Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army											Date: February 2018	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602211A / *Aviation Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**Cost To Complete**	**Total Cost**
Total Program Element	-	67.593	66.086	64.847	-	64.847	61.594	61.102	62.911	65.971	0.000	450.104
47A: *AERON & ACFT Wpns Tech*	-	54.082	55.630	53.884	-	53.884	50.413	49.622	51.195	54.021	0.000	368.847
47B: *Veh Prop & Struct Tech*	-	9.511	10.456	10.963	-	10.963	11.181	11.480	11.716	11.950	0.000	77.257
47C: *ROTORCRAFT COMPONENT TECHNOLOGIES (CA)*	-	4.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.000

A. Mission Description and Budget Item Justification

This Program Element (PE) conducts air vehicle component design, fabrication and evaluation to enable Army aviation transformation. Emphasis is on developing aviation platform technologies to enhance manned and unmanned air vehicle combat and combat support operations for attack, reconnaissance, air assault, survivability, logistics and command and control missions. Project 47A researches and evaluates components and subsystems for air vehicles in the areas of aviation and aircraft weapons technology. Project 47B researches and evaluates components and subsystems for air vehicles in the areas of propulsion and structures. Focus areas include: engines & drive trains; rotors & vehicle management systems; platform design & structures; aircraft & occupant survivability; aircraft weapons & sensors; maintainability & sustainability; and unmanned & optionally manned systems.

Work in this PE contributes to the Army Science and Technology (S&T) air systems portfolio and is fully coordinated with efforts in PE 0603003A (Aviation-Advanced Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602303A (Missile Technology) and PE 0603710A (Night Vision Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering S&T focus areas and the Army Modernization Strategy. Work in this PE is performed by the Army Research, Development, and Engineering Command (RDECOM).

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army					Date: February 2018
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*			R-1 Program Element (Number/Name) PE 0602211A *I Aviation Technology*		
B. Program Change Summary ($ in Millions)	**FY 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**
Previous President's Budget	65.914	66.086	61.846	-	61.846
Current President's Budget	67.593	66.086	64.847	-	64.847
Total Adjustments	1.679	0.000	3.001	-	3.001
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	4.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.292	-			
• Adjustments to Budget Years	-	-	3.001	-	3.001
• FFRDC	-0.029	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2017	FY 2018
Project: 47C: *ROTORCRAFT COMPONENT TECHNOLOGIES (CA)*		
Congressional Add: *Congressional Program Increase*	4.000	-
Congressional Add Subtotals for Project: 47C	4.000	-
Congressional Add Totals for all Projects	4.000	-

Change Summary Explanation

FY17 Congressional increase in 47C Aviation Technology

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / *Aviation Technology*	Project (Number/Name) 47A / *AERON & ACFT Wpns Tech*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
47A: *AERON & ACFT Wpns Tech*	-	54.082	55.630	53.884	-	53.884	50.413	49.622	51.195	54.021	0.000	368.847

A. Mission Description and Budget Item Justification

This Project designs and evaluates technologies for Army/Department of Defense (DoD) vertical lift and unmanned air systems to increase strategic and tactical mobility/deployability, improve combat effectiveness, increase aircraft and crew survivability; and improve combat sustainability. Areas of research address desired characteristics applicable to all aviation platforms, such as enhanced rotor efficiencies, improved survivability, increased structure and airframe capability, improved engine performance, improved sustainability, improved mission avionics performance, and reduced cost. This Project leverages work accomplished in collaboration with the National Aeronautics and Space Administration (NASA). Technologies within this project transition to advanced technology development programs with application to future, as well as current, Army/DoD aircraft systems.

Work in this Project is fully coordinated with Program Element (PE) 0603003A (Aviation Advanced Technology) and work in this Project related to aircraft weapons integration is also fully coordinated with PE 0602624A (Weapons and Munitions Technology), PE 0602303A (Missile Technology), and PE 0603710A (Night Vision Advanced Technology).

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: National Rotorcraft Technology Center (NRTC)	4.513	-	-
Description: NRTC focuses government, United States (U.S.) rotorcraft industry, and academia resources on the development of pre-competitive, high-priority, military technology to maintain U.S. preeminence in rotorcraft capabilities.			
Title: Platform Design & Structures Technologies	6.088	11.119	3.980
Description: Enables survivable, sustainable rotorcraft configurations by conceiving of and evaluating critical aviation technologies using design and analysis methods with greater modeling fidelity with an ultimate goal of reducing the timelines associated with overall design of new aircraft. Introduces high fidelity methodology for improved performance and design predictions earlier in the development and acquisition process. Use physics of failure modeling and coupled discipline analysis to drastically improve component and system reliability. Work is coordinated with Aviation Component Failure Modeling efforts in PE 0602211, Project 47B at Army Research Laboratory (ARL). ***FY 2018 Plans:*** Investigate and validate modeling and design tools to support development of future unmanned aerial vehicles. Conduct in-house and industry research in support of Next Generation Tactical Unmanned Aircraft Systems (NGTUAS) and other manned			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602211A / *Aviation Technology*	**Project (Number/Name)** 47A / *AERON & ACFT Wpns Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
and unmanned aircraft concepts; Develop a draft Model Performance Specification (MPS) for NGTUAS. Verify performance of multifunctional structures technologies for survivability through analysis and incremental testing; continue to mature probabilistic based stress and service life analyses; investigate advanced structural design and manufacturing techniques, including optimized smart structures and fastener-free joining methods. Initiate development of advanced damage tolerant electromechanical actuators to replace current generation hydraulic systems. Initiate development of energy optimized platform concepts and subsystems intended to maximize electric power availability while managing overall platform thermal loading and minimizing system level space, weight, and power burdens. ***FY 2019 Plans:*** Will conduct aircraft system conceptual design research of advanced manned and unmanned platforms. Will analyze and assess viability and potential performance of Next Generation Tactical UAS (NGTUAS) and other manned and unmanned system designs. Will conduct conceptual trade studies and analyses to refine the Model Performance Specification for NGTUAS. Will develop decision support tools to be incorporated into the integrated design environment to perform rapid trade space exploration and conduct technology and requirement sensitivity analyses. Will investigate conceptual design methodologies to assess uncertainty and reliability within the integrated design environment. Will further develop improved stress and load prediction capability that more accurately determines structural loads resulting from aerodynamic loads. Will explore biology-inspired, light-weight concepts that enable efficient, reliable, lighter weight platform structures. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Decrease in funding from FY18 to FY19 as this applied research effort transitions to Advanced Development (6.3) for maturation and demonstration.			
Title: Rotors & Vehicle Management Technologies	10.395	10.832	11.089
Description: Design and investigate advanced airfoil and rotor blade technologies, including active control elements, to support goals of increased hover and cruise efficiency. Design and evaluate advanced flight control and vehicle management component technologies to support goals of increased maneuverability, reliability, and reduced weight and cost. ***FY 2018 Plans:*** Improve the accuracy and efficiency of high-fidelity computational fluid dynamics simulations on high-performance parallel computers including rotors and vehicles with active flaps, active flow control, and morphing surfaces; evaluate and optimize computational execution efficiency software on new heterogeneous parallel computer hardware architectures. Conduct sub-scale testing of an advanced rotor design; conduct benchtop and sub-scale testing of passive and active flow control concepts. Analyze Joint Multi-Role Technology Demonstration (JMR-TD) flight test data to assess and improve government simulation modeling methods for advanced configurations. Apply advanced control allocation methods to a piloted simulation based on a JMR TD configuration. Study flight control and handling-qualities issues associated with an advanced wing-compound configuration. ***FY 2019 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602211A / *Aviation Technology*	**Project (Number/Name)** 47A / *AERON & ACFT Wpns Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Will conduct investigation of winged-compound aeromechanics and technologies; will conduct fundamental computational and experimental investigation of rotor blade structural loads; will develop and improve flow measurement techniques such as infra-red thermography for flow transition measurement; will examine interactional aerodynamic effects on of multi-rotor configurations including the rotor downwash/outwash; will investigate advanced vertical lift aircraft configurations using both high-fidelity and mid/low fidelity computational methods; will validate computational aeromechanics models against wind tunnel and flight test data. Will investigate advanced hub and rotor concepts for high speed flight. Will explore technologies that enable high performance Unmanned Aerial Systems (UAS) rotors and propulsors. Will develop and release an integrated flight simulation modeling tool that transforms or stitches a few specific frequency-domain flight data points into a full-flight non-linear model. Will investigate an initial set of Unmanned Aerial Vehicle (UAV) handling qualities and UAV flight control design and test methods. Will conduct flight test research to: develop criteria for active inceptors; confirm techniques for improving measurements of rotor states for feedback to the flight control system; and new Mission Task Elements for high-speed configurations. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Increase in funding from FY18 to FY19 to explore technologies that enable Unmanned Aerial System (UAS).			
Title: Engine and Drives Technologies	6.364	6.664	7.551
Description: Design and evaluate advanced turboshaft engine component technologies to support goals of reduced fuel consumption, engine size, weight, and cost, as well as improved reliability and maintainability. Design and evaluate advanced drive system component technologies to support multi-speed transmissions, lighter weight gearboxes, and reduced costs, while improving reliability and maintainability ***FY 2018 Plans:*** Complete validation testing of smart, adaptable, and efficient sand filtration technology for improved engine performance and durability; complete investigation of alternative adaptable engine architectures in support of high performance alternative concept engine; investigate of alternative adaptable engine components in support of high performance alternative concept engine and Future Vertical Lift (FVL) objectives; continue validation through experimentation drive train component technologies with multi-speed (ability to vary shaft speed between 50 and 100%) in support of next generation rotorcraft transmission and FVL objectives. ***FY 2019 Plans:*** Will continue investigation of alternative adaptable engine components in support of the high performance alternative concept engine program and Future Vertical Lift/Future Tactical Unmanned Aerial Systems; initiate design of high reduction ratio component concepts to provide improved drive system horsepower to weight and life capability to Future Vertical Lift aircraft. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Increase in funding from FY18 to FY19 to meet Army priority of Future Vertical Lift (FVL) engines and drive trains.			
Title: Survivability For Degraded Visual Environment (DVE) Operations	9.149	8.500	0.500

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602211A / *Aviation Technology*	**Project (Number/Name)** 47A / *AERON & ACFT Wpns Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Description: Research advanced sensor and cockpit display technologies to provide ability to maintain terrain and obstacle situational awareness during aircraft induced (brown-out & white-out) and environmentally induced (rain, snow, smog, fog, smoke, low light, etc.) DVE. Work in this area is being done in coordination with efforts at Army CERDEC, PE 603710A, Night Vision Advanced Technology. ***FY 2018 Plans:*** Initiate MCLAWS Version 5 (V5) development; MCLAWS V5 will be the updated flight control laws for U.S. Army helicopters. Begin to incorporate laboratory modeling and reconfiguring of Obstacle Field Navigation (OFN) and Safe Landing Area Determination (SLAD) into MCLAWS V5. ***FY 2019 Plans:*** Will finalize Obstacle Field Navigation (OFN), Safe Landing Area Determination (SLAD) guidance that includes auto landing capability, and sensor driven guidance to enroute and multiple helicopter landing zone selection. Technologies in this area will transition to efforts in Army AMRDEC, PE 063003A, Survivability For Degraded Visual Environment (DVE) Operations. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Decrease in funding from FY18 to FY19 as this applied research effort transitions to Advanced Development (6.3) for maturation and demonstration.			
Title: Aircraft and Occupant Survivability Technologies ***Description:*** Investigate advanced technologies to reduce susceptibility and vulnerability of aircraft to damage from threats or accidents, as well as technologies to defeat small arms, rocket and missile threats. ***FY 2018 Plans:*** Continue development of next generation advanced composite lightweight armor. Continue development of next generation lightweight ballistic tolerant crashworthy fuel containment systems. Continue development of crashworthiness subsystem devices that build on advanced crash protection concepts previously developed. Initiate development of advanced fire management subsystems. Continue development of adaptive Infrared (IR) engine suppressor system to optimize aircraft performance and Infrared (IR) signature. Continue to develop signature management technologies. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** This task has been realigned into Mission Systems to better coordinate survivability, offensive/defense weapons and sensors technologies	5.870	6.588	-
Title: Aircraft Weapon & Sensor Technologies	1.565	1.654	-

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602211A / *Aviation Technology*	**Project (Number/Name)** 47A / *AERON & ACFT Wpns Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Description: Design and develop innovative approaches for integrating advanced weapons and sensors on aircraft platforms, including smart dispensers, data transfer, and post-launch weapon communication. ***FY 2018 Plans:*** Define, develop and evaluate concepts for acquiring, storing, preparing, exploiting and distributing sensor data to enhance situational awareness, reduce crew workload and increase mission effectiveness. Refine the components required for launching organic payloads off of aircraft wingstores. Evaluate several air-to-air targeting algorithms intended to support advanced threat protection and counter Unmanned Aerial Systems (UAS). ***FY 2018 to FY 2019 Increase/Decrease Statement:*** This task has been realigned into Mission Systems to better coordinate survivability, offensive/defense weapons and sensors technologies			
Title: Mission Systems ***Description:*** Investigate technologies to reduce susceptibility and vulnerability of aircraft to damage from threats or accidents, as well as technologies to defeat small arms, rocket and missile threats. Investigate advanced engagement concepts of organically launch systems from Army aviation platforms. ***FY 2019 Plans:*** Will investigate adaptive Infrared (IR) engine suppression systems for future Army aircraft in an engine test cell to evaluate engine and IR suppression performance. Will continue maturation of signature management technologies for Future Vertical Lift (FVL). Will develop modeling and simulation tools to support survivability analysis against advanced threat systems. Will define, develop and assess advanced engagement concepts for exploitation of organically launch systems off of Army aviation platforms. Will investigate platform integration, mission systems, and survivability requirements to enable organically launch system engagements from Army aviation platforms. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** This is a new start for FY19.	-	-	11.894
Title: Unmanned and Optionally Manned Technologies ***Description:*** Design and Develop advanced Manned-Unmanned Teaming (MUM-T) concepts to expand aviation mission sets that include resupply, reconnaissance, surveillance, electronic warfare, protection, medical evacuation and attack. Design and develop collaborative and cooperative algorithms to support the goal of intelligent teaming for manned-unmanned operations. Design and develop advanced unmanned aircraft system (UAS) components to support goal of improved UAS performance. When applicable, technologies in this area are leveraged to support mitigation of degraded visual environments (DVE).	6.653	6.427	18.870

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602211A / *Aviation Technology*	**Project (Number/Name)** 47A / *AERON & ACFT Wpns Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
FY 2018 Plans: Mature autonomous flight control algorithms to support optionally manned helicopter flight operations. Design and develop tube launched UAS components to support manned unmanned teaming (MUM-T) of UAS with both manned and unmanned ground vehicles, building towards a UASs on-demand capability. Investigate system software and hardware architectures to make autonomous systems more resilient and adaptable to mission changes and system failures. Investigate multi modal cueing for increased situational awareness in all domains. Investigate management of aircrew workloads throughout mission execution, to include MUM-T. ***FY 2019 Plans:*** Will continue to investigate management of aircrew workloads throughout mission execution, to include advanced teaming. Will continue to develop algorithms for increased autonomy air platform autonomy and contingency management to support mission execution independent of a constant data link to a ground control station. Will investigate and evaluate human/machine interface technologies that enable reduced workloads, increased situational understating, and maximize human/machine performance in an aviation environment. Will evaluate technologies to support the following capabilities; resupply, reconnaissance, surveillance, electronic warfare, protection, medical evacuation and attack. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** This task funding has been increased to meet Army Future Vertical Lift Priority of Manned-Unmanned Teaming (MUM-T)			
Title: Maintainability & Sustainability Technologies ***Description:*** Enables highly reliable, low maintenance platforms that can survive un-sustained in the multi-domain battle space for extended periods. Explores enabling technologies comprising aircraft health state awareness, data driven sustainment approaches, and operationally durable designs. ***FY 2018 Plans:*** Investigate efforts to improve component prognostics capability for aviation systems. Investigate sensor and maintainability technologies that enable improved prognostics for an improved and integrated aircraft system health monitoring and management capability. Identify improved materials and processes that enhance system durability and reliability. Determine fleet and logistics management data interface and transfer gained knowledge. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** This task funding has been realigned to meet Army Future Vertical Lift Priority of Manned-Unmanned Teaming (MUM-T)	3.485	3.846	-
Accomplishments/Planned Programs Subtotals	54.082	55.630	53.884

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602211A / *Aviation Technology*	**Project (Number/Name)** 47A / *AERON & ACFT Wpns Tech*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / *Aviation Technology*	Project (Number/Name) 47B / *Veh Prop & Struct Tech*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
47B: *Veh Prop & Struct Tech*	-	9.511	10.456	10.963	-	10.963	11.181	11.480	11.716	11.950	0.000	77.257

A. Mission Description and Budget Item Justification

This Project investigates engine, drive train, and airframe enabling technologies such as multifunctional materials, fluid mechanics and high temperature, high strength, low cost shaft materials. Additional areas of research include platform, aerodynamic, transmission, and control technologies for implementation in autonomous Unmanned Aerial Systems (UAS) and failure analysis and prediction models and techniques to support a "zero maintenance helicopter" concept.

Work in this Project complements and is fully coordinated with Program Element (PE) 0603003A (Aviation Advanced Technology) and leverages basic research performed in PE 0601104/Project H54 (Micro Autonomous Systems Technology Collaborative Technology Alliance) and PE 0601104/Project H09 (Robotics Collaborative Technology Alliance).

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Rotor and Structure Technology	2.524	2.335	2.706
Description: Devise improved tools and methodologies to more accurately design for improved component reliability and durability, resulting in platforms that are lighter in weight and less costly to acquire and maintain. Investigate rotors and structures to significantly improve rotorcraft range and speed.			
FY 2018 Plans: Develop an efficient computational, structural fatigue method to predict the growth of small cracks or even earlier material damage indicators relevant to Army aviation; conduct experiments to verify the fatigue method and improve the accuracy predictions for remaining structural fatigue life. Develop a computational model of a co-axial rotor system to understand the fundamental interactions between counter-rotating rotors and their effects on transient hub loads and rotor blade defections.			
FY 2019 Plans: Will explore techniques for coalescing data from structural sensors, novel damage models, and advanced multifunctional material systems for extreme light weighting. Improved aero elasticity modeling, along with uncertainty quantification and propagation across requirements, design variables, and technology maturity level will be investigated to enable air vehicle design. Technology enablers such as self-responsive materials/structures, three-dimensional topology optimization, and machine learning will be investigated to improve reliable and durable vehicle components.			
FY 2018 to FY 2019 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602211A / *Aviation Technology*	**Project (Number/Name)** 47B / *Veh Prop & Struct Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
This task funding has been increased to continue to explore techniques that will improve the reliability and durability of vehicle components for Future Vertical Lift (FVL).			
Title: Air Vehicle Propulsion and Power Technology (previously tittled: Engine and Drive Train Technology) ***Description:*** Applied research investigating engine and drivetrain technologies for Army manned and unmanned air vehicles. Research, investigates, and conducts experiments to develop, innovate, and validate advanced models and improved methods for propulsion system components and configurations to enable improvements in power density, efficiency, reliability and life cycle cost for increasing performance and capabilities of Army aviation systems. ***FY 2018 Plans:*** Investigate and conduct experiments on engine and drivetrain technologies to enable improved performance and reduced maintenance costs for Army vehicles including (a) performance of a centrifugal compressor vaneless diffuser; (b) a variable area fuel injection nozzle concept for improved control of fuel quantity and jet penetration; (c) innovative active and passive articulating turbine rotor and stator blade mechanism concepts; (d) research in ceramic matrix composite (CMC) turbine blades; (e) representation learning and model-assist diagnostic techniques for early damage detection in high-performance flight-critical powertrain gearing. ***FY 2019 Plans:*** Will conduct research that leads to enhancements in propulsion including material improvements for high temperature engine and high stress drivetrains, reliable air and fuel delivery components for robust energy conversion of multiple fuel inputs in small engine systems, and aerodynamic performance in high efficiency centrifugal compressors. Will investigate more accurate simulations capable of predicting nonlinear and shifting dynamics and damage in complex and variable speed helicopter drivetrains. Techniques for interactive trade space navigation across performance, cost and capabilities will be investigated, which ties user value measures to performance and effectiveness. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Increase to support additional efforts in small engines for Unmanned Air Systems	2.611	1.557	2.021
Title: Micro/Small Scale Unmanned Aerial Systems ***Description:*** Develop means to maximize the endurance of Soldier and robot portable aerial Intelligence, Surveillance, and Reconnaissance (ISR) assets through investigation of technologies such as adaptive materials for wings/airframes and an array of behaviors, spanning low-level reflexive controls through higher intelligence path and mission planning. ***FY 2018 Plans:*** Incorporate span adaptive wing structure into flight body, create appropriate flight behaviors, and assess resultant contribution to energy efficient yet agile flight. Experimentally collect data to validate and improve mission driven analytical Unmanned Aerial	3.401	4.064	3.736

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602211A / *Aviation Technology*	**Project (Number/Name)** 47B / *Veh Prop & Struct Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Vehicle (UAV) technology trade space tools. Develop physics-based analytical tools for assessing performance impacts of multi-material technologies for UAVs. ***FY 2019 Plans:*** Will develop the underlying aerodynamic models that will enable small Unmanned Aircraft System (UAS) to perform aggressive maneuver through complex environments, where the incorporation of higher fidelity methods into computationally efficient physics based modeling tools will enable the design of novel UAS concepts. Will carry out research that will enable advanced speed, endurance, payload capability, and on-demand design and fabrication of small-mission based UAS. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** FY19 funding decrease due to reduced resources needed to meet base plans			
Title: Aviation Component Failure Modeling ***Description:*** Develop failure analysis and prediction models and techniques to support a "zero maintenance helicopter" concept. Work is coordinated with Aviation component and system reliability efforts in PE 0602211A / Project 47A at the United States (U.S.) Army Aviation and Missile Research, Development and Engineering Center. ***FY 2018 Plans:*** Develop a more efficient probabilistic and risk assessment method that can predict aviation component failure as damage is initially detected and continues to progress. ***FY 2019 Plans:*** Will develop probabilistic models that will enable the prediction of useful life of advanced propulsion materials and components and failure prediction in aviation materials and structural components. Material and structural information can be used to inform damage-adaptive maneuvers in real-time to enable ?zero-maintenance helicopter? technologies.	0.975	1.000	1.000
Title: High Speed & Efficient Vertical Take-off and Landing ***Description:*** Perform Vertical Take-Off and Landing (VTOL) research investigations in propulsion, aeromechanics and platform technologies to explore, innovate and combine the most promising technologies to enable more efficient hover, high-speeds, and greater maneuverability at longer ranges for Army aviation. Reconfigurable and adaptive technologies include hover rotor systems that can achieve high speed, low drag; aerodynamic lift technologies capable of higher speed and efficient cruise; and convertible propulsion technologies to deliver more efficient hover and higher speed cruise power. ***FY 2018 Plans:*** Investigate and develop active and passive technologies for structural damping augmentation to overcome structural performance limitations by developing physics-based mathematical models to enable higher fidelity analysis for concept assessment and	-	1.500	1.500

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602211A / *Aviation Technology*	**Project (Number/Name)** 47B / *Veh Prop & Struct Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
capability projection. Investigate engine cycle and powertrain configuration concepts that enable efficient hover and high speed cruise. ***FY 2019 Plans:*** Will conduct research in the areas of propulsion and active/passive platform technology that will enable improved reliability, efficiency, and stability of VTOL vehicles. This will include research in emerging propulsion technology such as hybrid-electric concepts, and lightweight power distribution configuration, as well as in aeromechanics research to enable higher speeds and greater efficiency for reconfigurable rotor systems. Embedded sensing, actuation, and control methods will also be investigated.			
Accomplishments/Planned Programs Subtotals	9.511	10.456	10.963

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602211A / *Aviation Technology*	Project (Number/Name) *47C / ROTORCRAFT COMPONENT TECHNOLOGIES (CA)*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
47C: *ROTORCRAFT COMPONENT TECHNOLOGIES (CA)*	-	4.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.000

Note

Congressional Increase for FY17

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Rotorcraft Component Technologies.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018
Congressional Add: Congressional Program Increase	4.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	4.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A