Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Army											Date: February 2020	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602144A / *Ground 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	-	0.000	143.899	28.047	-	28.047	31.666	31.807	32.889	33.387	0.000	301.695
BK7: *Robotics for Engineer Operations Technology*	-	0.000	9.998	6.265	-	6.265	3.243	2.431	1.768	5.995	0.000	29.700
BL1: *Materials and Manufacturing Research Technology*	-	0.000	8.127	10.270	-	10.270	10.499	10.818	10.943	11.054	0.000	61.711
BL2: *Explosives Forensics Technology*	-	0.000	1.542	1.571	-	1.571	1.602	1.634	1.653	1.670	0.000	9.672
BL4: *Countermine Technology*	-	0.000	4.244	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.244
BL5: *Expedient Passive Protection Technology*	-	0.000	4.119	1.467	-	1.467	2.030	5.948	4.606	3.507	0.000	21.677
BL7: *Power Projection in A2AD Environments Technology*	-	0.000	2.766	1.913	-	1.913	3.190	1.828	2.872	0.000	0.000	12.569
BL9: *Protection from Advanced Weapon Effects Technology*	-	0.000	4.403	3.957	-	3.957	7.393	4.346	5.332	5.332	0.000	30.763
BN8: *Ground Technology Materials(CA)*	-	0.000	108.700	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	108.700
CA9: *Predictive Maintenance*	-	0.000	0.000	2.604	-	2.604	3.709	4.802	5.715	5.829	0.000	22.659

Note

In Fiscal Year (FY) 2020, this Program Element (PE) is realigned with continuity of effort from the following PEs:
* 0602105A Materials Technology
* 0602622A Chemical, Smoke, and Equipment Defeating Technology
* 0602705A Electronics and Electronic Devices
* 0602712A Countermine Systems
* 0602720A Environmental Quality Technology
* 0602784A Military Engineering Technology

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Army	Date: February 2020
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*

A. Mission Description and Budget Item Justification

This PE researches efforts that support and enable the Army's modernization priority for the Next Generation of Combat Vehicles including systems for the deployment and sustainment of ground movement and maneuver. This PE designs and validates technologies that are necessary and foundational for legacy and future ground movement, maneuver and protection of Soldiers and systems.

All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy

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 the Project supports the Army Science and Technology Ground portfolio.

Work is performed by the United States (U.S.) Army Futures Command and the U.S. Army Engineer Research and Development Center.

Work in this PE complements PE 0602145A (Next Generation Combat Vehicle Technology), PE 0603119A (Ground Advanced Technology), PE 0603462A (Next Generation Combat Vehicle Advanced Technology), PE 0602143A (Soldier Lethality Technology) and PE 0603118A (Soldier Lethality 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	0.000	35.199	29.837	-	29.837
Current President's Budget	0.000	143.899	28.047	-	28.047
Total Adjustments	0.000	108.700	-1.790	-	-1.790
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	108.700			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-1.790	-	-1.790

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Project: BN8: *Ground Technology Materials(CA)*		
Congressional Add: *Environmental Quality Enhanced Coatings*	-	5.000
Congressional Add: *Environmental Friendly Coatings Technology*	-	3.000
Congressional Add: *Additive Manufacturing for Artificial Intelligence and Machine Learning*	-	5.000

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 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2019	FY 2020
Congressional Add: *Earthen Structures Soil Enhancement*	-	4.000
Congressional Add: *M1 Abrams Tank Track System*	-	2.200
Congressional Add: *High Performance Polymers*	-	5.000
Congressional Add: *Materials Manufacturing Processes*	-	6.000
Congressional Add: *Highly Durable Advanced Polymers for Lightweight Armor*	-	8.000
Congressional Add: *Cellulose Nanocomposite Research*	-	5.000
Congressional Add: *Countermine Program*	-	5.000
Congressional Add: *Materials Research*	-	17.500
Congressional Add: *Additive Manufacturing and Materials Processing*	-	15.000
Congressional Add: *Cold Weather Military Research*	-	3.000
Congressional Add: *Cold Spray Technologies*	-	15.000
Congressional Add: *Center for Research in Extreme Batteries*	-	10.000
Congressional Add Subtotals for Project: BN8	-	108.700
Congressional Add Totals for all Projects	-	108.700

Change Summary Explanation

FY20 increase related to $108.700 million of Congressional Add funding.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*	Project (Number/Name) BK7 / *Robotics for Engineer Operations 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
BK7: *Robotics for Engineer Operations Technology*	-	0.000	9.998	6.265	-	6.265	3.243	2.431	1.768	5.995	0.000	29.700

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0602784A Military Engineering Technology
* Project T41 Mil Facilities Eng Tec
* Project T45 Energy Tec Apl Mil Fac
PE 0602720A Environmental Quality Technology
* Project 048 Ind Oper Poll Ctrl Tec

A. Mission Description and Budget Item Justification

This research investigates and develops standoff robotic capabilities for Combat Engineers to reduce Soldier/Engineer risks and fatalities while conducting activities essential to shaping the environment. It will close the gaps between commercial construction equipment and the requirements of the future Engineer Force to support maneuver, movement, and sustainment. This research will develop the capability to generate a near real-time site model with appropriate engineering details to allow unmanned shaping of the environment through physical interaction (e.g. push, pull, lift, or dig). This effort will also develop the requisite mission planner and task execution controller that accepts input from the user and provides suggestions and feedback based on updates to the site model, reporting from hardware agents, and resource allocation logic. The end state goal is the development of beyond visual line of sight teleoperation and semiautonomous capabilities allowing Engineer robotic support to match pace in near term and future combat environments. This effort will support the development, testing, and evaluation of prototypical robotic Combat Engineer equipment. This Project develops modeling and simulation tools that represent realistic states for Engineer robotic operations and develops and assesses semi-autonomous and autonomous construction equipment technologies needed for remote control Engineer operations.

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 supports the Army Science and Technology Ground Portfolio.

Work in this Project is conducted by the United States (US) Army Engineer Research and Development Center and coordinated with US Army Futures Command.

Work in this Project is coordinated with PE 0603462A (Next Generation Combat Vehicle Advanced Technology) and complements PE 063119A (Ground Advanced Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Dynamic Site Characterization	-	2.132	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BK7 / *Robotics for Engineer Operations Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Description: This effort develops the capability to dynamically characterize the environment in which robotic Engineer equipment will operate through implementation of multi-modal sensing, sensor data fusion, and object detection and classification. ***FY 2020 Plans:*** Adapt, modify, and improve object detection and classification capability to specifically support Combat Engineer tasks as well as develop capabilities for detailed engineering characteristics for soils and classification of materials both on the surface and subsurface. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY21 the Dynamic Site Characterization effort continues in the Beyond-Visual-Line-of-Sight (BVLOS) Teleoperated Engr Ops effort in this Project.			
Title: Mission Planning and Task Execution Control ***Description:*** This effort develops a mission planning and task execution control capability to enable unmanned robotic Engineer equipment operations. This capability will provide a near real time operational view of the area of interest and will convert mission planning directives into commands for the robotic equipment. ***FY 2020 Plans:*** Develop the tools for the visualization of the site model to allow an operator to view, explore, and utilize site data. In addition, it will create a user interface for an operator to input mission planning directives, machine control, and view task status. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY21 the Mission Planning and Task Execution Control effort continues in the BVLOS Teleoperated Engr Ops effort in this Project.	-	3.132	-
Title: Integration Prototype Model Development ***Description:*** This effort develops remote control protocols and processes for testing of construction equipment to assess suitability for use during engineer operations; assesses commercially available autonomy solutions from transportation and construction industries to develop enhanced semi-autonomous and autonomous equipment technology; and develops simulation tools for coordinated, multi-equipment operations. ***FY 2020 Plans:*** Build a hardware-in-the-loop synthetic environment for development and testing of control algorithms and adapt, modify, and expand semi-autonomous navigation capabilities to facilitate one operator controlling multiple types of equipment. ***FY 2020 to FY 2021 Increase/Decrease Statement:***	-	4.613	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BK7 / *Robotics for Engineer Operations Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
In FY21 the Integration Prototype Model Development effort continues in the BVLOS Teleoperated Engr Ops effort in this Project.			
Title: Beyond-Visual-Line-of-Sight Teleoperated Engr Ops ***Description:*** This effort develops site characterization technologies, equipment localization technologies, equipment tools, and controls protocols to support remote control and semi-autonomous engineering operations and develops modeling and simulation tools to support remote operations. ***FY 2021 Plans:*** Will develop Combat Engineer specific library for object classification and identification to allow for greater fidelity in semi-autonomous site characterization; will develop site localization technologies for Engineer equipment operating in Global Positioning System denied environments; will develop machine learning and artificial intelligence protocols unique to construction equipment tool manipulation and execution; will develop equipment controls and control interfaces to allow multiple pieces of equipment to be operated/overseen by one operator. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Work in the BVLOS Teleoperated Engr Ops effort was previously conducted under Dynamic Site Characterization, Mission Planning and Task Execution Control, and Integration Prototype Model Development efforts in this Project.	-	-	6.265
Title: FY 2020 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.121	-
Accomplishments/Planned Programs Subtotals	-	9.998	6.265

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 / 2	R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*	Project (Number/Name) BL1 / *Materials and Manufacturing Research 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
BL1: *Materials and Manufacturing Research Technology*	-	0.000	8.127	10.270	-	10.270	10.499	10.818	10.943	11.054	0.000	61.711

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0602105A Materials Technology
* Project XW4 Manufacturing Science
PE 0602705A Electronics and Electronic Devices
* Project H94 Electronics and Electronic Devices

A. Mission Description and Budget Item Justification

This Project links materials research, manufacturing processes, and design to enable higher quality additive manufacturing products for Army applications through the development of high performance feedstock materials (polymers, metals, and ceramics), physics-based process models, and in-situ process monitoring. Integration of these tools with process models enables real-time control and manipulation of materials structure and properties to produce three-dimensional hybrid electronics packaging, power and energy sources and converters and new materials/structures for protection. The goal of this work is to develop robust physics-based models to optimize material properties, structures, and manufacturing processes for Army applications in protection, maneuver, power, sensing, and signature management necessary to rapidly respond to emerging and unknown threats in a battlefield environment.

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 supports the Army Science and Technology Ground and Next Generation Combat Vehicle.

Work in this effort is performed by the United States (US) Army Futures Command.

This work is done in coordination with PE 0602145A (Next Generation Combat Vehicle Technology), 0602143A (Soldier Lethality Technology) and 0603118A (Soldier Lethality Advanced Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Agile Expedient Manufacturing	-	2.227	-
Description: This effort researches developing manufacturing processes to accelerate the rate of innovative material adaptations (protection, power, sensing, and signature management) necessary to rapidly respond to emerging and unknown threats in a battlefield environment. Efforts include the development of innovative materials technologies through combinations of additive			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BL1 / *Materials and Manufacturing Research Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
and subtractive manufacturing, direct write processes, coupled electro-magnetic fields, and other hybrid processes, as well as the development of robust predictive modeling and simulation tools linking manufacturing processes with materials structure, properties, and performance to enable the design and production of optimal materials at the point of need using available materials, energy sources, etc. ***FY 2020 Plans:*** Will develop novel chemistries and incorporate into ambient reactive extrusion processes to print energetic polymer propellants with optimal architectures. Will develop material processes to control and modify interfaces to enable three-dimensional hybrid electronics packaging that integrates microprocessors, amplifiers, three-dimensional antennas, and sensors for Army applications. Will investigate coupling electromagnetic fields to metal additive manufacturing processes to control specific microstructures in Magnesium alloys. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY21 the Agile Expedient Manufacturing effort moves to Additive Manufacturing Research to combine all Additive Manufacturing within this Project.			
Title: Power and Energy ***Description:*** This effort focuses on the design and characterization of chemistries, materials, and components for advanced batteries, fuel reformers, and fuel cells. Potential Army applications include hybrid power sources, smart munitions, hybrid electric vehicles, and soldier power applications. This effort also investigates the applicability of photosynthesis to provide fuel and electricity for soldier power applications, and investigate silicon carbide power module components that could enable compact, high-efficiency, high-temperature, and high-power density converters for motor drive and pulse power applications. ***FY 2020 Plans:*** Will develop electrolytes for high-voltage cathodes that will enable the transition of next generation high-energy batteries to the North Atlantic Treaty Organization (NATO) standard 6T format; will explore the feasibility of using biomimetic electrochemical devices for neuromorphic computing to enable artificial intelligence; will develop more efficient oxygen evolution catalysts for water electolyzers to generate hydrogen for fuel cells; and will investigate thermal and liquid reserve battery chemistries that extend operational duration of the battery while maintaining the 30-year shelf life requirement. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY21 the Power and Energy effort is realigned to Energy Sources and Storage within this Project.	-	1.609	-
Title: Additive Manufacturing Research ***Description:*** This effort researches new additive manufacturing (AM) capabilities that enable production of lightweight materials for protection, lethality, and maneuverability that cannot be produced through traditional manufacturing methods. Efforts include	-	3.922	8.483

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BL1 / *Materials and Manufacturing Research Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
the development of new feedstock materials engineered specifically for low-volume additive processes to produce net-shape materials with desired properties and functionalities; integrated process models and real-time monitoring for closed-loop control and production of lightweight materials with optimal architectures, property gradients, and interfaces; and design optimization capabilities that connect materials and manufacturing to access the full design space enabled by additive manufacturing. ***FY 2020 Plans:*** Will quantify processing-structure-property relationships in additively manufactured ultra-high strength steel alloys designed specifically for laser-based AM processes; will validate continuum scale model of laser-metal powder bed AM process and mesoscale phase field model of microstructure development; will develop optimal non-laser based AM process to retain unique micro/nanostructures in nanocrystalline metal feed stocks; will create novel additive processes to incorporate novel particulate and high aspect ratio fillers into AM polymer composites. ***FY 2021 Plans:*** Will build upon prior metallic suspension chemistries to demonstrate electrical interconnect deposition capability for ambient reactive extrusion processes; demonstrate high conductivity, high resolution metallic inks to enable chip to chip interconnect and board level integration; demonstrate modified interfaces into three-dimensional hybrid electronics; develop improved performance for the integrated microprocessors, amplifiers, three-dimensional antennas, and sensors for Army applications; investigate use of electromagnetic fields in metal additive manufacturing processes to control specific microstructures in Magnesium alloys for structural and protection uses. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY21 the Agile Expedient Manufacturing effort in this Project is realigned to combine all Additive Manufacturing-related efforts within this Project in this effort.			
Title: Energy Sources and Storage ***Description:*** This effort focuses on the design and characterization of chemistries, materials, and components for advanced batteries, fuel reformers, and fuel cells. Potential Army applications include hybrid power sources, smart munitions, hybrid electric vehicles, and soldier power applications. This effort also investigates the applicability of photosynthesis to provide fuel and electricity for soldier power applications, and investigate silicon carbide power module components that could enable compact, high-efficiency, high-temperature, and high-power density converters for motor drive and pulse power applications. ***FY 2021 Plans:*** Will develop electrolytes for high-voltage cathodes with high capacity silicon anode that will enable the transition of next generation high energy dense, safe batteries for Soldier use; synthesize and develop highly active low-cost catalysts for fuel production and to use in fuel cell and power conversion applications; investigate modeling of spin activated liquid reserve batteries	-	-	1.787

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BL1 / *Materials and Manufacturing Research Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
to explore the design space as it relates to requirements for energy, activation times, and environmental conditions for future munition systems. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY21 this effort is realigned from the Power and Energy effort in this Project.			
Title: FY 2020 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.369	-
Accomplishments/Planned Programs Subtotals	-	8.127	10.270

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 / 2	R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*	Project (Number/Name) BL2 / *Explosives Forensics 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
BL2: *Explosives Forensics Technology*	-	0.000	1.542	1.571	-	1.571	1.602	1.634	1.653	1.670	0.000	9.672

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0602622A Chemical, Smoke and Equipment Defeating Technology
* Project 552 Smoke/Novel Effects Munitions

A. Mission Description and Budget Item Justification

This Project investigates and develops analytical methods for military explosives, homemade explosives (HME), HME precursors, and residue analysis for forensics attribution purposes. This project pursues research in signatures and algorithms required to provide improved residue analysis of explosives and precursor materials to enable integration into chemical and explosive hazard detection equipment for the warfighter.

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 supports the Army Science and Technology Ground Portfolio.

Work in this effort is performed by the United States (US) Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Forensic Analysis of Explosives Signatures Applied Research	-	1.472	1.571
Description: This effort investigates forensics analytical methods for military explosives, HME, HME precursors, and residue analysis for attribution.			
FY 2020 Plans: Will investigate Photonic Integrated Circuits (PIC) for chemical sensing of explosives, narcotics, and other chemicals of interest for forensic analysis and personnel borne detectors. Will investigate novel materials to enhance selectivity in explosives detection.			
FY 2021 Plans: Will develop analytical methods for forensic analysis of explosives and other chemical hazards with the objective of assigning attribution to include collection, preparation, instrumental analysis and advanced statistical techniques; Will provide solutions for analytical problems encountered by expeditionary laboratories based on the research performed in this task.			
FY 2020 to FY 2021 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BL2 / *Explosives Forensics Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Funding change reflects planned lifecycle of this effort.			
Title: FY 2020 SBIR/STTR Transfer	-	0.070	-
Description: Funding transferred in accordance with Title 15 USC ?638			
FY 2020 Plans: Funding transferred in accordance with Title 15 USC ?638			
FY 2020 to FY 2021 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	-	1.542	1.571

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 / 2	R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*	Project (Number/Name) BL4 / *Countermine 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
BL4: *Countermine Technology*	-	0.000	4.244	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.244

Note

In Fiscal Year 2020 (FY20) this Project was realigned from:
Program Element (PE) 0602712A Countermine Systems
* Project H24 Selectable Neutralization and Breaching Technology

In Fiscal Year 2021 (FY21) this Project is being realigned to:
PE 0602145A Next Generation Combat Vehicle Technology
* Project BF9 Sensors for Autonomous Operations and Surv Tech

A. Mission Description and Budget Item Justification

This Project designs and develops selectable explosive hazard (EH) (i.e., mine, minefield, improvised explosive device) neutralization technologies combined with detection confirmation sensor capabilities to provide a future integrated detection and neutralization capability in support of both manned and unmanned mounted route clearance and conventional mine breaching operations.

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 supports Army Science and Technology Ground Portfolio and Soldier Lethality modernization priorities.

Work in this effort is performed by the United States (US) Army Futures Command.

This Project is coordinated with PE 0602145A (Next Generation Combat Vehicle Technology), 0602143A (Soldier Lethality Technology), 0603462A (Next Generation Combat Vehicle Technology Advanced Technology) and 0603118A (Soldier Lethality Advanced Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Countermine Technology	-	4.051	-
Description: Designs and develops selectable explosive hazard neutralization technologies combined with detection confirmation sensor capabilities to provide a future integrated detection and neutralization capability in support of both manned and unmanned mounted route clearance and conventional mine breaching operations. Products of this effort include sensor components for high reliability confirmation, cueing algorithms that produce repeatable and accurate registration coordinates for neutralization, and trade off analysis of candidate neutralization techniques to achieve a desired neutralization order of magnitude (low or high order detonation).			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BL4 / *Countermine Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Will design EH neutralization techniques and set parameters of confirmation sensors; will mature laser, radio frequency and microwave sources to validate neutralization techniques. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY21 funding in this Project was realigned to PE 0602145A (Next Generation Combat Vehicle Technology) / BF9 (Sensors for Autonomous Operations and Survivability Technology) to meet higher priority modernization needs.			
Title: FY 2020 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.193	-
Accomplishments/Planned Programs Subtotals	-	4.244	-

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 / 2	R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*	Project (Number/Name) BL5 / *Expedient Passive Protection 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
BL5: *Expedient Passive Protection Technology*	-	0.000	4.119	1.467	-	1.467	2.030	5.948	4.606	3.507	0.000	21.677

Note

In Fiscal Year 2020 (FY20) this Project was realigned from:
Program Element (PE) 0602720A Environmental Quality Technology
* Project 835 Military Med Environ Crit
PE 0602784A Military Engineering Technology
* Project T40 Mobility/Weapons Effects Technology

A. Mission Description and Budget Item Justification

This Project designs and develops rapidly deployable passive protective solutions; algorithms for decision support applications and software; and tactics, techniques, and procedures to increase the survivability of personnel, critical assets, and facilities. Through experimental and computational investigation and design, this project develops force protection technologies for complex and urban environments. This Project also develops expedient solutions and decision support applications for protection against advanced energetic threats and large caliber rockets, missiles, and other emerging weapons.

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 supports the Army Science and Technology Ground Portfolio.

Work in this Project is conducted by the United States (US) Army Engineer Research and Development Center and coordinated with US Army Futures Command.

Work in this Project complements PE 0603119A (Ground Advanced Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Integrate Novel Materials for Tone Down Applications	-	0.330	-
Description: This effort utilizes native vegetation as an unconventional countermeasure for Army concealment. Work includes identification of spectral properties for infrared disruption, and inclusion of additive materials for tone-down applications.			
FY 2020 Plans: Produce libraries of native vegetation, soil, materials, and spectral signal property information for incorporation into tone-down applications to provide enhanced living concealment based on geographical regions. Deliver suite of fully characterized			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BL5 / *Expedient Passive Protection Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
formulations for use in unconventional countermeasures to include risk guidance on application hazards associated with material debris. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY21 work in this effort transitions to Protection Against High Trajectory Large Caliber Rocket and Missile Threats efforts in this Project			
Title: Force Protection in the Urban Environment ***Description:*** This effort develops force protection solutions for urban environments and computational test bed capabilities to develop advanced materials and expedient protective solutions; develops rapidly deployable protection systems; decision support applications and software; and tactics, techniques, and procedures to provide protection with consideration for a complex three-dimensional threat. ***FY 2020 Plans:*** Will conduct investigations to develop blast stagnation, blast reduction, overhead cover design, and ballistic protection algorithms; will develop an expedient retrofit kit for existing buildings and rapidly deployable force protection; will investigate a methodology for rapidly closing subterranean features. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Work in this effort transitions to the Protection Against High Trajectory Large Caliber Rocket and Missile Threats effort in this Project in FY21.	-	3.775	-
Title: Protection Against High Trajectory Large Caliber Rocket and Missile Threats ***Description:*** This effort investigates high trajectory large caliber rocket and missile weapon effects on critical assets and facilities and develops expedient force protection solutions for these new weapon threats. These solutions include the application of novel protective materials and designs. This effort develops and validates deployable protection systems against these threats and develops decision support tools to aid the warfighter in selecting protective positions. ***FY 2021 Plans:*** Will investigate effects of high trajectory large caliber rockets and missiles on legacy protective systems and new conceptual passive protection designs. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Work in this effort was previously conducted under the Force Protection in the Urban Environment and Integrate Novel Materials for Tone Down Applications efforts in this Project.	-	-	1.467
Title: FY 2020 SBIR/STTR Transfer	-	0.014	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BL5 / *Expedient Passive Protection Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Description: Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	-	4.119	1.467

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 / 2	R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*	Project (Number/Name) BL7 / *Power Projection in A2AD Environments 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
BL7: *Power Projection in A2AD Environments Technology*	-	0.000	2.766	1.913	-	1.913	3.190	1.828	2.872	0.000	0.000	12.569

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0602784A Military Engineering Technology
* Project T40 Mobility/Weapons Effects Technology

A. Mission Description and Budget Item Justification

This Project develops remote assessment technologies to determine entry and maneuver corridors, develops site selection tools and decision support technologies for all climates in all season conditions including aviation site selection tools, enhanced automated route reconnaissance technologies, mobility models for extreme climates, and road capacity assessment technologies. These technologies reduce reliance on manned on-site reconnaissance for projection platform assessments and provide all season capacity predictions to ensure air and ground battlespace entry and maneuver. This Project also designs and develops material solutions to repair, rebuild and construct infrastructure required for movement and maneuver in highly contested, complex operational environments such as Anti-Access/Area Denial (A2/AD).

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 supports the Army Science and Technology Ground Portfolio.

Work in this Project is conducted by the United States (US) Army Engineer Research and Development Center and coordinated with US Army Futures Command.

Work in this PE complements PE 0603119A (Ground Advanced Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Entry and Sustainment in Complex Contested Environments	-	2.756	0.913
Description: This effort develops strategic and tactical level planning tools for assessing engineering behavior of ground surfaces as it relates to battlefield maneuver to include factors affecting on-and-off-road vehicle mobility as well as aviation assembly areas; applies new technologies for data acquisition to engineering design factors to rapidly assess vehicle and terrain interaction.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BL7 / *Power Projection in A2AD Environments Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Conduct experiments on engineering properties of ice and snow to investigate remote sensing technologies for off-road mobility in extreme environments; explore Light Detection and Ranging and photogrammetric data exploitation for characterizing lines of communication; will design and develop computational framework for rapid determination of road structural capacity. ***FY 2021 Plans:*** Will validate remote sensing data analysis algorithms for predicting off-road mobility in arctic regions; will design and develop methodology for rapid road and trail classification; will conduct computational experiments for analyzing ground vehicle impact on bound and unbound granular materials. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** In FY21 a portion of the funding for this effort will continue in the Engineering for Battlespace Maneuver effort in this Project.			
Title: Engineering for Battlespace Maneuver ***Description:*** This effort develops the capability to rapidly repair and upgrade damaged infrastructure along mobility corridors and restaging areas to maintain and enhance freedom of maneuver achieving overmatch and tactical advantage in contested complex environments. ***FY 2021 Plans:*** Will design and develop techniques for rapid soil stabilization to support military ground vehicle maneuver; will conduct experiments to provide stand-off assessments of existing route characteristics; will develop algorithms to support engineer planning for route maintenance to prioritize maneuver corridors based on available engineer assets. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Work in this effort was previously conducted under the Entry and Sustainment in Complex Contested Environments effort in this Project.	-	-	1.000
Title: FY 2020 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.010	-
Accomplishments/Planned Programs Subtotals	-	2.766	1.913

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BL7 / *Power Projection in A2AD Environments Technology*

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 / 2	R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*	Project (Number/Name) BL9 / *Protection from Advanced Weapon Effects 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
BL9: *Protection from Advanced Weapon Effects Technology*	-	0.000	4.403	3.957	-	3.957	7.393	4.346	5.332	5.332	0.000	30.763

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0602784A Military Engineering Technology
* Project T40 Mobility/Weapons Effects Technology

A. Mission Description and Budget Item Justification

This Project develops structural hardening, high-performance computing capabilities, and force protection technologies to enhance survivability of personnel and critical assets. This project investigates and develops advanced materials for protection against blast, fragmentation, and penetration through physical experiments and modeling and simulation. Additionally, this project investigates, designs, and develops passive protection technologies and protective design criteria to mitigate attack from emerging advanced threats.

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 supports the Army Science and Technology Ground Portfolio.

Work in this Project is performed by the United States (U.S.) Army Engineer Research and Development Center and coordinated with the U.S. Army Futures Command.

Work in this PE complements PE 0603119A (Ground Advanced Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Materials and Modeling for Force Protection	-	1.409	1.427
Description: This effort develops advanced composite and other protective materials and multi-scale modeling techniques to reduce material weight and increase resistance against blast and penetration threats; develops innovative virtual material design procedures and optimized manufacturing processes supported by computational modeling and simulation.			
FY 2020 Plans: Scale up optimized protective material systems including new composite materials for expeditionary protective systems and use multi-scale modeling to develop protective materials for structural hardening using foreign indigenous materials.			
FY 2021 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BL9 / *Protection from Advanced Weapon Effects Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Will develop multi-scale modeling approaches for materials of geological origin and composite material systems. Will conduct physical and computational experiments to investigate multiple force protection materials and components against relevant advanced weapon threats. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Defeat of Complex Attack ***Description:*** This effort develops passive protection structural hardening designs and solutions against emerging large-caliber advanced weapons; investigates and validates computational models for predicting residual protective capacity for multi-hit threat scenarios; and develops micro-mechanics-based models and material solutions matured by conducting high-rate experiments. ***FY 2020 Plans:*** Validate algorithm and design methodology for enhancing practical material solutions used in structural hardening and will develop and conduct high-rate and high-pressure experiments for micromechanical and continuum scale computational models. ***FY 2021 Plans:*** Will refine algorithms and design methods for structural hardening material solutions by conducting advanced high-rate and high-pressure dynamic experiments to improve computational models at the micro-mechanical and macro-continuum scales. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	-	2.969	2.530
Title: FY 2020 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.025	-
Accomplishments/Planned Programs Subtotals	-	4.403	3.957

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BL9 / *Protection from Advanced Weapon Effects Technology*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*	Project (Number/Name) BN8 / *Ground Technology Materials(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
BN8: *Ground Technology Materials(CA)*	-	0.000	108.700	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	108.700

Note

Congressional Interest Item funding provided for Ground Technology Materials.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Ground Technology Materials.

The cited work 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 2019	FY 2020
Congressional Add: Environmental Quality Enhanced Coatings	-	5.000
FY 2020 Plans: Environmental Quality Enhanced Coatings		
Congressional Add: Environmental Friendly Coatings Technology	-	3.000
FY 2020 Plans: Environmental Friendly Coatings Technology		
Congressional Add: Additive Manufacturing for Artificial Intelligence and Machine Learning	-	5.000
FY 2020 Plans: Additive Manufacturing for Artificial Intelligence and Machine Learning		
Congressional Add: Earthen Structures Soil Enhancement	-	4.000
FY 2020 Plans: Earthen Structures Soil Enhancement		
Congressional Add: M1 Abrams Tank Track System	-	2.200
FY 2020 Plans: M1 Abrams Tank Track System		
Congressional Add: High Performance Polymers	-	5.000
FY 2020 Plans: High Performance Polymers		
Congressional Add: Materials Manufacturing Processes	-	6.000
FY 2020 Plans: Materials Manufacturing Processes		
Congressional Add: Highly Durable Advanced Polymers for Lightweight Armor	-	8.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** BN8 / *Ground Technology Materials(CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
FY 2020 Plans: Highly Durable Advanced Polymers for Lightweight Armor		
Congressional Add: Cellulose Nanocomposite Research	-	5.000
FY 2020 Plans: Cellulose Nanocomposite Research		
Congressional Add: Countermine Program	-	5.000
FY 2020 Plans: Countermine Program		
Congressional Add: Materials Research	-	17.500
FY 2020 Plans: Materials Research		
Congressional Add: Additive Manufacturing and Materials Processing	-	15.000
FY 2020 Plans: Additive Manufacturing and Materials Processing		
Congressional Add: Cold Weather Military Research	-	3.000
FY 2020 Plans: Cold Weather Military Research		
Congressional Add: Cold Spray Technologies	-	15.000
FY 2020 Plans: Cold Spray Technologies		
Congressional Add: Center for Research in Extreme Batteries	-	10.000
FY 2020 Plans: Center for Research in Extreme Batteries		
Congressional Adds Subtotals	-	108.700

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 / 2	R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*	Project (Number/Name) CA9 / *Predictive Maintenance*	

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
CA9: *Predictive Maintenance*	-	0.000	0.000	2.604	-	2.604	3.709	4.802	5.715	5.829	0.000	22.659

Note

In Fiscal Year 2021 (FY21) this Project was realigned from:
Program Element (PE) 0602145A Next Generation Combat Vehicle Technology
* Project BF8 Artificial Intelligence & Machine Learning Tech

A. Mission Description and Budget Item Justification

This Project develops and characterizes artificial intelligence (AI) and machine learning (ML) tools and capabilities to intelligently predict and analyze maintenance status for emerging and legacy ground platforms; extracts maintenance data from existing databases, sensor data and inference of missing data via virtual simulations investigating maintenance concepts that employ AI data capture and integrate AI tools into enterprise resource planning for military ground vehicles. Research enables use of predictive maintenance to increase fleet operational readiness through reduced downtime by preventing critical failure during missions, maximizing availability to combatant commands.

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

Work in this Project supports the Army Science and Technology Ground Portfolio and the Joint Artificial Intelligence Center (JAIC)

Work in this Project is performed by the United States (US) Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Predictive Maintenance	-	-	2.604
Description: This effort performs research on AI, deep learning, and predictive analytics to forecast major issues on platforms and enables services to respond to upcoming failures. Focus will be to identify component failure relationships to principal end items for prediction of critical failure prior to corrective maintenance and reactive supply chain requisitions. Research will increase efficiency, decrease fleet operating and sustainment costs for equipment platforms, and reduce the time and costs associated with repair part requisition, management and transportation.			
FY 2021 Plans: Will investigate and develop new capabilities of a standardized end-to-end pipeline for gathering data from maintenance sensors in ground platforms (both manned and unmanned); improve performance failure prediction models for critical components;			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602144A / *Ground Technology*	**Project (Number/Name)** CA9 / *Predictive Maintenance*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
develop engine health model to predict maintenance events; develop data analytics to categorize failures both off-line (in depot tear-downs) and to aid field maintainers. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** This effort is realigned in FY21 from PE 0602145A (Next Generation Combat Vehicle Technology) / BF8 (Artificial Intelligence and Machine Learning Technology) to support Army modernization priorities.			
Accomplishments/Planned Programs Subtotals	-	-	2.604

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A