Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602601A / *Combat Vehicle and Automotive Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	78.759	104.404	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	183.163
C05: *Armor Applied Research*	-	18.999	21.474	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	40.473
H77: *National Automotive Center*	-	17.347	12.082	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	29.429
H91: *Ground Vehicle Technology*	-	32.413	36.848	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	69.261
T26: *Ground Vehicle Technologies (CA)*	-	10.000	34.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.000

Note

In Fiscal Year (FY) 2020, this Program Element (PE) is realigned with continuity of effort to:
* PE 0602145A (Next Generation Combat Vehicle Technology).

A. Mission Description and Budget Item Justification

This PE researches, designs, and evaluates combat and tactical vehicle automotive technologies that enable the Army to have a lighter, more survivable, more mobile and more deployable force. Project C05 (Armor Applied Research) investigates, researches, and evaluates advanced ground vehicle design and occupant protection technologies in such areas as armor concepts, ballistic defeat mechanisms, blast mitigation, survivability modeling and simulation (M&S), hit avoidance, kill avoidance, safety, sensors, counter measures, instrumentation, and survivability packaging concepts to achieve superior survivability/protection for Soldiers and military ground vehicles. Survivability technologies will be designed for integration into/with the Modular Active Protection System (MAPS). Project H77 (National Automotive Center), which was chartered by the Secretary of the Army to conduct shared government and industry, or "dual use", technology programs to leverage commercial investments in automotive technology research and development for Army ground combat and tactical vehicle applications. Project H91 (Ground Vehicle technology) designs, matures, and evaluates a variety of innovative and enabling technologies in the areas of electrical power, thermal management, propulsion, mobility, power for advanced survivability, vehicle diagnostics, fuels, lubricants, water purification, intelligent systems, autonomy enabled systems, and other component technologies to enhance the mobility, power and energy, and reduce the logistic chain of combat and tactical vehicles. This PE executes the Army's Combat Vehicle Prototyping (CVP) program to mature, integrate, and demonstrate ground vehicle leap ahead technologies in support of future combat vehicles.

In FY18/FY19 work in this PE is related to, and fully coordinated with, PEs 0602105A (Materials Technology), 0602618A (Ballistics Technology, Robotics Technology), 0602705A (Electronics and Electronic Devices), 0602716A (Human Factors Engineering Technology), 0603005A (Combat Vehicle and Automotive Advanced Technology), 0603125A (Combating Terrorism Technology Development), 0603734A (Military Engineering Advanced Technology), and 0708045A (Manufacturing Technology). Beginning in FY20, work in this PE is related to, and fully coordinated with PE 0602145A (Next Generation Combat Vehicle Technology) and PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

Work in this PE is coordinated with the United States Marine Corps, the Naval Surface Warfare Center, and other ground vehicle developers within the Defense Advanced Research Projects Agency (DARPA) and the Departments of Energy, Commerce, and Transportation.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602601A *I Combat Vehicle and Automotive Technology*

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

The Ground Portfolio technology investments are creating a layered vehicle protection suite including Active Protection (Hard-Kill and Soft-Kill) capabilities supported by robust advanced armor (Enhanced Survivability).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	67.232	70.450	69.169	-	69.169
Current President's Budget	78.759	104.404	0.000	-	0.000
Total Adjustments	11.527	33.954	-69.169	-	-69.169
• Congressional General Reductions	-0.028	-0.046			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	10.000	34.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	2.882	-			
• SBIR/STTR Transfer	-1.327	-			
• Adjustments to Budget Years	-	-	-69.169	-	-69.169

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: T26: *Ground Vehicle Technologies (CA)*		
Congressional Add: *Program Increase*	10.000	34.000
Congressional Add Subtotals for Project: T26	10.000	34.000
Congressional Add Totals for all Projects	10.000	34.000

Change Summary Explanation

FY18 increase related to Congressional add of $10 Million
FY19 increase related to Congressional add of $34 Million
FY20 increase related to Science and Technology financial restructuring

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / *Combat Vehicle and Automotive Technology*	Project (Number/Name) C05 / *Armor Applied Research*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
C05: *Armor Applied Research*	-	18.999	21.474	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	40.473

Note

In Fiscal Year (FY) 2020, the Project will be realigned to:
Program Element (PE) 0602145A Next Generation Combat Vehicle Technology:
* Project BG6 Advanced Concepts for Active Defense Technology
* Project BH9 Protection for Autonomous Systems Tech

A. Mission Description and Budget Item Justification

This Project investigates, researches, and evaluates advanced ground vehicle design and occupant protection technologies in such areas as armor concepts, ballistic defeat mechanisms, blast mitigation, survivability modeling and simulation (M&S), improved situational awareness, hit avoidance, kill avoidance, safety, sensors for blast, crash and rollovers, instrumentation and survivability packaging concepts to achieve superior survivability/protection for Soldiers and ground combat and tactical vehicles. Survivability/protection technologies are being investigated to meet anticipated ground combat and tactical vehicle survivability objectives. Additionally, this project focuses on analysis, modeling, and characterization of potential survivability solutions that could protect against existing and emerging threats. This analysis is used to aid in the identification of technologies to enter maturation and development in PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 221 (Combat Vehicle Survivability).

This Project supports Army Science and Technology efforts in the Ground Maneuver portfolio.

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 2018	FY 2019	FY 2020
Title: Advanced Armor Development:	10.417	9.826	-
Description: The objective of this effort is to design, integrate and validate performance of advanced armor systems to defeat single and multiple chemical energy (CE) and kinetic energy (KE) emerging threats for combat and tactical vehicles. These systems include base armor (small arms / medium caliber, opaque and transparent B-kits), applique armor (passive / reactive / active multi-threat C-kits), multifunctional armor, and adaptive and cooperative armors.			
FY 2019 Plans: Will mature design of adaptive armor subsystem for system integration; will complete experiments on system attachments to validate component integration; will use the integration experiment results to identify and design the desired attachment approach for follow-on integration of those technologies; will verify performance of subsystem integration design for adaptive armor			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602601A / *Combat Vehicle and Automotive Technology*	**Project (Number/Name)** C05 / *Armor Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
technologies through experimentation and finite element modeling; will begin design and development of hybrid multi-threat armor subsystem. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BG6 (Advanced Concepts for Active Defense Technology) in FY20 as part of the financial restructure.			
Title: Blast Mitigation: ***Description:*** This effort designs, fabricates and evaluates advanced survivability and protection capabilities, tools and technologies to improve protection against vehicle mines, improvised explosive devices (IEDs) and other underbody threats and crash events. This effort also designs and evaluates technologies purposed for protecting the occupant such as seats and restraints. Blast and crash mitigation technologies are further investigated and matured in such areas as active and passive exterior/hull/cab/kits, interior energy absorbing capabilities for seats, floors, restraints, sensors for active blast mitigating technologies and performance evaluation, M&S, experimentation and instrumentation. ***FY 2019 Plans:*** Will develop and document best practices (multi-material, cost-conscious, lightweight design) for optimization of structural subsystem technologies that will provide platform ballistic protection. Will complete individual component performance testing of seats, restraints, flooring, and structures. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This program ends in FY19..	2.324	2.441	-
Title: Improved Situational Awareness for Ground Platforms ***Description:*** This effort investigates situational awareness (SA) technologies and architectures to improve occupant and vehicle survivability in all conditions and environments to include degraded visual environments (DVE) for ground vehicles. This effort also investigates and analyzes electronic architectures to enable the efficient integration of DVE systems such as intra-vehicle data and video networks, SA input/output devices, and associated software architectures and interfaces. ***FY 2019 Plans:*** Will mature increased local SA components in DVE using scalable low cost Local Situational Awareness (LSA) sensors and a digital video architecture system. Will investigate advanced vehicle crew stations with scalable Warfighter-Machine Interface (WMI), augmented reality and crew aids. Will conduct experiments to validate decreased visual latency, increased SA, increased target detection, and increased operational tempo in DVE. ***FY 2019 to FY 2020 Increase/Decrease Statement:***	5.001	4.499	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602601A / *Combat Vehicle and Automotive Technology*	**Project (Number/Name)** C05 / *Armor Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This program ends in FY19.			
Title: Vision Protection ***Description:*** This effort investigates and develops protection materials, concepts, and devices to protect vehicle occupants' eyes, vehicle cameras and electro-optical fire control systems against emerging laser threats. This effort also evaluates methods to apply the advanced protection materials, concepts, and devices onto vehicle cameras and electro-optical systems to prevent lasers from destroying sighting systems, disabling cameras that provide situational awareness, and damaging or disorienting Warfighter vision.	1.257	-	-
Title: Protection for Autonomous Systems ***Description:*** This effort investigates and develops materials, concepts, and devices to protect autonomous systems against emerging threats. This effort also evaluates methods to apply the advanced protection materials, concepts, and devices onto autonomous systems to prevent disabling or destroying sensors, electronics, and mechanical components, or physical exploitation of subsystems. ***FY 2019 Plans:*** Will investigate concepts for protection of autonomous systems in forecasted operational environments. Will identify technologies that address projected threats and hazards. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BH9 (Protection for Autonomous Systems Tech) in FY20 as part of the financial restructuring.	-	2.384	-
Title: Active Defense Technologies ***Description:*** This effort investigates, analyzes, and designs active hard-kill (physical countermeasure) and soft-kill (non-kinetic countermeasure such as electronic jamming or spoofing) protection Active Protection System (APS) components for future integration onto tactical and combat vehicle platforms. This effort also investigates, designs, and development active, modular components and controls for APS vehicle protection and associated architectures and interfaces. ***FY 2019 Plans:*** Will investigate and analyze future hard-kill and soft-kill active defense concepts for use with combat vehicles. Will investigate and design modular components according to architecture and interface requirements. Will develop and assess advanced soft-kill technologies that will defeat higher-level and emerging threats. ***FY 2019 to FY 2020 Increase/Decrease Statement:***	-	1.762	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602601A / *Combat Vehicle and Automotive Technology*	**Project (Number/Name)** C05 / *Armor Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BG6 (Advanced Concepts for Active Defense Technology) in FY20 as part of the financial restructuring.			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.562	-
Accomplishments/Planned Programs Subtotals	18.999	21.474	-

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 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / *Combat Vehicle and Automotive Technology*	Project (Number/Name) H77 / *National Automotive Center*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
H77: *National Automotive Center*	-	17.347	12.082	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	29.429

Note

In Fiscal Year (FY) 2020, funding for this Project is realigned to
Program Element (PE) 0602145A Next Generation Combat Vehicle Technology:
* Project BJ3 (Hydrogen Based Combat System Technology)
* Project BI9 (Vehicle System Security Technology)
* Project BH5 (Platform Electrification and Mobility Tech)
* Project BI4 (Materials Application and Integration Tech)

A. Mission Description and Budget Item Justification

This Project funds the National Automotive Center (NAC), which was chartered by the Secretary of the Army to conduct shared government and industry (dual use) technology programs to leverage commercial investments in automotive technology research and development for Army ground combat and tactical vehicle applications. Primary thrusts for this activity include advanced power and energy technologies for tactical and non-tactical ground vehicles, electric infrastructure and alternative energy for installations and bases, vehicle networking and connectivity to maximize overlap between commercial and military requirements. Active outreach to industry, academia and other government agencies develops new thrust areas for this Project to maximize shared commercial and government investment.

This Project supports Army Science and Technology efforts in the Ground Maneuver portfolio.

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

The Ground Portfolio technology investments are maturing powertrain technologies to provide a fuel efficient engine/power plant capability that is common across the fleet to reduce fuel, training, maintenance and parts requirements.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Power, Energy and Mobility:	4.076	4.224	-
Description: This effort investigates dual use power, energy, and mobility technologies leveraging commercial and academic investment to military application. This effort focuses on technologies such as lightweight composite materials, electrification of engine accessories, alternative fuels, hybrid vehicle architectures, and compact electrical power generation in order to maximize common investment to meet Army ground vehicle requirements.			
FY 2019 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602601A / *Combat Vehicle and Automotive Technology*	**Project (Number/Name)** H77 / *National Automotive Center*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will continue to leverage commercial and academic investments into dual use power, energy, and mobility technologies. Will investigate advances in battery design and safety. Will conduct fuel-cell experimentations, in order to mature component designs, and investigate alternative base fuels. Will research into electrification of parasitic powertrain and vehicle loads that promise weight savings in addition to more efficient use of onboard power. Will identify feasible material options to reduce weight and \or increase structural integrity which would improve mobility in areas such as: aluminum, composites, joining technologies, and design optimization. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BJ3 (Hydrogen Based Combat System Technology) and Project BI9 (Vehicle System Security Technology) as part of the financial restructuring			
Title: Dual Use Technologies: ***Description:*** This effort investigates, researches and evaluates ground vehicle technologies with both military and commercial applications such as renewable energy technologies, electrical power management between vehicles and the grid, alternative fuels, new human machine interfaces, and advanced vehicle networking, automation, and secure communication (telematics). This effort maximizes commercial technology investment for military applications in line with the National Automotive Center's Charter. Collaborations with industry, universities and other government agencies on standards writing for joint applications will facilitate this activity. ***FY 2019 Plans:*** Will research ground vehicle technologies with both military and commercial applications. Will conduct experiments with innovative human machine interfaces, advanced vehicle networking, and vehicle automation technologies. Will focus on vehicle security engineering best practices that prevent detriment to crew and vehicles from cyber-attacks. Will research of autonomy systems on coalition international vehicles. Will further the advancement of tactics, training, and procedures (TTPs) for inclusion of autonomous systems and studies on vehicle networking and cyber security. Will mature concepts to increase logistics fleet affordability and reduce logistics footprint through autonomy. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BJ3 (Hydrogen Based Combat System Technology) and Project BI9 (Vehicle System Security Technology) in FY20 as part of the financial restructuring.	13.271	7.497	-
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:***	-	0.361	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602601A / *Combat Vehicle and Automotive Technology*	**Project (Number/Name)** H77 / *National Automotive Center*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 SBIR / STTR Transfer			
FY 2019 to FY 2020 Increase/Decrease Statement: FY 2019 SBIR / STTR Transfer			
Accomplishments/Planned Programs Subtotals	17.347	12.082	-

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 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / *Combat Vehicle and Automotive Technology*	Project (Number/Name) H91 / *Ground Vehicle Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
H91: *Ground Vehicle Technology*	-	32.413	36.848	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	69.261

Note

In Fiscal Year (FY) 2020, this Project realigns to
Program Element (PE) 0602145A Next Generation Combat Vehicle Technology:
* Project BH5 Platform Electrification & Mobility Tech
* Project BF1 Autonomous Ground Resupply Tech
* Project BF3 Combat Vehicle Robotics Tech)
* Project BF6 Crew Augmentation and Optimization Tech

A. Mission Description and Budget Item Justification

This Project designs, develops, and evaluates a variety of innovative enabling technologies in the areas of vehicle concepts, virtual prototyping, electronic controls, electrical power, thermal management, propulsion, mobility, survivability, vehicle diagnostics, fuels, lubricants, water purification, intelligent systems, autonomy enabled systems, and other component technologies for application to combat and tactical vehicles.

This Project supports Army Science and Technology efforts in the Ground Maneuver portfolio.

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 2018	FY 2019	FY 2020
Title: Propulsion and Thermal Systems:	7.039	5.909	-
Description: This effort researches, designs and evaluates high power density engines and transmission systems needed to offset increasing combat vehicle weights (armor), improved fuel economy (fuel cost & range), and reduced cooling system burden (size, heat rejection). This effort also researches and matures thermal management technologies and systems including heat energy recovery, propulsion and cabin thermal management sub systems to utilize waste heat energy and meet objective power and mobility requirements on all ground vehicles. Lastly, this effort maximizes efficiencies within propulsion and thermal systems to reduce burden on the vehicle while providing the same or greater performance capability.			
FY 2019 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602601A / *Combat Vehicle and Automotive Technology*	**Project (Number/Name)** H91 / *Ground Vehicle Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will conduct experiments on advanced heat exchanger, efficient fan, and waste heat recovery system in the advanced thermal management system. Will validate advanced thermal management system design. Will improve the component and system design based on test results. Will complete subsystem testing of high power density engine and transmission. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BH5 (Platform Electrification & Mobility Technology) in FY20 as part of the financial restructuring.			
Title: Power Management Technologies: ***Description:*** This effort investigates power management technologies, software, and implementation approaches. Technologies include Alternating Current (AC) to Direct Current (DC) inverters, DC converters, solid state circuit protection, power distribution, and automated control of complete power systems. Special emphasis has been placed on developing high temperature capable power electronics, leading to the use of Silicon Carbide (SiC) in the above technologies. ***FY 2019 Plans:*** Will validate power architecture control software functionality in order to confirm power quality, prioritization and optimization algorithms that maximize available power on the vehicle. Will validate environmental, EMI, reliability performance, and other testing of high operating temperature vehicle power architecture system Silicon Carbide components and software to ensure readiness for future combat vehicle testing. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BH5 (Platform Electrification & Mobility Technology) in FY20 as part of the financial restructuring.	3.258	2.586	-
Title: Power Electronics, Hybrid Electric and Onboard Vehicle Power (OBVP) Components: ***Description:*** This effort researches, develops and evaluates technologies to increase onboard vehicle electric power to enable vehicle systems such as advanced survivability systems, situational awareness systems, advanced computing, and the Army network. This effort researches, designs and evaluates high temperature and efficient power generation components to provide increased electrical power and reduced thermal loads using high operating temperature switching devices and advanced electrical generation components such as integrated starter generators and integrated starter alternators. This effort also researches, designs and evaluates advanced control techniques for power generation components to make these systems more efficient, increase electrical power output and reduce thermal loads. ***FY 2019 Plans:***	1.323	0.233	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602601A / *Combat Vehicle and Automotive Technology*	**Project (Number/Name)** H91 / *Ground Vehicle Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will complete analysis and system design optimization on an advanced combat vehicle propulsion system. Will evaluate the increase in onboard vehicle power availability and fuel efficiency with no negative impact to vehicle mobility. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BH5 (Platform Electrification & Mobility Technology) in FY20 as part of the financial restructuring.			
Title: Advanced Non-Primary Power Systems: ***Description:*** This effort researches, investigates, conducts experiments and validates Auxiliary Power Units (APUs) technologies such as modular/scalable engine based APUs, fuel cell reformer systems to convert JP 8 to hydrogen, sulfur tolerant JP 8 fuel cell APUs and novel engine based APUs for military ground vehicle and unmanned ground systems. This effort also determines inputs for APU interface control documents, as well as investigates solutions for reducing APU acoustic signature for silent operation during mounted surveillance missions. This effort investigates the use of small engines and JP 8 fuel cell systems for use as prime power solutions for unmanned ground systems.	1.900	-	-
Title: Elastomer Improvement Program: ***Description:*** This effort researches, formulates and tests new elastomer (rubber) compounds for vehicle track systems to increase track system durability, reduce track system failures and reduce Operations & Sustainment (O&S) costs related to premature track system failures.	1.236	-	-
Title: Intelligent Systems Technology Research: ***Description:*** This effort investigates improved operations of manned platforms through the application of sensing and autonomy technologies developed for unmanned systems such as maneuver and tactical behavior algorithms, driver assist techniques, autonomy kits, advanced navigation and planning, vehicle self-protection, local situational awareness, advanced perception, vehicle and pedestrian safety, active safety, and robotic command and control. ***FY 2019 Plans:*** Will develop advanced vehicle behaviors to transition to autonomy-enabling kits for tactical wheeled vehicles in leader-follower convoy operations. Will continue to develop and design common user interfaces and open architecture design. Will continue to research automation software and algorithms, increased robotic reliability and autonomous testing methodologies and procedures. Will continue to advance capabilities to enable operations in increasingly challenging environments like off-road terrain and reduced communication areas. ***FY 2019 to FY 2020 Increase/Decrease Statement:***	10.490	9.919	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602601A / *Combat Vehicle and Automotive Technology*	**Project (Number/Name)** H91 / *Ground Vehicle Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / BF1 (Autonomous Ground Resupply Tech) in FY20 as part of the financial restructuring.			
Title: Energy Storage: ***Description:*** This effort investigates novel advanced ground vehicle energy storage devices such as advanced chemistry batteries and ultra-capacitors for starting, lighting, and ignition and silent watch requirements for powering vehicle electronics and communications systems with main engine off. Develop and test energy storage devices to meet harsh military requirements that far exceed commercial requirements such as extreme temperature operation (46 to +71C), ballistic shock and vibration, and electromagnetic interference (in accordance with Military Standard 810G). Designs and develops advanced batteries to reduce battery volume and weight while improving battery energy and power densities within the same footprint and standardized form factor of current batteries (6T) to enhance logistics. ***FY 2019 Plans:*** Will conduct durability and performance experimentation at the battery pack level for advanced Li-ion chemistries to validate improved energy density, starting, lighting, propulsion system ignition, silent watch, reliability, battery safety management, for military vehicles. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / BH5 (Platform Electrification and Mobility Tech) in FY20 as part of the financial restructuring.	3.093	2.451	-
Title: Anti-Tamper ***Description:*** This effort investigates and develops mature anti tamper methodologies and technologies in combat and tactical vehicles. Technologies such as controllers and tactical information systems for autonomous appliques, active protection systems, and Command, Control, Communications, Computers & Intelligence (C4I), will be designed for enhanced protection against current and evolving threats. This includes: enhancing and defending technologies used to secure data in vehicle systems; defending against the threat of unwanted behavioral changes in multi agent systems; the prevention of unauthorized control of, or denying service to a targeted platform; reverse engineering and conducting vehicle digital forensics; and responding to active attacks that have penetrated anti tamper defenses in a platform.	4.074	-	-
Title: Crew Station ***Description:*** This effort focuses on crew size reduction and crew stations tailored to mission and soldier needs through the utilization of emerging human interaction technologies, automations, machine intelligence and the provision of cohesive domain personalization to permit soldiers to achieve leap ahead performance beyond today?s constrained ground vehicle environment.	-	4.690	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602601A / *Combat Vehicle and Automotive Technology*	**Project (Number/Name)** H91 / *Ground Vehicle Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 Plans: Will conduct experiments to provide data to improve early warning detections, reduce response times and shorten task durations for future crewstation programs. Will investigate crew size reduction to determine if the same overall performance can be produced by performing simulations to provide data, reports and analysis to the future fighting vehicles. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BF6 (Crew Augmentation and Optimization Technology) in FY20 as part of the financial restructuring.			
Title: Unmanned Ground Systems Research ***Description:*** This effort researches, designs, and develops technologies that enable scalable integration of multi domain teamed robotic and autonomous system capabilities supporting Army combat formations. Investigate behaviors and algorithms to mature functions that detect and classify risks and threats, reduce burden on the Soldier operator, and validate initial safety procedures for armed Unmanned Ground Vehicles (UGVs) in contested, austere and congested environments. Investigates increased situational awareness needed for a high degree of survivability and lethality for complex maneuvers. Mature government owned autonomy architecture to enable iterative software capability upgrades for systems. Conduct experiments in static environment with multiple live and simulated manned unmanned vehicles with evolving threats. Investigate behaviors and hardware needed to rapidly learn, adapt & reason faster than the adversary. ***FY 2019 Plans:*** Will investigate vehicle behaviors to enable teamed robotic and autonomous systems to support specific capabilities supporting Army combat formations. Will research and design common user interfaces for remote lethality with limited targeting assist. Will research automation software and algorithms, increased robotic reliability and function, and determine certified safety procedures for soldier-operated armed UGVs. Will conduct experiments using various commercial network solutions. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This research effort realigns to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BF3 (Combat Vehicle Robotics Technology) as part of the financial restructuring.	-	10.478	-
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:***	-	0.582	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602601A / *Combat Vehicle and Automotive Technology*	**Project (Number/Name)** H91 / *Ground Vehicle Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 SBIR / STTR Transfer			
Accomplishments/Planned Programs Subtotals	32.413	36.848	-

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 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602601A / *Combat Vehicle and Automotive Technology*	Project (Number/Name) T26 / *Ground Vehicle Technologies (CA)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
T26: *Ground Vehicle Technologies (CA)*	-	10.000	34.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.000

Note

Congressional increase.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Ground Vehicle Technology applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Program Increase	10.000	34.000
FY 2018 Accomplishments: Program Increase		
FY 2019 Plans: Program Increase		
Congressional Adds Subtotals	10.000	34.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A