Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Army											Date: February 2020	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603734A *I Military Engineering Advanced Technology*							
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	-	100.359	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	100.359
T08: *Combat Eng Systems*	-	24.759	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.759
T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	-	75.600	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	75.600

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being realigned, with continuity of effort realigned to the following PEs:
* PE 0603119A Ground Advanced Technology Projects
* PE 0603462A Next Generation Combat Vehicle Advanced Technology
* PE 0603463A Network C3I Advanced Technology
* PE 0603465A Future Vertical Lift Advanced Technology
* PE 0603466A Air and Missile Defense Advanced Technology

A. Mission Description and Budget Item Justification

This Program Element (PE) demonstrates data and information architectures and software applications, as well as sensing systems, that can be used to provide Warfighters with timely, accurate, easily interpretable data and information for the operational and tactical mission environments, focusing on physical and human terrain and weather; methodologies, software applications, and hardware for improving ground vehicle mobility and countermobility to support ground force operations including manned-unmanned teaming; demonstrates material technologies and tools for force projection, and sustainment. This PE also demonstrates subsystems and systems to increase the survivability of personnel, critical assets, and facilities through structures, shields, and barriers to combat highly adaptive and increasingly severe threats; and systems and interoperable systems of systems for detecting threats, assessing situations, defending against threats, and communicating information and warnings for force protection.

This work is fully coordinated with and complementary to PE 0602784A (Military Engineering Technology).

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

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 PE is led by the Army Engineering Research and Development Center (ERDC).

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Army	Date: February 2020
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603734A *I Military Engineering Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	101.438	0.000	0.000	-	0.000
Current President's Budget	100.359	0.000	0.000	-	0.000
Total Adjustments	-1.079	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.300	-			
• SBIR/STTR Transfer	-0.779	-			

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*		
Congressional Add: *Resilient Energy Systems*	1.000	-
Congressional Add: *Additive Manufacturing/3D Printing*	2.000	-
Congressional Add: *Advanced Polymer Development*	20.000	-
Congressional Add: *Bathymetric-topographic LIDAR Research*	8.200	-
Congressional Add: *Extreme Terrain Research*	4.000	-
Congressional Add: *Secure Management of energy generation and storage*	3.000	-
Congressional Add: *Rapid low energy mobile manufacturing*	3.000	-
Congressional Add: *Centrifuge Enabled Research*	2.500	-
Congressional Add: *Energy and technology research in cold and arctic regions*	4.000	-
Congressional Add: *ERDC Collaboration (Transportation System Assessment Technologies)*	2.000	-
Congressional Add: *Natural Gas technology*	4.000	-
Congressional Add: *Reliable Distributed Energy in Austere Environments*	3.000	-
Congressional Add: *Research Facility Modernization*	2.000	-
Congressional Add: *Research in the Permafrost environment*	4.000	-
Congressional Add: *Secure and resilient power generation in cold region environments*	5.000	-
Congressional Add: *Silicone anode technology*	4.000	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Army	Date: February 2020
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603734A *I Military Engineering Advanced Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Congressional Add: *Transportation infrastructure evaluation system*	3.900	-
Congressional Add Subtotals for Project: T15	75.600	-
Congressional Add Totals for all Projects	75.600	-

Change Summary Explanation

FY19 funds reprogrammed out for higher priority Army requirements.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / *Military Engineering Advanced Technology*	Project (Number/Name) T08 / *Combat Eng Systems*	

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
T08: *Combat Eng Systems*	-	24.759	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.759

Note

In FY20 this Project is being realigned to:
Program Element (PE) 0603119A Ground Advanced Technology, Projects:
* BL6 Expedient Passive Protection for Critical Assets Advanced Technology
* BL8 Power Projection in A2/AD Environments Advanced Technology
* BM1 Protection from Advanced Weapon Effects Advanced Technology
PE 0603462A Next Generation Combat Vehicle Advanced Technology, Projects:
* BF2 Autonomous Ground Resupply (AGR) Advanced Technology
* BG3 Modeling & Simulation for MUMT Advanced Technology
PE 0603463A Network C3I Advanced Technology, Projects:
* AS9 Asymmetric Vision by Persistent Geophysical Sensing and Infrasound Advanced Technology
* AT3 Subterranean Detection and Monitoring Advanced Technology
* AU4 Geospatially Enabled Operational Design (GEOD) Advanced Technology
* AT8 Network-Enabled GeoSpatial and GEOINT Services Advanced Technology
* AU6 Automated Analytics for Understanding the Operational Environment Advanced Technology
* AU1 Tactical GeoSpatial Information Capabilities Advanced Technology
PE 0603465A Future Vertical Lift Advanced Technology, Project:
* AL3 High Performance Computing for Rotorcraft Applications Advanced Technology
PE 0603466A Air and Missile Defense Advanced Technology, Project:
* AE3 Unconventional Countermeasures & Survivability Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates software and architectures for geospatial mapping applications and decision aids for the Warfighter. Project components, systems, system of systems, and decision aids enable ground vehicle mobility (freedom of movement), including force projection, and counter-mobility to impede movement of threat forces. Additional components, systems, system of systems for survivability support protection of personnel, facilities, and assets through design and reinforcement of structures, and for force protection to detect, assess, and defend against threats for troops and critical fixed and semi-fixed assets. Protection measures support force projection in areas such as air and sea ports of debarkation, dispersed small units, and units operating in complex and urban environments, which may include subterranean challenges. Work is in support of current and future ground force operations and future vertical lift. Software and architectures for geospatial projects mature and validate geospatial decision tools in support of operations planning and decision making to advance utility of geospatial capability and techniques across the Army, services, and coalition, and to advance and mature the information architecture that supports the total Army's discovery and access to data, geospatial information, and analytical tool suites. Methods to characterize and visualize behavior and population dynamics mature and validate efforts to portray the operational

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

environment including culture, demographics, terrain, climate, and infrastructure, into geospatial frameworks. Force protection activities are focused on filling critical gaps in protecting forces operating in disbursed small units over complex and urban terrain and include maturation, integration, and demonstration of components, systems, and systems of systems for rapidly deployable threat detection in direct line-of-site and nonline-of-site environments; situation assessment to help reduce false alarms and decrease manpower required to monitor the environment; and passive protection to mitigate blast and weapon effects from advanced and emerging threats. Work in survivability and force protection also includes maturing and demonstrating software to characterize blast effects generated from explosive events, such as improvised explosive device detonation in soils, and supports design and decision aids. Force protection activities are also focused on protection of critical assets and infrastructure required to project forces into denied access areas. Work in mobility and force projection includes maturing and demonstrating software and hardware to assess and improve freedom of movement for ground forces, including autonomous ground resupply and manned-unmanned teaming and demonstrates infrastructure health monitoring assessment technologies to support emerging projection challenges in complex, contested environments such as distributed sustainment over large distances. Engineered Resilient Systems (ERS) activities focus on developing capabilities for "upfront engineering" that will result in more operationally efficient and resilient systems that are more affordable in a more rapid fashion. This effort develops and demonstrates an end-to-end thread involving analysis to inform requirements, reduce risk, and assess lifecycle cost pre-milestone A through tradespace analytics for selected systems of interest.

This work is being fully coordinated and is complementary to the ERS work described in the Office of the Secretary of Defense (OSD) Program Element (PE) 0603832/ Project D8Z.

This work is fully coordinated with and complementary to PE 0602784A (Military Engineering Technology). Geospatial activities are coordinated with the National Geospatial Intelligence Agency (NGA). Autonomous ground resupply activities are coordinated with PEs 0603005A (Combat Vehicle and Automotive Advanced Tech) / Project 515 (Robotic Ground Systems), and PE 0602601A (Combat Vehicle and Automotive Technology) / Project H77 (National Automotive Center), and 0602601A (Combat Vehicle and Automotive Technology) / H91 (Ground Vehicle Technology) in collaboration with the Tank and Automotive Research, Development and Engineering Center (TARDEC). Autonomous ground resupply activities are also coordinated with PEs 0603001A (Warfighter Advanced Technology) / Project 543 (Ammunition Logistics), PE 0604639A (Weapons and Munitions - Advanced Development) / EC3 (Ammunition Logistics Prototyping), and 0605805A (Munitions Standardization, Effectiveness and Safety) / Project 297 (Mun Survivability & Log). Unconventional Countermeasure activities are coordinated with PE 0602720A (Environmental Quality Technology) / Project 835 (Mil Med Environ Crit) and PE 0603728 (Environmental Quality Technology Demonstrations) / Project 03E (Environmental Restoration Technology).

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

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 led by the Army Engineering Research and Development Center (ERDC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Geo-Enabled Mission Command Enterprise	2.797	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Description: This effort matures methods and demonstrates data, information, and software tools and architectures to bring physical and human terrain and effects data into decision frameworks for consistent and accurate implementation in the Army Geospatial Enterprise (AGE). This provides ready-access of low-overhead, light-weight, analytic tools to other Services and the Department of Defense (DoD) and increases situational awareness of the operational environment in support of mission planning and operations.			
Title: GeoIntelligence - Enabling Technology Demonstration ***Description:*** This effort provides demonstration of analytic tools and algorithms that use multi-source (e.g. optical, Light detection and ranging (LiDAR)), multiplatform (e.g. satellite, light Unmanned Aerial Vehicle (UAV)), multi-temporal image sources to build urban tactical decision aids suitable for use on mobile devices to provide geospatial analysis to the Army, other Services, and DoD, in support of mission planning and operations (such as small units in an urban setting). This effort continues work that was part of Geo-Enabled Mission Command Enterprise.	1.914	-	-
Title: Human Geography Demonstration ***Description:*** This effort matures and demonstrates the integration of behavior and population dynamics research and analysis into geospatial frameworks to depict aspects of the operational environment including culture, demographics, terrain, climate, and infrastructure for mission planning and awareness. Efforts include exploitation of existing open source text, leveraging multi-media and cartographic materials, and data collection methods from the tactical edge to characterize parameters of social, cultural, and economic geography of special interest to the Warfighter.	0.969	-	-
Title: Austere Entry and Maneuver Support Demonstrations ***Description:*** This effort matures and demonstrates improved means for achieving force projection in in austere and complex environments and integrated sensing and simulation systems for predicting physical conditions in these operational environments. This effort matures and demonstrates technologies to assess, construct, or repair infrastructure required to support entry, sustainment, and maneuver operations in complex and contested battlespaces. This effort matures and demonstrates simulation technology for manned-unmanned teaming maneuver.	6.598	-	-
Title: Adaptive Protection Demonstrations ***Description:*** This effort validates protection solutions for facilities and critical assets, including fixed and semi-fixed. A focus will be on technologies to defeat new and emerging advanced weapons threats. Technologies include: low-logistics protective construction and facility protection, use of indigenous materials, innovative structural hardening and retrofit, and the synergistic	7.698	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
use of unconventional countermeasures to increase the effectiveness of protection to critical assets. This effort also demonstrates rapidly deployable protective measures and retrofit technologies for use in urban environments.			
Title: Engineered Resilient Systems ***Description:*** This effort matures and demonstrates capabilities (tools and methodologies) to rapidly create high-fidelity environmental data to support the simulation of system performance for different Army missions in various geographic settings worldwide; provide input to and obtain output from combat simulations for different echelons pertaining to system performance; and conduct system trades that consider system performance in different operational environments and mission contexts. The Engineered Resilient Systems (ERS) initiative has been identified as a Science and Technology emphasis area by the Assistant Secretary of Defense for Research and Engineering, ASD(R&E). This effort focuses on Army systems of interest and on high-fidelity environmental data for the associated battlespace, on linkages to force-on-force combat simulations representing the systems of interest, and on tools to explore trades in order to help inform requirements, reduce risk, and assess lifecycle cost pre-milestone A.	4.783	-	-
Accomplishments/Planned Programs Subtotals	24.759	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / *Military Engineering Advanced Technology*	Project (Number/Name) T15 / *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	

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
T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	-	75.600	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	75.600

A. Mission Description and Budget Item Justification

Congressional Interest Item for Military Engineering Technology Demonstrations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Resilient Energy Systems	1.000	-
FY 2019 Accomplishments: Resilient Energy Systems		
Congressional Add: Additive Manufacturing/3D Printing	2.000	-
FY 2019 Accomplishments: Additive Manufacturing/3D Printing		
Congressional Add: Advanced Polymer Development	20.000	-
FY 2019 Accomplishments: Advanced Polymer Development		
Congressional Add: Bathymetric-topographic LIDAR Research	8.200	-
FY 2019 Accomplishments: Bathymetric-topographic LIDAR Research		
Congressional Add: Extreme Terrain Research	4.000	-
FY 2019 Accomplishments: Extreme Terrain Research		
Congressional Add: Secure Management of energy generation and storage	3.000	-
FY 2019 Accomplishments: Secure Management of energy generation and storage		
Congressional Add: Rapid low energy mobile manufacturing	3.000	-
FY 2019 Accomplishments: Rapid low energy mobile manufacturing		
Congressional Add: Centrifuge Enabled Research	2.500	-
FY 2019 Accomplishments: Centrifuge Enabled Research		
Congressional Add: Energy and technology research in cold and arctic regions	4.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T15 / *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
FY 2019 Accomplishments: Energy and technology research in cold and arctic regions		
Congressional Add: ERDC Collaboration (Transportation System Assessment Technologies)	2.000	-
FY 2019 Accomplishments: ERDC Collaboration (Transportation System Assessment Technologies)		
Congressional Add: Natural Gas technology	4.000	-
FY 2019 Accomplishments: Natural Gas technology		
Congressional Add: Reliable Distributed Energy in Austere Environments	3.000	-
FY 2019 Accomplishments: Reliable Distributed Energy in Austere Environments		
Congressional Add: Research Facility Modernization	2.000	-
FY 2019 Accomplishments: Research Facility Modernization		
Congressional Add: Research in the Permafrost environment	4.000	-
FY 2019 Accomplishments: Research in the Permafrost environment		
Congressional Add: Secure and resilient power generation in cold region environments	5.000	-
FY 2019 Accomplishments: Secure and resilient power generation in cold region environments		
Congressional Add: Silicone anode technology	4.000	-
FY 2019 Accomplishments: Silicone anode technology		
Congressional Add: Transportation infrastructure evaluation system	3.900	-
FY 2019 Accomplishments: Transportation infrastructure evaluation system		
Congressional Adds Subtotals	75.600	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A