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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army / BA 2: Applied Research</i>	<b>R-1 Program Element (Number/Name)</b> PE 0602716A / <i>Human Factors Engineering Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	-	23.755	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	23.755
H70: <i>Human Fact Eng Sys Dev</i>	-	23.755	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	23.755

**Note**

In Fiscal Year (FY) 2020, this Program Element (PE) is realigned with continuity of effort to the following PEs:

- \* PE 0602143A Soldier Lethality Technology
- \* PE 0602145A Next Generation Combat Vehicle Technology

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

This PE conducts applied research on human factors to maximize the effectiveness of Soldiers in concert with their equipment. The resulting data are the basis for weapon systems and equipment design standards, guidelines, handbooks, and Soldier training as well as manpower requirements to improve equipment operation and maintenance. Application of this research will yield reduced workload, fewer errors, enhanced Soldier protection, user acceptance, and allows the Soldier to extract the maximum performance from the equipment.

Major efforts research sources of stress, potential stress moderators, and intervention methods, and identify and quantify human performance measures and methods to address current and future warrior performance issues. Individual efforts exploit adaptive learning methods and strategies, enhance and validate human performance modeling tools; investigate integration of advanced concepts in crew stations designs, optimizes interfaces for information systems and improves human robot interaction (HRI) in a full mission context.

Results of these efforts are transitioned to the Research, Development, and Engineering Centers, the Program Executive Offices (PEO) & Program Managers, Army Training and Doctrine Command (TRADOC), Army Medical Command (MEDCOM), Human Systems Integration (HSI) Directorate (Army G1), and Army Test and Evaluation Command (ATEC).

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

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<b>B. Program Change Summary (\$ in Millions)</b>	<b><u>FY 2019</u></b>	<b><u>FY 2020</u></b>	<b><u>FY 2021 Base</u></b>	<b><u>FY 2021 OCO</u></b>	<b><u>FY 2021 Total</u></b>
Previous President's Budget	24.121	0.000	0.000	-	0.000
Current President's Budget	23.755	0.000	0.000	-	0.000
Total Adjustments	-0.366	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.007	-			
• SBIR/STTR Transfer	-0.359	-			

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**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602716A / <i>Human Factors Engineering Technology</i>	<b>Project (Number/Name)</b> H70 / <i>Human Fact Eng Sys Dev</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
H70: <i>Human Fact Eng Sys Dev</i>	-	23.755	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	23.755

**Note**

In Fiscal Year (FY) 2020 this Project is being realigned to:  
 Program Element (PE) 0602143A Soldier Lethality Technology  
 \* Project AY6 Soldier Squad Small Arms Armaments Technology  
 \* Project BB7 Exoskeleton: technology for Man-Machine Interface  
 \* Project BC3 Soldier Decision Making & Comms Performance Tech  
 \* Project BE8 Synthetic Training Environment (STE) Technology  
 PE 0602145A Next Generation Combat Vehicle Technology  
 \* Project BF6 Crew Augmentation and Optimization Tech

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

This Project conducts applied research on human factors to maximize the effectiveness of Soldiers in concert with their equipment. The resulting data are the basis for weapon systems and equipment design standards, guidelines, handbooks, and Soldier training as well as manpower requirements to improve equipment operation and maintenance. Application of this research will yield reduced workload, fewer errors, enhanced Soldier protection, user acceptance, and allows the Soldier to extract the maximum performance from the equipment.

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Results of these efforts are transitioned to the Research, Development, and Engineering Centers, the Program Executive Offices (PEO) & Program Managers, Army Training and Doctrine Command (TRADOC), Army Medical Command (MEDCOM), Human Systems Integration (HSI) Directorate (Army G1), and Army Test and Evaluation Command (ATEC).

Efforts in this Project support the Under Secretary of Defense for Research and Engineering Science and Technology priorities and the Army Modernization Strategy.

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

<b>Title:</b> Interfaces for Collaboration and Decision Making	FY 2019	FY 2020	FY 2021
<b>Description:</b> This effort looks at the study of how networks influence, and are influenced by, human behavior in the context of military decision making. The studies, which range from computational modeling to networked simulations in a laboratory	2.800	-	-

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
environment, to large-scale simulation exercises, will investigate the effects of technology on information flow, cognitive workload, team collaboration, organizational effectiveness, situational awareness, and decision making.				
<b>Title:</b> Human Performance Modeling <b>Description:</b> Enhance human performance modeling tools to enable system analysis that will inform system design early in the acquisition process. These tools will allow the identification of design flaws that can be mitigated to reduce workload and human errors and increase user acceptance of developing technologies allowing the Soldier to extract the maximum performance from the equipment. Collect and analyze empirical data on human perception (vision and hearing) to support human and system performance models used for equipment design and training.		1.025	-	-
<b>Title:</b> Brain-Computer Interaction <b>Description:</b> Investigate the use of neurophysiological and behavior-based technologies for enhancing the interaction between Soldiers and systems such as autonomous systems and advanced crew stations. Implement guidelines for algorithms for characterizing Soldier brain activity in operational contexts, and real-time techniques to integrate neurally-based information into systems designs.		1.230	-	-
<b>Title:</b> Dismounted Soldier Performance <b>Description:</b> Investigate equipment design standards and human performance measures and create guidelines for maneuver team information systems solutions that improve situational understanding and decision cycle time; identify, mature, and quantify human performance limitations to address future warrior performance issues.		1.375	-	-
<b>Title:</b> Human-Robot Interaction <b>Description:</b> Design human-centered design requirements and technologies for supervision and Soldier interaction with multiple semi-autonomous unmanned vehicles in urban and unstructured environments. This research will be transitioned to U.S. Army TARDEC.		3.068	-	-
<b>Title:</b> Understanding Socio-cultural Influence <b>Description:</b> Investigate and model cognitive aspects of socio-cultural influences on Soldier/Commander decision making and communication to enhance Soldier performance with systems, within teams and in the mission context. Extend models of individual and teams to societal levels to support regional understanding, training, mission rehearsal, and influence.		2.025	-	-
<b>Title:</b> Continuous Multi-Faceted Soldier Characterization for Adaptive Technologies		1.600	-	-

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<p><b>Description:</b> This effort will investigate technologies that provide the foundation for future Army systems to adapt to individual Soldier's states, behaviors, and intentions in real-time. Develop novel approaches to individualize adaptive systems through enhanced interfaces, interactions, or interventions that capitalize on prediction methods; and decrease time-to-train, augment physical, cognitive, and social performance, and improve human-network interactions.</p>				
<p><b>Title:</b> Training Effectiveness Research</p> <p><b>Description:</b> Novel technologies and their implementation in Army systems may result in demands on Soldiers that exceed their knowledge, skill, or memory capacity. When demands cannot be remediated by human systems integration, training may enable the demands to be met. This effort will identify human operator tasks in complex, intelligent, and emerging systems critical to mission employment of new technologies. The aspects (particularly knowledge and skill) of those tasks will be determined through experimentation and analysis to inform development of training and simulation technologies, fundamental research on the effectiveness of training regimes, and simultaneous task combinations that must be trained.</p>		0.992	-	-
<p><b>Title:</b> Rapid Soldier Capability Enhancement</p> <p><b>Description:</b> Research the relationship of augmentation agents and Soldier performance &amp; behavior. Investigates the effects of augmentation agents (perceptual, cognitive, and/or physical), used either individually or coupled as a system of agents, on Soldier performance, resilience, and training during operationally relevant tasks. Development of guidelines and models for designing and employing augmentation agents. Implementation of guidelines will enhance augmented Soldier performance.</p>		2.760	-	-
<p><b>Title:</b> Tools for Assessing Human/Intelligent Team Performance</p> <p><b>Description:</b> Develop tools for verifying and validating Soldier interactions and overall human-system performance of mixed Soldier-intelligent agent teams, while providing the foundation for a generalizable tool for a broad range of Human-System Integration (HSI) assessments. Focus on flexible, tailor-able analysis tools for laboratory grade, high-resolution assessment of dismount-robot interactions in complex environments.</p>		1.000	-	-
<p><b>Title:</b> Explainable Intelligence Underlying Efficient Integration of Cognitive Assist Agents</p> <p><b>Description:</b> This effort will develop novel methods for joint human / intelligent agent learning and decision making to capitalize on the individual strengths of humans and intelligent agents to improve emergent group performance; and enable rapid, cooperative decision making and learning utilizing machine learning approaches.</p>		2.050	-	-
<p><b>Title:</b> Soldier Focused Neurotechnologies</p>		2.330	-	-

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<b>Description:</b> Neurotechnologies for Soldier use are limited by a lack of sufficient tools and methodologies capable of interpreting brain data in real world environments. Research will focus on the development of novel user-transparent data acquisition systems that are comfortable and non-invasive and on the development of robust tools that account for high levels of variance and noise expected in recorded brain data in real-world environments.			
<b>Title:</b> Exoskeleton <b>Description:</b> Accelerates Soldier lethality and mobility capabilities through exoskeleton systems with improved Soldier compatibility and reduced training requirements. Advances innovative assessment and analysis techniques and metrics that inform hardware design, system control and technology use case objectives. Identifies and matures fundamental assessment protocols for transition to Army Test and Evaluation community.	1.500	-	-
<b>Accomplishments/Planned Programs Subtotals</b>	23.755	-	-

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

N/A

**Remarks**

**D. Acquisition Strategy**

N/A