Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army											Date: February 2018	
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 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**Cost To Complete**	**Total Cost**
Total Program Element	-	59.101	32.448	25.864	-	25.864	26.236	26.701	27.186	27.730	0.000	225.266
T08: *Combat Eng Systems*	-	21.101	32.448	25.864	-	25.864	26.236	26.701	27.186	27.730	0.000	187.266
T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	-	38.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	38.000

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.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Priorities.

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

Work in this PE is led by the Army Engineering Research and Development Center (ERDC)

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army	Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	20.684	32.448	25.864	-	25.864
Current President's Budget	59.101	32.448	25.864	-	25.864
Total Adjustments	38.417	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	38.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.000	-			
• SBIR/STTR Transfer	-0.576	-			
• FFRDC	-0.007	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2017	FY 2018
Project: T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*		
Congressional Add: *Program Increase*	30.000	-
Congressional Add: *Secure management of energy generation and storage*	3.000	-
Congressional Add: *Installation energy efficiency enhancements*	5.000	-
Congressional Add Subtotals for Project: T15	38.000	-
Congressional Add Totals for all Projects	38.000	-

Change Summary Explanation

FY17 Congressional increase in project T15 Military Engineering Technology Demonstration.
FY18 funds increase for Extend Map-Based Planning Services to include Joint mission planning capabilities. Human Geography demonstrations to extend the means to characterize Warfighter-relevant social, cultural, and economic geography indicators to the tactical edge.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
T08: *Combat Eng Systems*	-	21.101	32.448	25.864	-	25.864	26.236	26.701	27.186	27.730	0.000	187.266

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 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 non-line-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.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization priorities for Next Generation Combat Vehicle, Air Missile Defense, Network/C3I, and Future Vertical Lift. 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

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

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).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Geo-Enabled Mission Command Enterprise	-	-	2.923
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. ***FY 2019 Plans:*** Will mature a flexible Army geospatially-enabled planning environment that enables mission analysis and development of staff estimates (such as Intelligence Preparation of the Battlefield) at the tactical level that enables data synchronization with the Command Post Computing Environment systems. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** New start in FY19			
Title: Map-Based Planning Services (MBPS)	1.756	9.630	-
Description: This effort matures geospatially enabled, collaborative mission planning capabilities providing services, data, and information to Army planners, staffs, and leaders. These mission planning capabilities will allow collecting, processing, storing, displaying, and sharing of authoritative data and information in a geo-temporal context. Work will leverage a Standard Shareable Geospatial Foundation provided by the AGE and incorporate Geo-Enabled Mission Command tools and analytical capabilities. This effort continues work that was part of Geo-Enabled Mission Command Enterprise and matures work in PE 0602784A/Project 855. ***FY 2018 Plans:*** Demonstrate a globally accessible, collaborative, map-based web environment which enables simultaneous viewing, editing, and sharing of information within and between military planners enabling a digitally supported military decision making process including supporting analytics and services; mature and demonstrate capability to collect, process, store, display, and share			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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 2017	FY 2018	FY 2019
authoritative data from Joint sources in a map-based environment; mature and demonstrate Joint mission planning capabilities that will allow concurrent and collaborative planning by operational, logistics, and intelligences staffs to crate, compile, and consolidate Operational Plans. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Mission planning capabilities were matured and transitioned. Funds used to support JPES PDM as well as to mature a flexible Army geospatially-enabled planning environment			
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. ***FY 2018 Plans:*** Mature and demonstrate an environmental scenario generator to provide weather and terrain effects to mobility and sensor performance models when exercising analysis of multiple courses of action within the military decision making process; develop and enhance tactical decision aid execution operating on three dimensional terrain datasets within a browser-based visualization environment. ***FY 2019 Plans:*** Will develop man/machine learning algorithms to automate production processes, to enable change detection, and to support learning by manned and autonomous systems with the capability to collect and/or complete 3D high-resolution common operating picture of complex and urban terrain.	0.729	2.000	2.000
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. ***FY 2018 Plans:***	-	1.000	1.000

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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 2017	FY 2018	FY 2019
Demonstrate high-resolution population modeling, including adaptation of urban growth models, supporting Army Component Command major consequence assessments, and generating analysis of populations affected by catastrophic events. ***FY 2019 Plans:*** Will demonstrate methods for military assessment of population vulnerability and resilience disruptors as a result of combat, disasters, disease, etc., within dense urban and complex environments; will demonstrate computational models to support a federated model approach for complex urban systems; and will develop methodologies to support the military decision making process addressing the impacts of the physical, ecological, and sociocultural environments relative to contingency base site selection, design, operations and maintenance.			
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. ***FY 2018 Plans:*** Demonstrate technologies for planning and conducting Anti-Access/Area Denial (A2/AD) entry operations without airfields/ports and with damaged/destroyed airfields/ports; optimize and provide persistent monitoring technologies and an integrated seismic-infrasound-acoustic-meteorological (SIAM) array for remote structural health monitoring to produce near-real-time awareness of critical infrastructure and connecting lines of communication; and mature and demonstrate simulation and decision support tools to ensure both manned and unmanned ground vehicle mobility in complex, urban, and constantly changing environments. ***FY 2019 Plans:*** Will mature real-time hardware-in-the-loop simulator to validate autonomous vehicle maneuver configurations and will demonstrate performance through field experiments. Will demonstrate obstacle detection software to support real-time mobility decisions in urban environments. Will mature and demonstrate near-real time infrastructure monitoring technology that automates analyses of seismic-infrasound-acoustic-meteorological (SIAM) data to eliminate subject matter expert requirement and will mature toolkits to support littoral zone maneuver and vehicle operating surfaces assessment. Will mature all-season austere entry and sustainment node decision support tools for site selection. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Increase due to inflation.	7.141	6.889	6.897
Title: Adaptive Protection Demonstrations	6.616	7.929	8.044

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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 2017	FY 2018	FY 2019
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 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. ***FY 2018 Plans:*** Demonstrate modeling & simulation tools to predict structural response/damage to support regional tradespace analysis; provide an initial version of an urban building protection assessment tool and mature rapidly deployable protective technologies for dismounted urban operations; demonstrate unconventional countermeasures that hinder target acquisition, thus interrupting the threat system kill-chain of advanced threat systems; optimize linear sensing systems (LSS) for perimeter security in complex geo-environments; and mature technologies to detect subterranean activities for protection of forces and critical assets. ***FY 2019 Plans:*** Will mature and demonstrate urban building assessment tool and will mature retrofit technologies to ensure safe building occupation decisions for dismounted soldiers in urban environments. Will mature and demonstrate rapid signature reduction methods to increase critical asset survivability. Will mature perimeter security and surveillance monitoring and detection systems to detect, track, and classify subterranean and other threat activities. Will mature and demonstrate new protective technologies to defeat future near-peer adversarial threats. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Increased investments to support advancements of new protective technologies to defeat future near-peer adversarial threats			
Title: Engineered Resilient Systems	4.859	5.000	5.000
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. ***FY 2018 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Provide a simulation workflow manager tool that facilitates the linkages between data sources and computational models during simulation; validate design and tradespace analysis implementation tools; and conduct tradespace analyses of candidate sensors to demonstrate environmental effects on sensor performance among other analyses in support of Warfighter systems development. ***FY 2019 Plans:*** Will validate environmental effects as they relate to the acquisition of Army aviation, ground vehicle, and sensor platforms; will develop workflow automation processes for these platforms; will integrate mission effectiveness into the resulting tradespaces; will leverage emerging data analytics techniques and machine learning algorithms to optimizes insight prior to acquisition decision points; and will develop novel methodologies through the use of environmental simulation, tradespace analytics, and computational prototyping of Army systems.			
Accomplishments/Planned Programs Subtotals	21.101	32.448	25.864

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	-	38.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	38.000

Note

Congressional Program Increase for FY17

A. Mission Description and Budget Item Justification

These is a Congressional Interest Item for Military Engineering Technology Demonstrations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018
Congressional Add: Program Increase ***FY 2017 Accomplishments:*** N/A	30.000	-
Congressional Add: Secure management of energy generation and storage ***FY 2017 Accomplishments:*** N/A	3.000	-
Congressional Add: Installation energy efficiency enhancements ***FY 2017 Accomplishments:*** N/A	5.000	-
Congressional Adds Subtotals	38.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A