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 0602211A *I Aviation 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	-	80.424	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	80.424
47A: *AERON & ACFT Wpns Tech*	-	52.748	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	52.748
47B: *Veh Prop & Struct Tech*	-	10.676	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.676
47C: *ROTORCRAFT COMPONENT TECHNOLOGIES (CA)*	-	17.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	17.000

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is realigned with continuity of effort to the following PE:
* 0602148A Future Vertical Lift Technology

A. Mission Description and Budget Item Justification

This 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 Under Secretary of Defense for Research and Engineering S&T focus areas and the Army Modernization Strategy. Work in this PE is performed by the United States Army Futures Command (AFC).

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 0602211A *I Aviation Technology*			
B. Program Change Summary ($ in Millions)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Previous President's Budget	81.805	0.000	0.000	-	0.000
Current President's Budget	80.424	0.000	0.000	-	0.000
Total Adjustments	-1.381	0.000	0.000	-	0.000
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.381	-			

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2019**	**FY 2020**
Project: 47C: *ROTORCRAFT COMPONENT TECHNOLOGIES (CA)*		
Congressional Add: *Adaptive Flight Control Technology Development*	6.986	-
Congressional Add: *Aviation and Missile Technology Transfer and Innovation*	5.000	-
Congressional Add: *UH-60 Main Rotor Blade Modernization*	5.000	-
Congressional Add: *FY 2018 NDAA SEC 825 MDAP Cost Overrun*	0.014	-
Congressional Add Subtotals for Project: 47C	17.000	-
Congressional Add Totals for all Projects	17.000	-

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 0602211A / *Aviation Technology*	Project (Number/Name) 47A / *AERON & ACFT Wpns Tech*	

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
47A: *AERON & ACFT Wpns Tech*	-	52.748	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	52.748

Note

In Fiscal Year (FY) 2020 this Project is being realigned to Program Element (PE) 0602148A Future Vertical Lift Projects:
* Project AI5 Next Gen Tactical UAS TD Technology
* Project AI7 Alternative Concept Engine Technology
* Project AJ2 Next Generation Rotorcraft Transmission Technology
* Project AJ4 Digital Vehicle Management and Control Technology
* Project AJ6 Advanced Rotors Technology
* Project AJ8 Experimental and Computational Aeromechanics Techn
* Project AK1 UAS Survivability Technology
* Project AK2 Aviation Survivability Technology
* Project AK9 Adv Teaming for Tactical Aviation Oper
* Project AL2 High Performance Computing for Rotorcraft App Tech
* Project AM2 Aircraft and Aircrew Protection Technology

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 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 Under Secretary of Defense for Research and Engineering Science and Technology (S&T) focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Platform Design & Structures Technologies	3.897	-	-

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 0602211A / *Aviation Technology*	**Project (Number/Name)** 47A / *AERON & ACFT Wpns Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
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.			
Title: Rotors & Vehicle Management Technologies ***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.	10.855	-	-
Title: Engine and Drives Technologies ***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	7.392	-	-
Title: Survivability For Degraded Visual Environment (DVE) Operations ***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.	0.489	-	-
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.	11.643	-	-
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 systems (UAS) components to support goal of improved UAS performance. When applicable, technologies in this area are leveraged to support mitigation of DVE.	18.430	-	-

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 0602211A / *Aviation Technology*	**Project (Number/Name)** 47A / *AERON & ACFT Wpns Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: FY 2018 NDAA SEC 825 MDAP Cost Overrun ***Description:*** FY 2018 NDAA SEC 825 MDAP Cost Overrun	0.042	-	-
Accomplishments/Planned Programs Subtotals	52.748	-	-

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 0602211A / *Aviation Technology*	Project (Number/Name) 47B / *Veh Prop & Struct Tech*	

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
47B: *Veh Prop & Struct Tech*	-	10.676	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.676

Note

In Fiscal Year (FY) 2020 this Project is being realigned to
Program Element (PE) 06022148A Future Vertical Lift Projects:
* Project AI9 Future UAS Engine Technology
* Project AK9 Adv Teaming for Tactical Aviation Operations Tech
* Project AL4 High Speed and Efficient VTOL Vehicle Technology
* Project AL5 Air Vehicle Structures and Dynamics Technology

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 PE 0603003A (Aviation Advanced Technology) and leverages basic research performed in PE 0601104A (University and Industry Research Centers) / Project H09 (Robotics Collaborative Technology Alliance).

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Rotor and Structure Technology ***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.	2.635	-	-
Title: Air Vehicle Propulsion and Power 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.	1.968	-	-
Title: Micro/Small Scale Unmanned Aerial Systems	3.630	-	-

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 0602211A / *Aviation Technology*	**Project (Number/Name)** 47B / *Veh Prop & Struct Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
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.			
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 (Aviation Technology) / Project 47A (Aeron & Acft Wpns Tech) at the United States (US) Army Aviation and Missile Research, Development and Engineering Center.	0.974	-	-
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.	1.461	-	-
Title: FY 2018 NDAA SEC 825 MDAP Cost Overrun ***Description:*** FY 2018 NDAA SEC 825 MDAP Cost Overrun	0.008	-	-
Accomplishments/Planned Programs Subtotals	10.676	-	-

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 0602211A / *Aviation Technology*	Project (Number/Name) *47C / ROTORCRAFT COMPONENT TECHNOLOGIES (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
47C: *ROTORCRAFT COMPONENT TECHNOLOGIES (CA)*	-	17.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	17.000

Note

Congressional Increase for Fiscal Year 2019 (FY19).

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Rotorcraft Component Technologies.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020
Congressional Add: Adaptive Flight Control Technology Development ***FY 2019 Accomplishments:*** Adaptive Flight Control Technology Development	6.986	-
Congressional Add: Aviation and Missile Technology Transfer and Innovation ***FY 2019 Accomplishments:*** Aviation and Missile Technology Transfer and Innovation	5.000	-
Congressional Add: UH-60 Main Rotor Blade Modernization ***FY 2019 Accomplishments:*** UH-60 Main Rotor Blade Modernization	5.000	-
Congressional Add: FY 2018 NDAA SEC 825 MDAP Cost Overrun ***FY 2019 Accomplishments:*** FY 2018 NDAA SEC 825 MDAP Cost Overrun	0.014	-
Congressional Adds Subtotals	17.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A