directly aligns with the Next Generation Combat Vehicle (NGCV) Army Modernization Priority. There is no funding request in PB 2024 as the program continues development and transitions from PE 0604017A/ Robotics Development, CF4 / Robotic Combat Vehicle (RCV) NGCV-CFT (BA4) to Program Element 0604641A / Tactical Unmanned Ground Vehicle (TUGV), CF5 / Robotic Combat Vehicle (BA5) NGCV-CFT.

FD9: Robotics Systems: Program Office Robotics Development (RD) improves robotic and autonomous program acquisition schedules and facilitating quicker delivery of emerging technology to warfighters by supporting the development of integrated and synchronized capability documents (e.g. JCIDS, Department Directed, etc.) and by maturing / transitioning robotics 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 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.

FY 2024 funding will expand Modeling and Simulation (M&S) including Continuous Autonomy Simulation Test Laboratory Environment (CASTLE) capability 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). Funding supports Program management activities including inter-service support, travel, conducting Analysis of Alternatives (AoA), draft performance specifications, prototype demos, acquisition documents, payload demos, future payload maturation for Robotic Platforms and pre-MS B activities.

Funding 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. Funding will also support 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army	Date: March 2023
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604017A *I Robotics Development*

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	80.525	26.594	3.088	-	3.088
Current President's Budget	78.309	26.555	3.024	-	3.024
Total Adjustments	-2.216	-0.039	-0.064	-	-0.064
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-2.216	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-0.064	-	-0.064
• FFRDC Transfer	-	-0.039	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: CF4: *Robotic Combat Vehicle (RCV) NGCV-CFT*		
Congressional Add: *RCV Medium*	20.000	-
Congressional Add Subtotals for Project: CF4	20.000	-
Congressional Add Totals for all Projects	20.000	-

Change Summary Explanation

Decreased funding to support higher Army priorities.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / *Robotics Development*	Project (Number/Name) CF4 / *Robotic Combat Vehicle (RCV) NGCV-CFT*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CF4: *Robotic Combat Vehicle (RCV) NGCV-CFT*	-	75.661	26.555	-	-	-	-	-	-	-	0.000	102.216
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

The Robotic Combat Vehicle (RCV) development efforts will produce unmanned ground combat vehicle prototypes to aid Concepts of Operations (CONOPS) and Tactics, Techniques, and Procedures (TTP) development, integrate and secure advanced autonomy and artificial intelligence algorithms, and inform follow-on production and fielding decisions. RCV will transition from Manned Unmanned Teaming (MUM-T) experimentation to deliberate hardware and software focused development programs to include a RCV Light (L) Middle-Tier Acquisition (MTA) Rapid Prototyping program as well as a Software Acquisition Pathway (SWP) program.

RCV Experimentation, which concluded in 4Q FY2022, included initial hardware and software integration as well as Soldier Operational Experiments (SOE) to train, test, and evaluate the ability of Soldiers to perform missions using Mission Enabling Technology-Demonstrators (METDs) and Robotic Combat Vehicles (RCVs). Information gathered from the SOEs will be used to further inform MUM-T and which RCV(L) capabilities to develop.

To solicit early Soldier feedback, the RCV(L) MTA Rapid Prototyping program will be accomplished through two complimentary lines of effort (LOE) - Surrogate Prototypes (SP) and Full System Prototypes (FSP). The RCV(L) Surrogate Prototypes (SP) LOE utilizes updated RCV experimental prototypes and new build SPs in an iterative design-upgrade-test approach that includes integration of a Minimum Viable Capability Release (MVCR) and follow-on Capability Releases (CR) from the RCV Software Acquisition Pathway (SWP) program. The SP LOE includes annual design-upgrade-test cycles, each culminating in a Knowledge Point (KP) to review program process and determine SP capabilities ready for incorporation into the FSP LOE. The RCV(L) Full System Prototypes (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 Robotic Combat Vehicle (RCV) Software Acquisition Pathway (SWP) focuses on embedded software development and sustainment activities including RCV autonomy software, control station software, and payload control software. The RCV SWP will provide software capabilities to the Surrogate Prototypes (SP) and Full System Prototype (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 total cost of the RCV(L) MTA Rapid Prototyping program is $508.3 million (then-year dollars) RDT&E from FY 2022 to FY 2027. The RCV(L) MTA Rapid Prototyping program is fully funded across the Future Years Defense Program.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** CF4 / *Robotic Combat Vehicle (RCV) NGCV-CFT*

Robotic Combat Vehicle (RCV) funding in this program element directly aligns with the Next Generation Combat Vehicle (NGCV) Army Modernization Priority. There is no funding request in PB 2024 as the program continues development and transitions from PE 0604017A/ Robotics Development, CF4 / Robotic Combat Vehicle (RCV) NGCV-CFT (BA4) to Program Element 0604641A / Tactical Unmanned Ground Vehicle (TUGV), CF5 / Robotic Combat Vehicle (BA5) NGCV-CFT.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: RCV Experimentation - Development Engineering ***Description:*** RCV Experimentation Development Engineering encompasses initial hardware and software design and integration of RCV technologies, to include network, autonomy, sensors, aided target recognition, hostile fire detection and location, and pre-shot detection. RCV Experimentation Development Engineering also includes development or capabilities informed by Soldier feedback during Soldier Operational Experiments (SOE). RCV Experimentation Development Engineering is performed by the U.S. Army Combat Capabilities Development Command (DEVCOM) Ground Vehicle Systems Center (GVSC), DEVCOM Armaments Center (AC), DEVCOM Command, Control, Communication, Computers, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center, and RCV contractors.	21.670	-	-
Title: RCV Experimentation - Testing and Evaluation ***Description:*** Test and Evaluation includes Experimental Prototype and Surrogate Prototype (SP) shakedown testing, safety and performance testing at Government test sites, and the spares parts and technical support to execute Soldier Operational Experiments (SOE) using Experimental Prototypes. The SOEs will solicit Solder feedback, inform new doctrine for manned/ unmanned teaming based operations, validate user requirements, and aid in determination of capabilities ready for incorporation into future RCV designs and software releases.	11.967	-	-
Title: RCV Experimentation - Modeling and Simulation ***Description:*** RCV Modeling and Simulation effort will produce the ability to experiment in a virtual environment to conduct data collection and results that will inform the physical testing learning objectives. This will provide the initial data set to inform the operational experimentation in the RCV Campaign of Learning as well as feed initial data to the Requirements Community as they build new MUM-T, CONOPS and Tactics, Techniques, and Procedures (TTP). As test data is collected, high fidelity simulations for unmanned operation of combat platforms will be refined in a virtual test environment to enable virtual test - fix - test cycles in a virtual developmental space.	0.950	-	-
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	9.641	23.360	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** CF4 / *Robotic Combat Vehicle (RCV) NGCV-CFT*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
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. ***FY 2023 Plans:*** FY 2023 SP Product Development includes Ground Vehicle Systems Center (GVSC), QinetiQ, and Textron engineering design efforts for user interfaces, autonomy integration, and perception upgrades. Additionally, FY 2023 SP Product Development includes GVSC engineering support to an initial United States Army Forces Command (FORSCOM) Pilot, and OEM technical support and spare parts for Government testing. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in funding from FY 2023 to FY 2024 is due to transition to Budget Activity 5. The program funding continues in Program Element 0604641A / Tactical Unmanned Ground Vehicle (TUGV), CF5 / Robotic Combat Vehicle (BA5) NGCV-CFT.			
Title: Software Acquisition Pathway (SWP) - Software Engineering Development ***Description:*** Software Acquisition Pathway (SWP) Software Engineering Development focuses on embedded software development and sustainment activities including Robotic Combat Vehicle (RCV) autonomy software, control station software, payload control software, and cybersecurity hardening. SWP Software Engineering Development will deliver annual software capability releases (CR) to both the Surrogate Prototype (SP) and Full System Prototype (FSP) lines of effort. Developed software will also be delivered to the SWP systems integration laboratory (SIL) for live and virtual software testing.	5.401	-	-
Title: Program Management ***Description:*** Government project management to RCV development programs. Includes salaries, travel, training, supplies, facilities, and equipment. ***FY 2023 Plans:*** Government engineering, financial management, acquisition planning, risk assessment and mitigation, contract management, and operations support necessary to manage Surrogate Prototyping efforts. Includes salaries, training, travel, supplies, facilities, and equipment. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** The decrease in FY 2024 is due to transition of Program Management for RCV(L) Surrogate Prototypes (SP) build, RCV(L) Full Systems Prototypes (FSP), Software Acquisition Pathway (SWP) efforts to program element 0604641A / Tactical Unmanned Ground Vehicle (TUGV), CF5 / Robotic Combat Vehicle (BA5) NGCV-CFT.	6.032	2.226	-
Title: SBIR/STTR Transfer	-	0.969	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** CF4 / *Robotic Combat Vehicle (RCV) NGCV-CFT*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: Requirements to support Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Program. ***FY 2023 Plans:*** Requirements to support Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC §638			
Accomplishments/Planned Programs Subtotals	55.661	26.555	-

	FY 2022	FY 2023
Congressional Add: RCV Medium	20.000	-
FY 2022 Accomplishments: RCV Medium build and refurbishment, development engineering, and support to testing.		
Congressional Adds Subtotals	20.000	-

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• 0604641A: *Tactical Unmanned Ground Vehicle (TUGV)*	-	109.849	142.125	-	142.125	142.354	142.518	144.039	145.645	0.000	826.530

Remarks

Robotic Combat Vehicle Light (RCV(L)) 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 an RCV(L) Middle-Tier Acquisition (MTA) Rapid Prototyping program as well as a Software Acquisition Pathway (SWP) program.

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

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** CF4 / *Robotic Combat Vehicle (RCV) NGCV-CFT*

The SP LOE will utilize an existing Other Transaction Authority (OTA) task assignment with QinetiQ North America to both update existing RCV experimental prototypes to Surrogate Prototype configuration as well as procure new build Surrogate Prototypes. The Surrogate Prototypes will support annual design-upgrade-test cycles that include FORSCOM operational pilots to collect Soldier feedback and demonstrate improved capabilities related to autonomous software, system safety, and cyber and spectrum resiliency. 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 to deliver prototype demonstrators to inform down select to a single vendor for prototype build. 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 Limited User Tests (LUT) will be executed to evaluate system suitability and effectiveness.

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

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 efforts. 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 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.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** CF4 / *Robotic Combat Vehicle (RCV) NGCV-CFT*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2022 Cost	FY 2022 Award Date	FY 2023 Cost	FY 2023 Award Date	FY 2024 Base Cost	FY 2024 Base Award Date	FY 2024 OCO Cost	FY 2024 OCO Award Date	FY 2024 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	MIPR	Various : Various	13.938	6.032	Oct 2021	2.226	Nov 2022	-		-		-	0.000	22.196	-
SBIR/STTR Transfer	Various	Various : Various	-	-		0.969	Jan 2023	-		-		-	0.000	0.969	-
		Subtotal	13.938	6.032		3.195		-		-		-	0.000	23.165	N/A

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2022 Cost	FY 2022 Award Date	FY 2023 Cost	FY 2023 Award Date	FY 2024 Base Cost	FY 2024 Base Award Date	FY 2024 OCO Cost	FY 2024 OCO Award Date	FY 2024 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Engineering	Various	GVSC; Various : Warren, MI; Various	22.461	36.712	Dec 2021	23.360	Nov 2022	-		-		-	0.000	82.533	-
RCV Medium	SS/FFP	Textron Systems; Howe & Howe : Hunt Valley, MD; Waterboro, ME	-	20.000	Feb 2023	-		-		-		-	0.000	20.000	-
		Subtotal	22.461	56.712		23.360		-		-		-	0.000	102.533	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2022 Cost	FY 2022 Award Date	FY 2023 Cost	FY 2023 Award Date	FY 2024 Base Cost	FY 2024 Base Award Date	FY 2024 OCO Cost	FY 2024 OCO Award Date	FY 2024 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Modeling and Simulation	MIPR	GVSC; Various : Warren, MI; Various	4.119	0.950	Jan 2022	-		-		-		-	0.000	5.069	-
Testing and Evaluation	MIPR	Various : Various	29.601	11.967	Dec 2021	-		-		-		-	0.000	41.568	-
		Subtotal	33.720	12.917		-		-		-		-	0.000	46.637	N/A

	Prior Years	FY 2022 Cost	FY 2022 Award Date	FY 2023 Cost	FY 2023 Award Date	FY 2024 Base Cost	FY 2024 Base Award Date	FY 2024 OCO Cost	FY 2024 OCO Award Date	FY 2024 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	70.119	75.661		26.555		-		-		-	0.000	172.335	N/A

Remarks

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

Exhibit R-3, RDT&E Project Cost Analysis: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / *Robotics Development*	Project (Number/Name) CF4 / *Robotic Combat Vehicle (RCV) NGCV-CFT*	

	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	Cost To Complete	Total Cost	Target Value of Contract

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.

Exhibit R-4, RDT&E Schedule Profile: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** CF4 / *Robotic Combat Vehicle (RCV) NGCV-CFT*

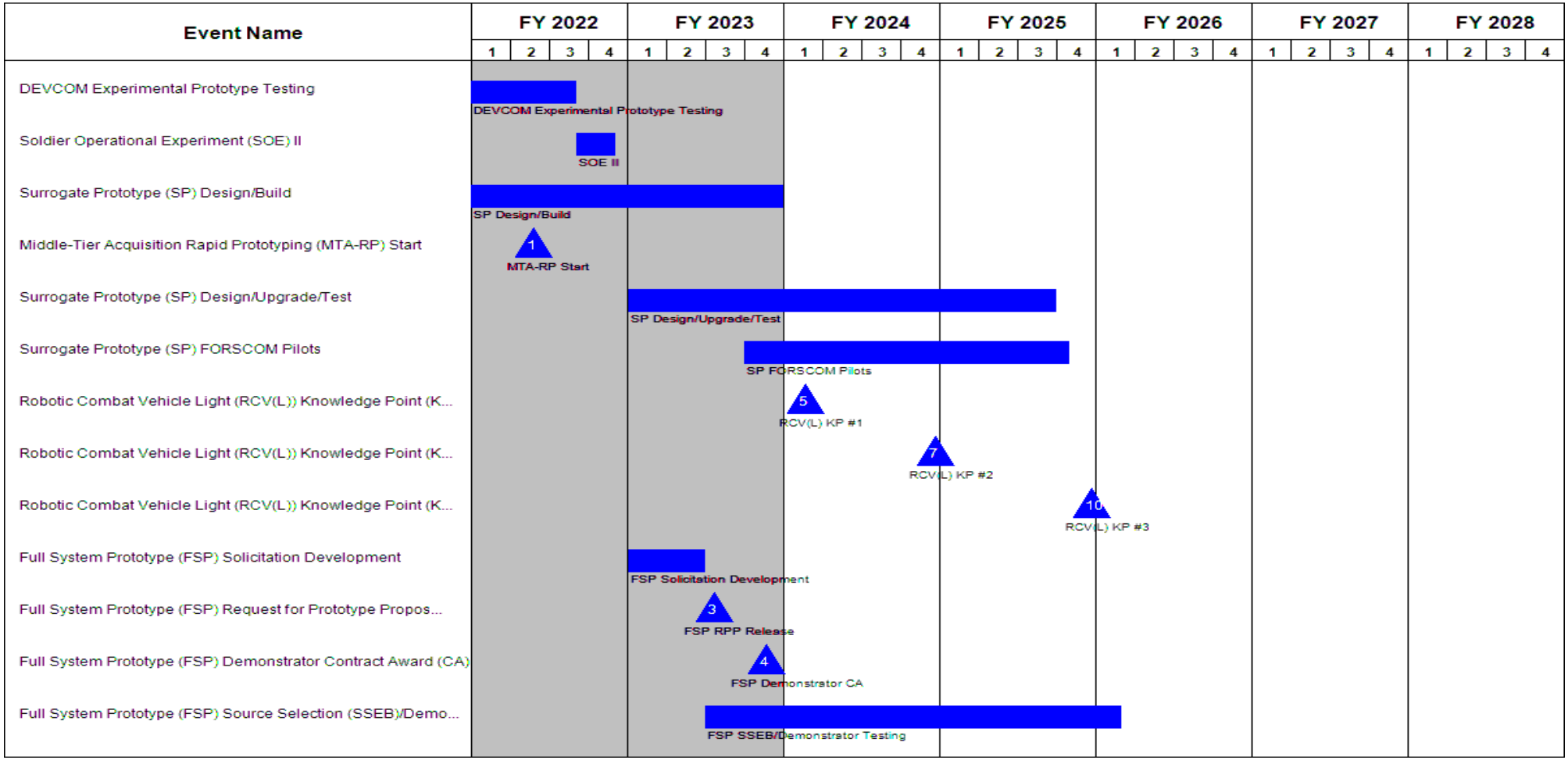

Exhibit R-4, RDT&E Schedule Profile: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** CF4 / *Robotic Combat Vehicle (RCV) NGCV-CFT*

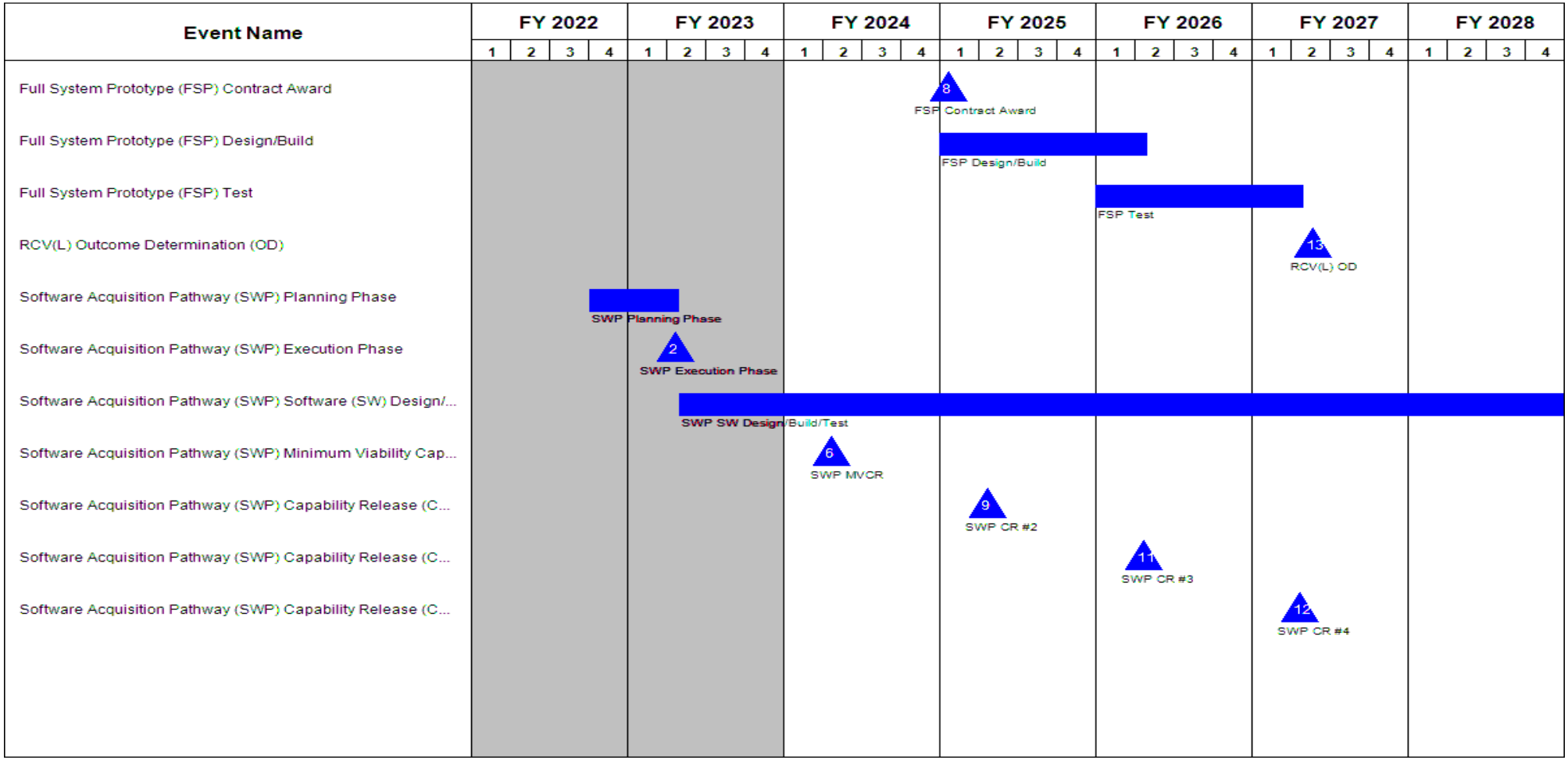

Exhibit R-4A, RDT&E Schedule Details: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** CF4 / *Robotic Combat Vehicle (RCV) NGCV-CFT*

Schedule Details

	Start		End	
Events	**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	1	2023	3	2025
Surrogate Prototype (SP) FORSCOM Pilots	4	2023	4	2025
Robotic Combat Vehicle Light (RCV(L)) Knowledge Point (KP) #1	1	2024	1	2024
Robotic Combat Vehicle Light (RCV(L)) Knowledge Point (KP) #2	4	2024	4	2024
Robotic Combat Vehicle Light (RCV(L)) Knowledge Point (KP) #3	4	2025	4	2025
Full System Prototype (FSP) Solicitation Development	1	2023	2	2023
Full System Prototype (FSP) Request for Prototype Proposal (RPP) Release	3	2023	3	2023
Full System Prototype (FSP) Demonstrator Contract Award (CA)	4	2023	4	2023
Full System Prototype (FSP) Source Selection (SSEB)/Demonstrator Testing	3	2023	1	2026
Full System Prototype (FSP) Contract Award	1	2025	1	2025
Full System Prototype (FSP) Design/Build	1	2025	2	2026
Full System Prototype (FSP) Test	1	2026	2	2027
RCV(L) Outcome Determination (OD)	2	2027	2	2027
Software Acquisition Pathway (SWP) Planning Phase	4	2022	2	2023
Software Acquisition Pathway (SWP) Execution Phase	2	2023	2	2023

Exhibit R-4A, RDT&E Schedule Details: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** CF4 / *Robotic Combat Vehicle (RCV) NGCV-CFT*

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Software Acquisition Pathway (SWP) Software (SW) Design/Build/Test	2	2023	4	2028
Software Acquisition Pathway (SWP) Minimum Viability Capability Release (MVCR)	2	2024	2	2024
Software Acquisition Pathway (SWP) Capability Release (CR) #2	2	2025	2	2025
Software Acquisition Pathway (SWP) Capability Release (CR) #3	2	2026	2	2026
Software Acquisition Pathway (SWP) Capability Release (CR) #4	2	2027	2	2027

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 4					R-1 Program Element (Number/Name) PE 0604017A / *Robotics Development*				Project (Number/Name) FD9 / *Robotics Systems*			
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
FD9: *Robotics Systems*	-	2.648	-	3.024	-	3.024	3.033	3.037	3.069	3.103	0.000	17.914
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Program Office 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.

Funding will expand 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). Funding 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.

Funding 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. Funding will also support 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 2024 RDTE funds in the amount of $3.024 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.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** FD9 / *Robotics Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Emerging Robotics Systems	2.648	-	3.024
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. ***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. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Program not funded in FY23. FY24 will resume technology maturation and Modeling and Simulation investment to reach Army goals of fully autonomous systems.			
Accomplishments/Planned Programs Subtotals	2.648	-	3.024

C. Other Program Funding Summary ($ in Millions)

N/A

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).

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.

Efforts include Capabilities Document input, close analysis of OTD activities that feed cost estimates, capture technical and test data, provide test support, develop Modeling and Simulation (M&S) capabilities, and develop a Software Integration Lab (SIL). Efforts may support Rapid prototyping to inform emerging requirements and other Army systems. A "buy/lease, try and inform" methodology may be used to evaluate Commercial Off the Shelf (COTS), Government Off the Shelf (GOTS) and Non-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.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
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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.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / *Robotics Development*	Project (Number/Name) FD9 / *Robotics Systems*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2022 Cost	FY 2022 Award Date	FY 2023 Cost	FY 2023 Award Date	FY 2024 Base Cost	FY 2024 Base Award Date	FY 2024 OCO Cost	FY 2024 OCO Award Date	FY 2024 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Software Integration Lab / Modeling & Simulation	MIPR	Multiple : Various	1.266	-		-		0.600	Dec 2023	-		0.600	0.000	1.866	-
VANE Development Support	MIPR	Army Corp of Engineer (ERDC) : Vicksburg, Mississippi	-	0.462	Apr 2022	-		0.300	Jan 2024	-		0.300	0.000	0.762	-
CASTLE / VANE Accreditation Support Plan and Validation	MIPR	Data Analysis Center (DEVCOM) : Aberdeen Proving Grounds, MD	-	0.519	Apr 2022	-		0.200	Jan 2024	-		0.200	0.000	0.719	-
CASTLE Autonomous System Test Capability Transition	MIPR	Software Engineering Center (GVSC) : Warren, MI	-	0.200	Jun 2022	-		-		-		-	0.000	0.200	-
CASTLE Radio Waveform Modeling Capability	MIPR	Software Engineering Center (GVSC) : Warren, MI	-	0.250	Feb 2022	-		-		-		-	0.000	0.250	-
Cybersecurity for Robotic and Autonomous Systems Hardening	MIPR	Ground Vehicle Robotics : Warren. MI	-	0.050	Mar 2023	-		0.300	Mar 2024	-		0.300	0.000	0.350	-
CASTLE Immersive Simulation Support	MIPR	Software Engineering Center (GVSC) : Warren, MI	-	0.406	Mar 2023	-		0.300	Mar 2024	-		0.300	0.000	0.706	-
CASTLE Automated Testing Development	MIPR	Software Engineering Center (GVSC) : Warren, MI	-	0.246	Mar 2023	-		0.250	Mar 2024	-		0.250	0.000	0.496	-
Automated Testing of Manned/Unmanned Teaming Ops Development	MIPR	Software Engineering Center (GVSC) : Warren, MI	-	-		-		0.300	Jan 2024	-		0.300	0.000	0.300	-
Artificial Intelligence/ Machine Learning	TBD	TBS : TBD	-	-		-		0.400	Jan 2024	-		0.400	0.000	0.400	-
		Subtotal	1.266	2.133		-		2.650		-		2.650	0.000	6.049	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2024 Army			Date: March 2023
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604017A / *Robotics Development*	Project (Number/Name) FD9 / *Robotics Systems*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2022 Cost	FY 2022 Award Date	FY 2023 Cost	FY 2023 Award Date	FY 2024 Base Cost	FY 2024 Base Award Date	FY 2024 OCO Cost	FY 2024 OCO Award Date	FY 2024 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Support / Historical Efforts	MIPR	Various : Multiple locations	13.116	0.515	Oct 2021	-		0.374	Oct 2023	-		0.374	0.000	14.005	-
		Subtotal	13.116	0.515		-		0.374		-		0.374	0.000	14.005	N/A

	Prior Years	FY 2022		FY 2023		FY 2024 Base		FY 2024 OCO		FY 2024 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	14.382	2.648		-		3.024		-		3.024	0.000	20.054	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** FD9 / *Robotics Systems*

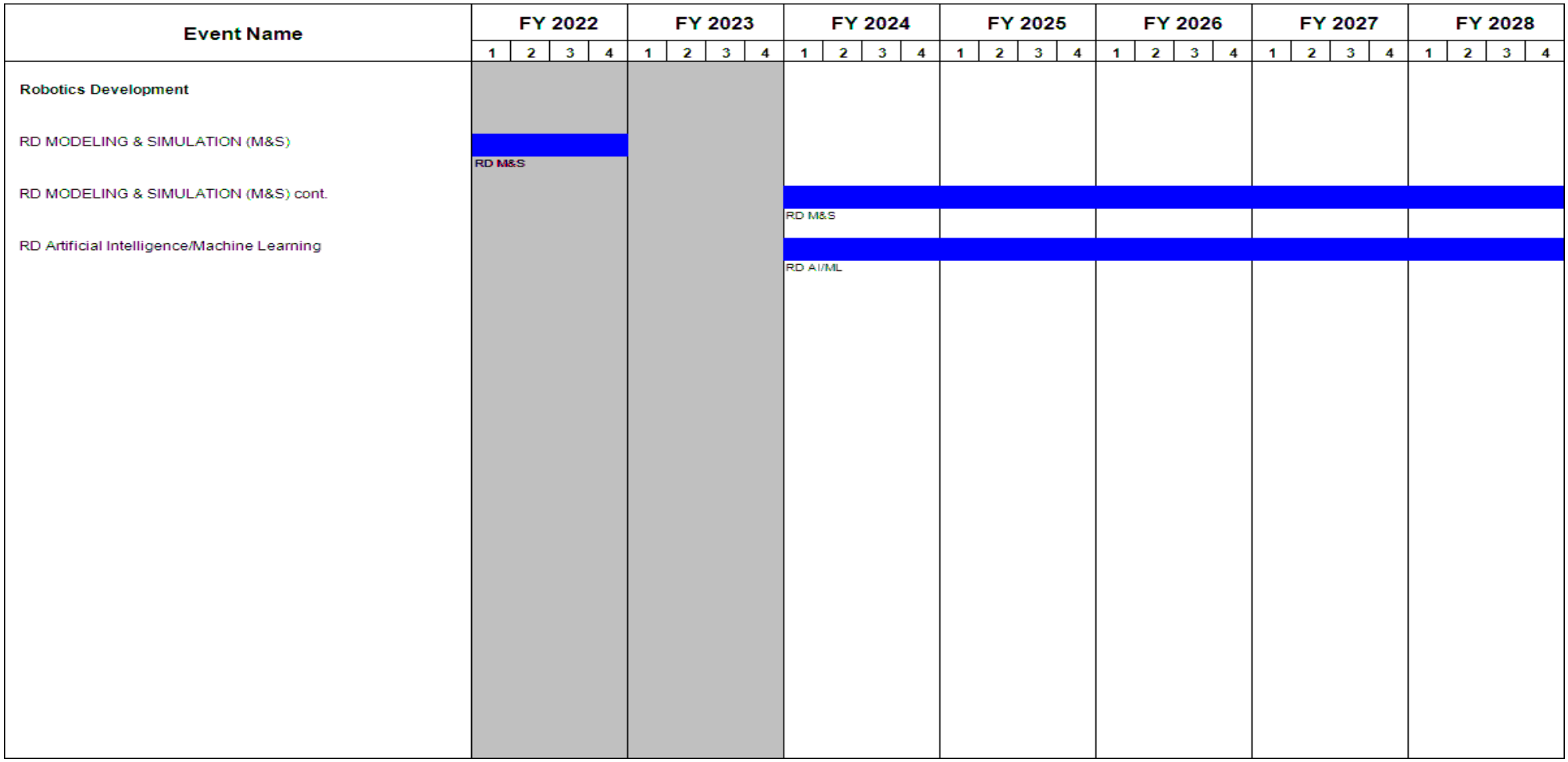

Exhibit R-4A, RDT&E Schedule Details: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604017A / *Robotics Development*	**Project (Number/Name)** FD9 / *Robotics Systems*

Schedule Details

	Start		End	
Events	**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