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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 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</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	-	15.427	18.986	21.069	-	21.069	29.231	30.140	30.491	30.022	0.000	175.366
CK9: <i>Advancing Concepts and Technology Forecasting Tech</i>	-	2.521	2.586	2.577	-	2.577	2.581	2.582	2.611	2.637	0.000	18.095
CN2: <i>Intelligent Weapons Concepts and Technologies</i>	-	3.312	4.474	4.484	-	4.484	4.490	4.493	4.533	4.578	0.000	30.364
CN9: <i>Soldier Enabling University Applied Research</i>	-	0.382	0.457	2.175	-	2.175	2.782	2.784	2.814	2.843	0.000	14.237
CO1: <i>Soldier Power And Energy Concepts and Technologies</i>	-	2.384	4.442	4.492	-	4.492	8.148	9.465	10.104	10.205	0.000	49.240
CO2: <i>Soldier-Intelligent Technology Research</i>	-	1.504	-	-	-	-	-	-	-	-	0.000	1.504
CV9: <i>Technical-SAVVY Soldier Applied Research</i>	-	2.246	3.396	3.665	-	3.665	3.775	3.356	2.888	2.143	0.000	21.469
CW9: <i>Syn Bio for Reactive-Resp Mtls-Soldiers & Sys</i>	-	3.078	3.631	3.676	-	3.676	7.455	7.460	7.541	7.616	0.000	40.457

A. Mission Description and Budget Item Justification

This Program Element (PE) investigates, designs, and performs research focused on technologies necessary for capability enhancements for the Soldier and Squad over the long-term well beyond those technologies planned within the Soldier Lethality Cross- Functional Team. Applied research projects investigate nascent and enduring science and technology areas that are applicable to the individual Soldier and Squads of Soldiers needs with emphasis on maximizing Soldier and Squad performance, lethality, mobility and survivability. This PE also designs and validates technologies that are necessary and foundational for future capabilities with far-reaching impact on mission success. The outputs of these efforts transition to advanced research efforts that mature and demonstrate potential opportunities to realize improved Soldier performance and inform technical requirements for future Soldier systems.

The PE will fund civilian salaries for in-house researchers/scientists and program managers collaborating with external subject matter experts in academia and industry who are leaders in these technology research areas. This PE is coordinated with PE 0602143A (Soldier Lethality Technology), 0602785A (Manpower, Personnel and Training Technology), 0603007A (Manpower, Personnel and Training Advanced Tech), 0603044A (Soldier Advanced Technology), and 0603118A (Soldier Lethality Advanced Technology).

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

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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>
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B. Program Change Summary (\$ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	15.716	18.986	21.027	-	21.027
Current President's Budget	15.427	18.986	21.069	-	21.069
Total Adjustments	-0.289	0.000	0.042	-	0.042
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.001	-			
• SBIR/STTR Transfer	-0.288	-			
• Adjustments to Budget Years	-	-	0.042	-	0.042

Change Summary Explanation

Funding increase is an economic adjustment.

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>				Project (Number/Name) CK9 / <i>Advancing Concepts and Technology Forecasting Tech</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
CK9: <i>Advancing Concepts and Technology Forecasting Tech</i>	-	2.521	2.586	2.577	-	2.577	2.581	2.582	2.611	2.637	0.000	18.095

A. Mission Description and Budget Item Justification

This Project works across the Army Futures Command Combat Capabilities Development Command (DEVCOM), with the Futures & Concepts Center (FCC), and the Directorate of Intelligence and Security to explore current and future emerging and disruptive applied scientific research to translate, integrate, and ingrain applied research outcomes with the Army.

Warfighting Concepts to describe how the Army will fight in the mid and far-term future while the Future Operational Environment contextualizes projected applied research outcomes in the deep future. Applied research outcomes describe the projected future operational effects of science in the context of Army concepts and probable operational capabilities to mitigate risk for future Army capabilities and enable informed decision making across the Army Modernization Enterprise. This Project ensures Army Concepts are grounded by recent and anticipated advances in applied scientific research, Army applied research is capability use-inspired to deliver the right future capability identified in the Army Concepts, and learning opportunities are created to advance Army Concepts and operationalize science for transformational overmatch.

This Project also performs long-range technology forecasts and trend analysis, informed by the threat and the predicted future state of technology, of Army-relevant applied research topics to enable informed decision making for the near-, mid-, and far-terms.

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

Research in this Project is performed by the Army Research Laboratory (ARL).

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

	FY 2023	FY 2024	FY 2025
Title: Advancing Concepts and Technology Forecasting	2.521	2.586	2.577
Description: Advancing Concepts and Technology Forecasting identifies and translates emerging and disruptive applied scientific research current and future outcomes in order to integrate and ingrain applied scientific data and knowledge with Army Warfighting Concepts which describe how the Army will fight in the mid- and far-term future. This effort also provides long-range, scientifically grounded technology forecasts and trend analysis, informed by the threat and future predicted state of technology, of applied research topics to enable informed decision-making for the near-, mid-, and far-terms.			
FY 2024 Plans: Will provide objective estimates of anticipated applied research advances of emerging scientific areas with high relevance to the Army. Broad technology areas include extensions to the Army Priority Research Areas and other topics such as Army-unique autonomous behaviors, cross-domain sensor modalities, and agile manufacturing technologies; integrate outcomes of mid-			

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>	Project (Number/Name) CK9 / <i>Advancing Concepts and Technology Forecasting Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2023	FY 2024	FY 2025
<p>and far-term Army Warfighting Concept priorities for decision advantage into emerging applied scientific research programs in distributed sensing and artificial intelligence for agile command and control, and for sustained operations into emerging applied scientific research programs in energy sciences.</p> <p>FY 2025 Plans: Will integrate mid- and far-term Army Concept priorities, including offensive and defense fires and platform survivability, to guide applied scientific research program development; participate in warfighting assessments to inform Army operability within continental environments of varying density and terrain.</p> <p>FY 2024 to FY 2025 Increase/Decrease Statement: Funding decrease reflects planned lifecycle of this effort.</p>				
Accomplishments/Planned Programs Subtotals		2.521	2.586	2.577
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>				Project (Number/Name) CN2 / <i>Intelligent Weapons Concepts and Technologies</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
CN2: <i>Intelligent Weapons Concepts and Technologies</i>	-	3.312	4.474	4.484	-	4.484	4.490	4.493	4.533	4.578	0.000	30.364

A. Mission Description and Budget Item Justification

This Project focuses on far-term, overarching lethality technologies by investigating techniques for Soldiers to guide the in-field adaptation of intelligent small arms technologies to respond to changing mission requirements, novel environments, and adversarial actions. Research areas include cognition-centric displays to ensure Soldiers maintain appropriate situational awareness in augmented reality (AR) environments, opportunistic shooter sensing, and interactive machine learning techniques to ensure small arms technologies can adapt to changing situations quickly and with reduced data requirements as compared to non-human guided machine learning and Artificial Intelligence (AI). The results of this Project will enhance operational performance of individuals and teams of Soldiers in the future operational environment through novel weapon and human-agent interaction technologies.

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

Work in this Project is performed by the Army Research Laboratory (ARL).

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

	FY 2023	FY 2024	FY 2025
Title: Human-Agent Interactions for Intelligent Squad Weapons	3.312	4.474	-
Description: This effort investigates enhanced target acquisition, situational awareness, and shooting performance through Soldier-centered integration of intelligent technologies and distributed information in augmented squad weapons. Enhances operational performance of individuals and teams of Soldiers through novel weapon and human-agent interaction technologies.			
FY 2024 Plans: Will mature algorithms for fusion of opportunistically sensed data from intelligent weapons and small unmanned aerial systems; develop adaptive small arms fire control capabilities using integrated opportunistic sensing within artificial intelligence (AI)-enhanced small arms ecosystems; develop methods for using opportunistic sensing to quantify emergent behaviors from dismounted, heterogenous human-autonomy squads during realistic scenarios; investigate approaches for providing contextualized Soldier-weapon-squad state data for enhanced squad-level task prioritization and command-level decision making.			
FY 2024 to FY 2025 Increase/Decrease Statement: Funding realigned from Human-Agent Interactions for Intelligent Squad Weapons in FY 2025 to support the creation of Distributed Information for Enhanced Squad Lethality within this Project.			
Title: Distributed Information for Enhanced Squad Lethality	-	-	4.484

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>	Project (Number/Name) CN2 / <i>Intelligent Weapons Concepts and Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2023	FY 2024	FY 2025
<p>Description: This effort investigates how multimodal data from heterogenous small units of Soldiers and systems can be combined and leveraged to provide actionable information for squad lethality and survivability, including enhanced target acquisition and engagement, situational awareness, tactical maneuver, and decision-making performance. Enhances operational performance at scale and complexity through novel human-agent interaction techniques over distributed formations of Soldier technologies.</p> <p>FY 2025 Plans: Will design and develop algorithms for fusion of opportunistically sensed data, including weapon data and gaze direction, from dismounted Soldier-systems to expand situational awareness capabilities; quantify relationships between heterogenous human-autonomy squad behaviors and cross-platform small-arms target detection and prioritization approaches to inform learning techniques; design and develop algorithms for fusion of opportunistically sensed data for small unit Soldier-systems to inform tactical options; investigate approaches for leveraging contextualized squad state data to expand autonomous learning across formations.</p> <p>FY 2024 to FY 2025 Increase/Decrease Statement: Funding increase reflects planned initiation of the effort. Funding realigned from Human-Agent Interactions for Intelligent Squad Weapons in FY 2025 to support the creation of Distributed Information for Enhanced Squad Lethality within this Project.</p>				
Accomplishments/Planned Programs Subtotals		3.312	4.474	4.484
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>				Project (Number/Name) CN9 / <i>Soldier Enabling University Applied Research</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
CN9: <i>Soldier Enabling University Applied Research</i>	-	0.382	0.457	2.175	-	2.175	2.782	2.784	2.814	2.843	0.000	14.237

A. Mission Description and Budget Item Justification

This Project investigates technologies from academia that will improve capabilities and systems to advance Soldier and Squad lethality-overmatch and Soldier performance. This Project funds collaborative, enduring applied extramural university-based research and brings together competitively selected universities with Army research teams into Technical Alliances. This Project will determine discovery solutions and inform capabilities development for mid- to far-term Army modernization priorities while also maintaining delivery of near-term technologies fundamental to the modernization priorities. The technical scope of this Project includes the investigation and design of overarching Soldier-centric technologies including, human systems integration, robotics, synthetic environments for training, advanced materials, power management, energy, Warfighter endurance, and computational technologies. This Project conducts applied research for potential emerging technologies in areas of strategic importance to the Army in Soldier capabilities related to increased protection, performance, agility, situational awareness, and lethality. This Project will also continuously strive to engage and collaborate with entities that might not otherwise collaborate with the Department of Defense (DoD) to identify and determine novel Soldier-centric technologies for accelerating the adoption of emerging technologies for the Warfighter in the Army Soldier portfolio.

Work in this Project complements Program Element 0603044A (Soldier Advanced Technology)/Project CN8 (Soldier Enabling University Advanced Development)

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

Work in this Project is performed by the University Technology Development Division.

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

	FY 2023	FY 2024	FY 2025
Title: Soldier Training and Performance	0.382	0.457	2.175
Description: Collaboratively investigate technologies for Soldier capabilities related to increased protection, performance, agility, situational awareness, training, and lethality.			
FY 2024 Plans: Collect, label, warehouse, and analyze training data for the development of synthetic training environment. Continue to investigate technologies to monitor health, cognitive state and readiness of Warfighters through digital biosensor/biomarkers and their wireless charging capabilities.			
FY 2025 Plans: Will fund research that enables the capture, warehousing, and manipulation of synthetic training data to support Commanders in making training and operational readiness decisions; investigate emergent technologies to monitor health, cognitive state and			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2023	FY 2024	FY 2025
<p>readiness of Warfighters through digital biosensor/biomarkers and their wireless charging capabilities; fund academic applied research in emerging Soldier related technologies related to increased protection, performance, agility, situational awareness, training, and lethality. The benefit of this effort is improved realistic training for decision making and improved understanding of a Soldier's cognitive load.</p> <p><i>FY 2024 to FY 2025 Increase/Decrease Statement:</i> Funding increase reflects a planned increase in applied research activity to support investigation of emerging technologies for military application.</p>				
Accomplishments/Planned Programs Subtotals		0.382	0.457	2.175
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>				Project (Number/Name) CO1 / <i>Soldier Power And Energy Concepts and Technologies</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
CO1: <i>Soldier Power And Energy Concepts and Technologies</i>	-	2.384	4.442	4.492	-	4.492	8.148	9.465	10.104	10.205	0.000	49.240

A. Mission Description and Budget Item Justification

This Project conducts applied research to improve safe, compact, efficient, rugged, lightweight, and energy dense power sources for increased capabilities for the mounted and dismounted force. This Project also investigates materials, processes, and component level energy storage and conversion technologies that enable tactical overmatch and reduce the physical and cognitive burden on Soldiers. Research will focus on safe electrochemical energy storage, high specific energy storage and conversion, novel materials and processing for energy and power, and new cell designs that address the power needs of future capabilities including advanced sensors, communications systems, and electronic Warfighting capabilities. Enabling and emerging technologies are supported in this Project to address future Soldier power needs necessary for increased lethality, increased mobility, and longer mission durations at reduced physical burden to the Soldier in the future operating environment.

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

Research in this Project is performed by the Army Research Laboratory (ARL).

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

	FY 2023	FY 2024	FY 2025
Title: Tactical Energy Sources and Energy Materials	2.384	2.442	2.488
Description: This effort conducts overarching power and energy research to determine and design alternative energy capabilities to replace current energy systems. Research focuses on new materials and processing techniques as well as energy storage technologies that support advanced sensors, communications systems, and electronic Warfighting capabilities.			
FY 2024 Plans: Will characterize nickel and nickel-based alloy catalyst parameters for ethanol partial oxidation; investigate alumina and ceria-based materials as support substrate for ethanol partial oxidation catalysts; design and develop baseline characterization methods to explore catalyst and catalyst support combinations for the reduction of ethanol reformation temperature; design and develop large area, high capacity rechargeable batteries utilizing aqueous, hybrid, and inorganic electrolytes and additives; determine temperature driven phase and transport behavior in aqueous, hybrid, and inorganic electrolytes and investigate conductivity, transference number, capacity, recharge rate, and cycle life at high and low temperatures; investigate incorporation of high energy anodes for rechargeable aqueous batteries including silicon, metal, and alloy chemistries; identify routes to synthetically protect			

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>	Project (Number/Name) CO1 / <i>Soldier Power And Energy Concepts and Technologies</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2023	FY 2024	FY 2025
<p>and passivate from electrolyte decomposition at high energy anodes; design and develop binders and methods for scalable processing and integration of battery material; mature high capacity halide-based cathode and supporting electrolyte interface.</p> <p>FY 2025 Plans: Will investigate stability, passivation, and cycle characteristics of high energy lithium-ion anode materials such as silicon, aluminum alloy, lithium metal, and copper foil in aqueous lithium-ion battery cells; explore integration and scaling of high energy anodes into higher capacity aqueous lithium-ion cells; assess aqueous lithium-ion component and cell performance to include capacity, capacity utilization, rate capability, and temperature dependences; mature anode protection electrolytes, aqueous electrolyte composition, and material suitability for high-throughput scalable processing and manufacturing; investigate emerging electrode processing techniques including electron beam curing to produce electrodes and electrolyte-in-electrode materials for aqueous and solid-state battery construction and performance; validate integration of halide-based cathode materials into lithium-ion cells; explore experimental conditions for nickel-based catalysts and other catalyst candidates on alumina and ceria-based supports to investigate ethanol reformation activity and the carbon deposition mechanism.</p> <p>FY 2024 to FY 2025 Increase/Decrease Statement: Funding increase is an economic adjustment.</p>				
<p>Title: Materials and Technologies for Electrochemical Alternative Power</p> <p>Description: This effort investigates materials for electrolyzers and alternative power sources for small unit energy and power needs. Research is focused on materials and technologies that will reduce the dependence on fossil fuels while diversifying the energy sources for soldier platforms.</p> <p>FY 2024 Plans: Will investigate electrocatalysts and membranes for open cell electrolysis; perform analysis on candidate fuel products and associated production rates constrained by size, weight, and power and reduced carbon footprint; design and develop the button cell fabrication process for electrochemical alternative power sources.</p> <p>FY 2025 Plans: Will explore and assess methods for energy and material harvesting from local resources; investigate processes for conversion of harvested energy and materials into chemical fuels; determine the energy conversion efficiencies related to chemical fuel synthesis and overall efficiency to electrical power.</p> <p>FY 2024 to FY 2025 Increase/Decrease Statement: Funding increase is an economic adjustment.</p>		-	2.000	2.004
Accomplishments/Planned Programs Subtotals		2.384	4.442	4.492

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>	Project (Number/Name) CO1 / <i>Soldier Power And Energy Concepts and Technologies</i>

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

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army	Date: March 2024
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Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>				Project (Number/Name) CO2 I <i>Soldier-Intelligent Technology Research</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
<i>CO2: Soldier-Intelligent Technology Research</i>	-	1.504	-	-	-	-	-	-	-	-	0.000	1.504

A. Mission Description and Budget Item Justification

This Project investigates research gaps related to human and intelligent systems to enhance decision making in response to changing conditions. Applied research is conducted on novel and emerging visualization technologies as well as methodologies for intelligent systems and Soldier to co-adapt for the real-time quantification, prediction, and enhancement of squad-level shared situational awareness (SA) and situational understanding (SU) across dynamic, complex, and uncertain operating environments, leading to demonstrated increases in mission effectiveness. The result of this Project will inform various efforts that rely on human and intelligent system interactions including systems that adapt the behavior of autonomous assets and intelligent Soldier tools, based on dynamic needs of the Soldier/squad, using real-time opportunistic measures of Soldier SA and changing mission environment. In addition, this Project will design novel approaches to represent uncertain and dynamically changing information, to increase Soldier comprehension and enhanced mission effectiveness, with reduced Soldier/squad burden and training requirements.

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

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

	FY 2023	FY 2024	FY 2025
Title: Soldier Performance in Sociotechnical Environments	1.504	-	-
Description: Technologies for squad-level situational awareness assessment (information visualization) that provide command-level decision support with communication and intervention capabilities. Research focuses on algorithms for the quantification and visualization of collective uncertainty at the squad level for mission command decision making. This effort also supports the monitoring and assessing of Soldier tactical readiness and effectiveness through technologies and approaches for opportunistic human sensing.			
Accomplishments/Planned Programs Subtotals	1.504	-	-

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

N/A

Remarks

D. Acquisition Strategy

N/A

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>	Project (Number/Name) CV9 / <i>Technical-SAVVY Soldier Applied Research</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
<i>CV9: Technical-SAVVY Soldier Applied Research</i>	-	2.246	3.396	3.665	-	3.665	3.775	3.356	2.888	2.143	0.000	21.469

A. Mission Description and Budget Item Justification

This Project conducts applied research to provide critical breakthroughs in developing a "technologically" fluent force. This research will develop models of technological fluency(TF) (TF Modeling), methods and measures to assess and develop the technological fluency of Soldiers across a career (TF Personnel Assessments), and technologies to maximize technological fluency resilience and performance in Soldiers and units (Maximizing TF). TF is defined as the ability of Soldiers and units to use and rapidly adapt new and intelligent technologies without formal training on these technologies, and it will be a decisive factor in a future operating environment in which Soldiers and squads are teamed with increasingly sophisticated and evolving technologies. Soldiers and leaders in specialty areas (e.g., Cyber and Emerging Tech) and General Purpose Forces will require increased technological aptitudes and skills to adapt emerging technologies to evolving mission sets and avoid being overmatched by Artificial Intelligence (AI)-enabled "smart" technologies.

This Project supports key Army needs and will coordinate with and/or leverage findings of several Program Elements (PEs) to include PE 0602785A (Manpower, Personnel and Training Technology), 0602143A (Soldier Lethality Technology), and 0602145A (Next Generation Combat Vehicle Technology).

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

Work in this Project is performed by the Army Research Laboratory (ARL) and the Army Research Institute (ARI) for Behavioral and Social Sciences.

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

	FY 2023	FY 2024	FY 2025
Title: Soldier Technical Enhancement Applied Research - ARL	1.469	2.096	2.356
Description: This effort enables TF through three areas of focus: TF Modeling through the creation and utilization of novel future-focused laboratory experimental test-beds; TF Personnel Assessments through methodologies and technologies for "opportunistic" (no Soldier burden) sensing and TF interpretation; and Maximizing TF through creating TF training approaches and in-field performance aids.			
FY 2024 Plans: Will mature human-system interaction experimental environment to include prototype adaptive intelligent system interactions and initial technology integration for opportunistic sensing capability; conduct validation experiments on initial TF models using human-system interaction test-beds.			
FY 2025 Plans:			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2023	FY 2024	FY 2025
<p>Will investigate approaches to opportunistically sense measures of technological fluency (TF) that can be extracted from in-field sources without creating additional operational burden; explore enhancements to experimental environments to enable validation of TF models that include degradations and enhancements of individuals.</p> <p>FY 2024 to FY 2025 Increase/Decrease Statement: Funding increase is an economic adjustment.</p>				
<p>Title: Soldier Technical Enhancement Applied Research - ARI</p> <p>Description: This effort enables TF through three areas of focus: TF Modeling by identifying and understanding the critical human knowledge, skills, abilities, and characteristics that enable TF in Soldiers and teams; TF Personnel Assessments by developing and validating personnel tests to assess knowledge, skills, and abilities, and characteristics to promote TF for talent management; and Maximizing TF by creating and validating TF training approaches to improve TF at both the individual and team levels of performance.</p> <p>FY 2024 Plans: Will continue to develop a competency model of Technological Fluency (TF) that identifies the critical knowledge, skills, abilities, and characteristics that enable TF; will initiate development of proof-of-concept training methods for maximizing TF competencies; will develop and define the individual personnel testing requirements needed to measure TF model competencies.</p> <p>FY 2025 Plans: Will develop and validate a competency model of Technological Fluency (TF) that identifies the critical knowledge, skills, abilities, and characteristics that enable TF; will develop proof-of-concept training methods for maximizing TF competencies; will develop personnel testing requirements and test blueprints to measure identified TF competencies.</p> <p>FY 2024 to FY 2025 Increase/Decrease Statement: Funding increase is an economic adjustment.</p>		0.777	1.300	1.309
Accomplishments/Planned Programs Subtotals		2.246	3.396	3.665
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>				Project (Number/Name) CW9 / <i>Syn Bio for Reactive-Resp Matls-Soldiers & Sys</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
CW9: <i>Syn Bio for Reactive-Resp Matls-Soldiers & Sys</i>	-	3.078	3.631	3.676	-	3.676	7.455	7.460	7.541	7.616	0.000	40.457

A. Mission Description and Budget Item Justification

This Project designs and investigates materials through the application of biotechnology and synthetic biology advances to develop material capabilities that respond and/or can adapt to a wide range of external stimuli and biological processes. Research into innovative materials that are capable of sensing, responding, and adapting to a broad spectrum of environmental variables will be conducted. This Project will explore new biology-based methods for controlled synthesis and assembly to create multi-functional materials and advanced composites as well as develop materials that are able to self-monitor, self-heal, and self-sustain. This Project also focuses on developing models, materials characterization techniques, non-destructive testing methods, and advanced fabrication and processing methodologies as well as the identification of unique material properties.

The cited research is consistent with the Undersecretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Research in this Project is performed by the Army Research Laboratory (ARL).

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

Title: Biological Bio-Composite Materials and Processes	FY 2023	FY 2024	FY 2025
Description: This effort conducts applied research through the application of biotechnology advances to develop materials with capabilities to respond and adapt to a wide range of external stimuli and biological processes. Research will explore new biology-based methods for controlled synthesis and assembly to create materials with precise chemistries, microstructures, properties, and responsive functionalities through controlled molecular placement, spatial architectures, and interfacial structures. Investment in bio-enabled materials research allows for the design of materials that are capable of sensing and responding, as well as adapting to a broad spectrum of environmental variables with the ability to self-monitor, self-heal, self-sustain, and self-degrade. Investments in this area could lead to future applications in Soldier performance, situational awareness, protection, and sustainment.	3.078	3.631	3.676
FY 2024 Plans: Will design and develop biological building blocks to interface with military equipment, electronics, and platforms (i.e. coatings, textiles, metals) for advance sensing, protection, and deception, and investigate signal output for sensors; investigate and tune novel biomaterials for control in electro-optical/electromagnetic (EO/EM) and determine shielding for protection; continue to tune and assess novel structural composites for scale and integration for down-stream processing (e.g. energetics, protective coatings); investigate strategies to integrate biomaterials into composites for protection, situational awareness,			

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602184A / <i>Soldier Applied Research</i>	Project (Number/Name) CW9 / <i>Syn Bio for Reactive-Resp Matls-Soldiers & Sys</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2023	FY 2024	FY 2025
and communication to determine utility of novel biomaterials for advanced composites and protective coatings; understand biodegradation mechanisms of protective coatings and identify strategies to tune effects and delivery mechanisms. FY 2025 Plans: Will use synthetic biology to develop sense-and-respond cascades, and investigate addressable and potentially specific interactions for composite assembly relevant to electro-optical/electromagnetic (EO/EM) materials; tie aforementioned capabilities back to traditional material science structure-property relationships; mature novel biomaterials for advanced composites and protective coatings; mature understanding of how biological interfaces can be leveraged for military platforms (i.e., coatings, textiles, and metals), and use synthetic biology to tune signal output for advanced sensing, reporting, and protection; develop novel synthetic biology enabled bio-capabilities for material manipulation and tune for desired capabilities. FY 2024 to FY 2025 Increase/Decrease Statement: Funding increase is an economic adjustment.				
Accomplishments/Planned Programs Subtotals		3.078	3.631	3.676
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				