Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army											Date: February 2018	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603125A / *Combating Terrorism - Technology Development*							
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	-	33.553	26.903	3.762	-	3.762	2.741	2.796	2.856	2.913	0.000	75.524
DF5: *Agile Integration & Demonstration*	-	25.553	26.903	3.762	-	3.762	2.741	2.796	2.856	2.913	0.000	67.524
DW4: *Energy Technologies (Congressional Adds (CAs))*	-	8.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.000

A. Mission Description and Budget Item Justification

This Program Element (PE) demonstrates and evaluates emerging technologies and systems with high payoff potential to address current technology shortfalls or future capability gaps. Efforts include: hybrid electric power technologies to reduce use of fossil fuel in tactical generators; collaboration with the United States (U.S.) Department of Energy to demonstrate technologies that provide significant gains in ground vehicle energy efficiency; demonstration of ground platform power management, generation, and distribution technologies that increase energy efficiencies and support the integration of advanced future capabilities; and field demonstrations and red teaming activities to stress and assess emerging technologies earlier in the systems development life-cycle, thus reducing potential vulnerabilities and providing an improved understanding of employment risks against potential threats.

Work in this PE is complementary to and is fully coordinated with PE 0602618A/Project H80 (Ballistics Technology/Survivability and Lethality Technology), PE 0602601A (Combat Vehicle and Automotive Technology), and 0603005A (Combat Vehicle and Automotive Advanced Technology).

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

Work in this PE is performed by the Army Research, Development, and Engineering Command (RDECOM).

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 0603125A *I Combating Terrorism - Technology Development*

B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	27.686	26.903	21.268	-	21.268
Current President's Budget	33.553	26.903	3.762	-	3.762
Total Adjustments	5.867	0.000	-17.506	-	-17.506
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	8.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-1.068	-			
• SBIR/STTR Transfer	-1.052	-			
• Adjustments to Budget Years	-	-	-17.506	-	-17.506
• FFRDC	-0.013	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2017	FY 2018
Project: DW4: *Energy Technologies (Congressional Adds (CAs))*		
Congressional Add: *Force Protection Radar Development*	8.000	-
Congressional Add Subtotals for Project: DW4	8.000	-
Congressional Add Totals for all Projects	8.000	-

Change Summary Explanation

FY17 Congressional increase in project DW4 Energy Technologies. FY19 decreases to project DF5 reflect changes to support Army Modernization Priorities resulting in conclusion of Red Teaming efforts in FY18 and reductions to the Ground Vehicle Power and Energy effort.

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 0603125A / *Combating Terrorism - Technology Development*	Project (Number/Name) DF5 / *Agile Integration & Demonstration*	

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
DF5: *Agile Integration & Demonstration*	-	25.553	26.903	3.762	-	3.762	2.741	2.796	2.856	2.913	0.000	67.524

Note

In FY19, the investment under Project DF5 is realigned in support of the Army science and technology (S&T) priorities as identified at the December 2016 S&T Army Requirements Oversight Council by the Chief of Staff of the Army.

A. Mission Description and Budget Item Justification

This Project demonstrates and evaluates emerging technologies and systems with high payoff potential to address current technology shortfalls or future capability gaps. Efforts include hybrid electric power technologies to reduce use of fossil fuel in tactical generators; collaboration with the United States (U.S.) Department of Energy (DOE) to demonstrate technologies that provide significant gains in ground vehicle energy efficiency; demonstration of ground platform power management, generation, and distribution technologies that increase energy efficiencies and support the integration of advanced future capabilities; and field demonstrations and red teaming activities to stress and assess emerging technologies earlier in the systems development life-cycle, thus reducing potential vulnerabilities and providing an improved understanding of employment risks against potential threats.

Work in this Project is complementary to and is fully coordinated with Program Element (PE) 0602618A/Project H80 (Ballistics Technology/Survivability and Lethality Technology), PE 0602601A (Combat Vehicle and Automotive Technology), and PE 0603005A (Combat Vehicle and Automotive Advanced Technology),.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Ground Platform Subsystem Demonstrations	4.508	4.000	1.073
Description: This effort contributes to the Army's ground platform risk reduction efforts which seek to address technical and integration challenges in the areas of mobility, survivability, vehicle architecture, and systems integration. Specifically, this effort focuses on maturing and demonstrating integrated vehicle power management, generation and distribution technologies to increase ground vehicle energy efficiencies and ensure ground platforms have enough power to enable future capabilities such as electromagnetic armor, active protection systems, improvised explosive device (IED) detect and defeat technologies, advanced situational awareness and future network integration technologies. This effort is coordinated with PE 0603005A. ***FY 2018 Plans:*** Mature the VEA Mobile Demonstrator (VMD) technology by optimizing subsystem performance during hardware integration onto vehicle platform, and begin demonstrations of VMD capabilities to validate system performance against future power and data			

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 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
requirements. Mature and validate powertrain controls architecture and algorithm to improve powertrain efficiencies and minimize parasitic losses through component modeling and simulation. Mature and validate integrated starter generator, advanced thermal management system, and advanced modular lithium ion battery technologies to improve subsystem fuel efficiency and increase electrical power generation. ***FY 2019 Plans:*** Will complete optimization of VEA Mobile Demonstrator (VMD) performance during hardware integration onto vehicle platform, and will validate system performance against future power and data requirements. Will complete validation of powertrain controls architecture and algorithms, improving powertrain efficiencies and minimizing parasitic losses. Will complete validation of integrated starter generator, advanced thermal management system, and advanced modular lithium ion battery technologies to improve subsystem fuel efficiency and increase electrical power generation. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Funding realigned to higher Army Priorities.			
Title: Ground Vehicle Power and Energy	4.747	5.340	2.689
Description: This effort matures and demonstrates advanced technologies that enable military ground vehicles to become significantly more energy efficient. It collaborates with the DOE to demonstrate technologies in: advanced combustion engines and transmissions; lightweight structures and materials; energy recovery and thermal management; alternative fuels and lubricants; hybrid propulsion systems; batteries and energy storage; and analytical tools (e.g., modeling and simulation). This effort is coordinated with PE 0602601A. ***FY 2018 Plans:*** Continue to support the AVPTA with the DOE to mature and demonstrate technologies within the alliance technology focus areas. Continue to provide the capability to model and simulate advanced chemistry batteries and batteries in extreme temperature conditions to improve characterizing battery life cycle estimations. Improve tire modeling and simulation capabilities based on dynamic property data from advanced tire testing. Improve corrosion prevention capabilities through results from investigation of corrosion mechanisms and effects on dissimilar material joints which identified materials and processes to inhibit corrosion. ***FY 2019 Plans:*** Will continue to support the AVPTA with the DOE to mature and demonstrate technologies within the alliance technology focus areas. Will develop methodology and software for optimal sizing of fuel cells and battery packs for military vehicles. Will develop advanced electrolytes to increase Lithium Metal Battery energy density, performance and life. Will develop and test Thermal Barrier Coatings to reduce heat loss/improve fuel economy of combustion engines. Will develop and evaluate next-generation, light-weight materials, manufacturing and related processes. Will support the AVPTA project portfolio via "Extended Enterprise"			

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 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
efforts such as Improving the Fuel Efficiency of the Current Ground Tactical Fleet; JP-8 Fuel Cell Power; and other activities that will enhance Operational Energy efficiency and reduce energy consumption. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Funding realigned to higher Army Priorities.			
Title: Red Teaming Field Demonstration ***Description:*** This effort conducts field demonstrations to stress emerging technologies in realistic environments and scenarios, using warfighters and adaptive adversaries. Field demonstration activities seek to place emerging technologies in the hands of Warfighters early in the development cycle to leverage their feedback and to uncover potential vulnerabilities in future systems, allowing identification of design fixes and improvements while mitigations are less expensive. Red Teaming Field Demonstration activities are coordinated with PE 0602618. ***FY 2018 Plans:*** Conduct a series of live field demonstrations where warfighters utilize technologies and systems in operationally relevant scenarios to address a set of priority, threat-informed challenges and areas of overmatch concern. Technical areas of interest include interoperability, internet of things, autonomous systems, and electronic warfare. Demonstrations are structured to stress the technologies/systems and uncover vulnerabilities through their employment in complex mission scenarios with friendly and opposing forces, including emulated threat probes for electronic warfare vulnerabilities. Provide feedback to developers through structured assessments to facilitate reduction or mitigation of vulnerabilities. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Effort concludes in FY18 due to a change in the priority of the effort.	8.041	7.282	-
Title: Red Teaming Systems Intensive Analysis ***Description:*** This effort conducts in-depth analysis (from concepts to employment to interoperability) of selected high priority emerging technology sub-systems and systems with planned transitions to future programs of record. The intent is assess technologies using virtual and laboratory experiments across a broad range of potential threat vectors, environments, and use cases to identify and mitigate any identified vulnerabilities as early as possible.. These venues allow for detailed analysis in areas that would be too dangerous or too expensive to assess during a live, field demonstration. ***FY 2018 Plans:*** Conduct the first phase of intensive analysis for key emerging systems and concepts identified from intelligence, requirements, acquisition, and science and technology community stakeholder strategy events; and continue to the next phase of ongoing intensive analysis for select key emerging systems and/or concepts to uncover vulnerabilities and potential risks pertaining to systems integration, interoperability, adaptability, user technology acceptance, and performance in contested environments.	4.910	4.369	-

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 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Potential technical areas of interest will include operations in subterranean and urban interior environments, indicators of military activity through social media, unmanned medivac and resupply, and electronic warfare. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Effort concludes in FY18 due to a change in the priority of the effort.			
Title: Red Teaming Vulnerability Exercises ***Description:*** This effort conducts tabletop exercises for in-depth assessments of emerging threats and technologies to anticipate future challenges in contested and congested environments, inform threat concepts, adapt system development practices, and maintain overmatch capability. Outputs of these exercises influence technologies and scenarios chosen for Systems Analysis and Field Demonstrations. ***FY 2018 Plans:*** Design and conduct a series of virtual scenario-based exercises, rooted in stakeholder input on emerging threats and areas of overmatch concern, with participants from government, academia, and industry who represent red (threat), blue (US forces), and green (influence base, neutrals) perspectives in order to expose assumptions, characterize needed capabilities, and identify current and future critical vulnerabilities. Exercises cover broader time and space conditions than are possible in live field experiments. Implement team challenge experiments to identify potential vulnerabilities and risks for developing concepts or systems; and, based on previous year evaluations, modify analysis methodologies, structured assessments, and frameworks to improve data captured for analysis and feedback, with the goal of providing insight and data to enable risk mitigation, informing current or future acquisition programs early in the development lifecycle. Potential technical areas of interest will include force protection, interoperability, internet of things, autonomous systems, and electronic warfare. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Effort concludes in FY18 due to a change in the priority of the effort.	3.347	2.912	-
Title: Unmanned Teaming Technology Assessment ***Description:*** This effort provides an assessment of technology components and enablers required to establish a manned-unmanned teaming capability for enhanced combat power in complex and contested environments. The assessment will consider Soldiers, unmanned ground vehicles, unmanned air vehicles, command and control, communications, and lethality technologies. ***FY 2018 Plans:*** Identify components, technologies and enablers required to establish a manned unmanned teaming capability to provide enhanced combat power in complex and contested environments. Determine component priority by assessing unmanned	-	3.000	-

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 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
capabilities in support of realistic mission scenarios. Primary components of the assessment include: Soldiers, unmanned ground vehicles, unmanned air vehicles, command and control, communications and lethality. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Effort concludes in FY18; planned progression of effort.			
Accomplishments/Planned Programs Subtotals	25.553	26.903	3.762

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 0603125A / *Combating Terrorism - Technology Development*	Project (Number/Name) DW4 / *Energy Technologies (Congressional Adds (CAs))*	

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
DW4: *Energy Technologies (Congressional Adds (CAs))*	-	8.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.000

A. Mission Description and Budget Item Justification

This project contains Congressional add funding.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018
Congressional Add: Force Protection Radar Development	8.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	8.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A