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 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603465A *I Future Vertical Lift Advanced 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	-	0.000	0.000	151.640	-	151.640	145.543	173.019	196.348	188.723	0.000	855.273
AI4: *Joint Multi-Role (JMR) Demonstration Advanced Tech*	-	0.000	0.000	10.000	-	10.000	0.000	0.000	0.000	0.000	0.000	10.000
AI6: *Next Gen Tactical UAS TD Advanced Technology*	-	0.000	0.000	21.748	-	21.748	25.583	25.094	23.536	22.788	0.000	118.749
AI8: *Alternative Concept Engine Advanced Technology*	-	0.000	0.000	2.929	-	2.929	2.604	1.737	1.772	1.791	0.000	10.833
AJ1: *Future UAS Engine Advanced Technology*	-	0.000	0.000	1.730	-	1.730	2.830	4.424	4.512	4.517	0.000	18.013
AJ3: *Next Generation Rotorcraft Transmission Adv Tech*	-	0.000	0.000	1.098	-	1.098	1.394	1.422	1.450	1.466	0.000	6.830
AJ5: *Digital Vehicle Management & Control Advanced Tech*	-	0.000	0.000	1.153	-	1.153	1.538	1.569	1.600	1.618	0.000	7.478
AJ7: *Advanced Rotors Advanced Technology*	-	0.000	0.000	2.500	-	2.500	2.500	2.510	2.560	2.577	0.000	12.647
AJ9: *Integ Mission Equip for Vert Lift Systems Adv Tech*	-	0.000	0.000	15.820	-	15.820	22.402	24.383	26.021	21.589	0.000	110.215
AK3: *Aviation Survivability Advanced Technology*	-	0.000	0.000	20.836	-	20.836	10.331	10.696	12.532	13.034	0.000	67.429
AK5: *Multi-Role Small Guided Missile Advanced Tech*	-	0.000	0.000	2.426	-	2.426	0.000	4.000	10.384	12.489	0.000	29.299
AK7: *Adv Rotorcraft Armaments Protection Sys Adv Tech*	-	0.000	0.000	3.139	-	3.139	3.931	11.931	12.170	12.306	0.000	43.477
AK8: *Air Launched Effects Advanced Technology*	-	0.000	0.000	3.215	-	3.215	3.865	4.196	4.635	4.394	0.000	20.305
AL1: *Adv Teaming for Tactical Aviation Oper Adv Tech*	-	0.000	0.000	20.964	-	20.964	41.368	40.618	40.322	46.814	0.000	190.086

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army													Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*								
AL3: *HPC for Rotorcraft Applications Adv Tech*	-	0.000	0.000	4.958	-	4.958	5.051	5.141	5.306	5.365	0.000	25.821
AL6: *Degraded Vis Environ Mitigation (DVE-M) Adv Tech*	-	0.000	0.000	29.151	-	29.151	0.000	0.000	0.000	0.000	0.000	29.151
AL7: *Full Spectrum Targeting Advanced Technology*	-	0.000	0.000	5.425	-	5.425	9.917	10.124	10.326	10.442	0.000	46.234
AL9: *Holistic Sit Awareness and Dec Making Adv Tech**	-	0.000	0.000	0.000	-	0.000	5.000	17.800	31.700	19.926	0.000	74.426
AM3: *Aircraft and Aircrew Protection Advanced Tech*	-	0.000	0.000	4.548	-	4.548	5.229	5.334	5.441	5.502	0.000	26.054
AM5: *Opt Energy Stg & Therm Mgmt for FVL Surv Adv Tech**	-	0.000	0.000	0.000	-	0.000	2.000	2.040	2.081	2.105	0.000	8.226

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2020

Note

In Fiscal Year (FY) 2020 this Program Element (PE) continues efforts previously funded in the following PEs:
* PE 0603003A (Aviation Advanced Technology)
* PE 0603004A (Weapons and Munitions Advanced Technology)
* PE 0603270A (Electronic Warfare Technology)
* PE 0603313A (Missile and Rocket Advanced Technology)
* PE 0603710A (Night Vision Advanced Technology)
* PE 0603734A (Military Engineering Advanced Technology)
* PE 0603772 (Advanced Tactical Computer Science and Sensor Technology)

A. Mission Description and Budget Item Justification

This PE matures and demonstrates manned and unmanned air vehicle and mission system technologies as well as advanced teaming capabilities to enable Army Future Vertical Lift. Emphasis is on platform and mission system 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. Within this PE, aviation technologies are advanced and integrated into realistic and robust demonstrations.

Work in this PE contributes to the Army Science and Technology (S&T) air systems portfolio and is fully coordinated with efforts in PE 0602148A (Future Vertical Lift Advanced Technology Development)

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 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603465A *I Future Vertical Lift 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. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this PE is performed by the United States Army Futures Command (AFC) and the Army Engineering Research and Development Center (ERDC).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	151.640	-	151.640
Total Adjustments	0.000	0.000	151.640	-	151.640
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	151.640	-	151.640

Change Summary Explanation

FY20 funding realigns activities from other PEs to consolidate Future Vertical Lift efforts.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AI4 / *Joint Multi-Role (JMR) Demonstration Advanced Tech*	

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
AI4: *Joint Multi-Role (JMR) Demonstration Advanced Tech*	-	0.000	0.000	10.000	-	10.000	0.000	0.000	0.000	0.000	0.000	10.000

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project demonstrates transformational advanced rotary-wing configurations and open systems architectures to prepare the Department of Defense (DoD) for decisions regarding Future Vertical Lift (FVL).

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Joint Multi-Role (JMR) Technology Demonstration	-	-	10.000
Description: Provide demonstration of Future Vertical Lift (FVL) platform configurations that address multi domain battle capability needs. Determine optimum vehicle attributes that meet future force capability needs for increased system speed, range, payload, and reduced operating costs in order to inform and reduce future aviation materiel acquisitions. Flight demonstrate operational capabilities of technology demonstrators.			
FY 2020 Plans: Will complete the Mission Systems Architecture Capstone Demonstration, which includes development of processes, tools, and standards necessary to specify, analyze, design, implement and qualify a Mission Systems Architecture for future programs using a Model-Based development approach. Will continue development of the Joint Common Architecture (JCA), including a functional model, data model, supporting documentation, and tools. Will continue final design, integration, and assessment of a notional Open Systems Architecture (OSA) that implements the Future Airborne Capability Environment (FACE) Technical Standard and			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AI4 / *Joint Multi-Role (JMR) Demonstration Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Hardware Open Systems Technologies (HOST). Will deliver architectural models and technical reports from vendors participating in the demonstration of the architectures. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 313. Overall decrease in funding from FY 2019 to FY 2020 for this effort due to completion of JMR TD flight demonstration.			
Accomplishments/Planned Programs Subtotals	-	-	10.000

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AI6 / *Next Gen Tactical UAS TD Advanced 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
AI6: *Next Gen Tactical UAS TD Advanced Technology*	-	0.000	0.000	21.748	-	21.748	25.583	25.094	23.536	22.788	0.000	118.749

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates conceptual designs and enabling technologies to support the development of technically feasible and achievable requirements for the Future Unmanned Aircraft Systems (FUAS) Program of Record. The Project will also reduce the developmental risk of critical technologies for FUAS.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Next Gen Tactical UAS Technology Demonstration	-	-	21.748
Description: This Project will develop and demonstrate conceptual designs and enabling technologies to support the development of technically feasible and achievable requirements for the Future Unmanned Aircraft Systems (FUAS) Program of Record.			
FY 2020 Plans: Air vehicle conceptual designs will be assessed against refined requirements for continuation to detailed design, fabrication, and demonstration in 2023. Proposed technology insertions will be prioritized to enable advanced UAS. Experiments will inform concepts of operation for future vertical lift family of systems within the ecosystem. Will incrementally demonstrate implementation of experiential learning-based algorithms for autonomous navigation, including strategies for perception, state estimation, vehicle			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AI6 / *Next Gen Tactical UAS TD Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
control, and exploration. Flight demonstration will be conducted to validate government in-house UA-scale airfoil and air vehicle design methodologies. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	21.748

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AI8 / *Alternative Concept Engine Advanced 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
AI8: *Alternative Concept Engine Advanced Technology*	-	0.000	0.000	2.929	-	2.929	2.604	1.737	1.772	1.791	0.000	10.833

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 447 ACFT Demo Engines

A. Mission Description and Budget Item Justification

This Project provides demonstration of adaptable, fuel efficient and high power to weight engine technologies for potential application to Future Vertical Lift platforms. Efforts include development of alternative, adaptive and smart engine technologies to provide improved performance, readiness and affordability across the engine operating envelope for increased operational capability.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Alternative Concept Engine (ACE)	-	-	2.929
Description: This effort demonstrates alternative, adaptive, and intelligent engine technologies to provide improved / mission-optimized performance, readiness and affordability across an expanding engine envelope for increased operational capability for Future Vertical Lift (FVL) platforms. The alternative concept engine technology demonstrations planned for this effort are applicable to current and future platforms.			
FY 2020 Plans: Alternative concept engine component fabrication and component validation testing will be completed and engine testing will be initiated.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AI8 / *Alternative Concept Engine Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This work was previously performed in PE 0603003A / Project 447.			
Accomplishments/Planned Programs Subtotals	-	-	2.929

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AJ1 / *Future UAS Engine Advanced 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
AJ1: *Future UAS Engine Advanced Technology*	-	0.000	0.000	1.730	-	1.730	2.830	4.424	4.512	4.517	0.000	18.013

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 447 ACFT Demo Engines

A. Mission Description and Budget Item Justification

This Project provides full system demonstration of a JP8-fueled, reliable, fuel-efficient and high power-to-weight engine concept for Future Unmanned Aircraft Systems (FUAS).

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Reliable Advanced Small Power Systems	-	-	1.730
Description: This effort demonstrates adaptive and intelligent engine technologies to provide improved / mission- optimized performance, readiness and affordability across an expanding engine envelope for increased operational capability for group 3 and 4 FUAS platforms. ***FY 2020 Plans:*** Reliable Advanced Small Power System component fabrication and component validation testing will be completed and engine testing will be initiated. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 447.			
Accomplishments/Planned Programs Subtotals	-	-	1.730

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AJ1 / *Future UAS Engine Advanced Technology*

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AJ3 / *Next Generation Rotorcraft Transmission Adv Tech*	

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
AJ3: *Next Generation Rotorcraft Transmission Adv Tech*	-	0.000	0.000	1.098	-	1.098	1.394	1.422	1.450	1.466	0.000	6.830

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project develops and ground demonstrates variable-speed transmission technologies that can be matured and integrated into the development of Future Vertical Lift (FVL) platforms.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Next Generation Rotorcraft Transmission	-	-	1.098
Description: This effort demonstrates advanced rotorcraft drive technologies with the potential to increase the horsepower-to-weight ratio; reduce drive system noise; reduce production, operating and support costs; and provide automatic component impending-failure detection. The drive system demonstrators for this effort will be applicable to Future Vertical Lift (FVL) platforms.			
FY 2020 Plans: Variable speed transmission hardware fabrication and full scale transmission stand testing will be completed. Integration into ground test aircraft will be initiated.			
FY 2019 to FY 2020 Increase/Decrease Statement: This work was previously performed in PE 0603003A / Project 313			
Accomplishments/Planned Programs Subtotals	-	-	1.098

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AJ3 / *Next Generation Rotorcraft Transmission Adv Tech*

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AJ5 / *Digital Vehicle Management & Control Advanced Tech*	

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
AJ5: *Digital Vehicle Management & Control Advanced Tech*	-	0.000	0.000	1.153	-	1.153	1.538	1.569	1.600	1.618	0.000	7.478

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project designs, integrates and demonstrates Future Vertical Lift (FVL) flight control and Vehicle Management Systems (VMS) technologies. Technologies demonstrated include: advanced flight control laws and autonomy; automatic reconfiguration for speed/damage; coupled cockpit symbology and haptic cueing; and handling qualities requirements for new platform concepts.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Digital Vehicle Management and Control	-	-	1.153
Description: This effort demonstrates integrated Future Vertical Lift (FVL) capable flight controls and advanced sensors to satisfy future capability needs to fly in any visual environment, adapt to degradation and damage to complete the mission and support autonomous operations and manned-unmanned teaming (MUM-T). Technologies demonstrated include: advanced flight control laws and autonomy; automatic reconfiguration for speed/damage; coupled cockpit symbology and haptic cueing; and handling qualities requirements for new platform concepts.			
FY 2020 Plans: Will complete North Atlantic Treaty Organization (NATO) working group research on rotorcraft simulation modeling fidelity assessment and improvement and publish lessons learned. Will develop unmanned FVL handling quality testing methods and requirements for flying in mission-relevant turbulent environments; Will validate and publish new response types for high-speed			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AJ5 / *Digital Vehicle Management & Control Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
and mission task elements for a FVL design standard. Will analyze Joint Multi-Role Technology Demonstrator (JMR-TD) handling qualities flight test results for validation of simulation models and inclusion of new JMR-relevant requirements in a FVL design standard. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	1.153

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AJ7 / *Advanced Rotors Advanced 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
AJ7: *Advanced Rotors Advanced Technology*	-	0.000	0.000	2.500	-	2.500	2.500	2.510	2.560	2.577	0.000	12.647

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project demonstrates and integrates new technologies that enable global and highly efficient/reliable operations for Future Vertical Lift (FVL) aircraft and Future Unmanned Aircraft Systems(FUAS) throughout the flight envelope.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Rotors Technology	-	-	2.500
Description: This effort demonstrates full scale, integrated rotor system technologies through the assessment of alternative designs aimed to satisfy future capability needs for Future Vertical Lift (FVL) and Future Unmanned Aircraft Systems (FUAS) increased system durability, efficiency, speed, range, and payload. Technologies include: integrated high speed, low drag rotor technologies for high speed configurations; interactional aero tailoring between rotor and body & auxiliary lift/ propulsors; light weight, low volume, efficient and high authority electro- mechanical actuators (EMAs); reliable and safety critical actuators/hubs/ controls for Independent Blade Control (IBC)/swash plateless rotors; damage compensation/load alleviation; active/passive flow control; and automated track and balance.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AJ7 / *Advanced Rotors Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will conduct advanced low drag rotor wind tunnel testing. Will conduct individual blade control actuator testing. Will conduct design and testing of robust, efficient UAS rotors and propulsion systems for FUAS platforms. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	2.500

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AJ9 / *Integ Mission Equip for Vert Lift Systems Adv Tech*	

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
AJ9: *Integ Mission Equip for Vert Lift Systems Adv Tech*	-	0.000	0.000	15.820	-	15.820	22.402	24.383	26.021	21.589	0.000	110.215

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project develops and demonstrates a mission systems architecture to support Future Vertical Lift (FVL) through utilization of a reconfigurable and flexible tiered architectural approach.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Integrated Mission Equipment for Vertical Lift Systems	-	-	15.820
Description: Develops and demonstrates a mission systems architecture to support Future Vertical Lift (FVL) through utilization of a reconfigurable and flexible tiered architectural approach. The tired approach will consist of the following: Maturing and implementing Model Based Engineering methods and Modular Open Systems Architecture strategies; instantiating an architecture verification environment and developing an agile and resilient digital backbone to support the rapidly changing threat environment including the digital battleground.			
FY 2020 Plans: Publish baseline requirements for both a representative mission package and instrumented architecture laboratory. Document detailed design of the Architecture Verification Environment (AVE). Instantiate initial AVE capabilities which will include architecture requirements validation processes, methods and tools for validating Future Attack Reconnaissance Aircraft (FARA) and Future Long Range Assault Aircraft (FLRAA) architecture requirements. Establish AVE experimental framework to collect the body of knowledge necessary to effectively verify architecture implementations			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AJ9 / *Integ Mission Equip for Vert Lift Systems Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
against specifications. Conduct initial development and testing of the IME software infrastructure to support representative mission packages. Document the Digital Backbone (DBB) specification for power, mechanical, thermal, hardware, software and data. Publish specific guidance documentation to assist the Government and Industry partners in the development of open architecture capabilities. Create a model based specification for documentation of the flying testbed mission system. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	15.820

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AK3 / *Aviation Survivability Advanced 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
AK3: *Aviation Survivability Advanced Technology*	-	0.000	0.000	20.836	-	20.836	10.331	10.696	12.532	13.034	0.000	67.429

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech
PE 0603270A Electronic Warfare Technology, Project:
* K16 Non-Commo Ecm Tech Dem
PE 0603710A Night Vision Advanced Technology, Project:
* K86 Night Vision, Abn Sys

A. Mission Description and Budget Item Justification

This Project matures and demonstrates increased Future Vertical Lift (FVL) survivability through the integration and demonstration of technologies that reduce platform signatures, improve threat warning and countermeasures against integrated networked air and ground threat systems.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Survivability Against Integrated Networked Threats	-	-	4.802
Description: This effort increases rotorcraft survivability by reducing platform signatures, providing the means to more efficiently counter enemy detection and tracking systems			
FY 2020 Plans: Will mature and demonstrate Aircraft Survivability Correlator algorithms. Will improve and validate own-ship and team based survivability behaviors. Will mature and demonstrate holistic survivability technologies to enhanced FVL survivability.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AK3 / *Aviation Survivability Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This work was previously performed in PE 0603003A / Project 313.			
Title: Digital Dual Use Sensors (DDUS) ***Description:*** This effort will mature and demonstrate dual band infrared sensor technologies to enable future multi-function sensing concepts suitable for both manned and unmanned aviation platforms. Effort will combine recent advances in digital readout technologies and large (megapixel) infrared detector fabrication to develop a dual band infrared proof-of-principle demonstrator and assess the feasibility of the sensor to support both pilotage and aircraft survivability functions. ***FY 2020 Plans:*** Will mature sensor optics; will complete fabrication of focal plane array (FPA) packages into cooled assemblies. Will integrate components into proof-of principle camera system; will demonstrate camera systems in laboratory and airborne field environments; will validate sensor to enable both pilotage and aircraft survivability functions. Will complete final technical report capturing lessons learned and recommendations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603710A / Project K86.	-	-	9.500
Title: Multispectral Threat Detection and Countermeasure Technologies ***Description:*** This effort matures and demonstrates countermeasure technologies that provide platform protection and integrated cueing against electro-optical (EO), infrared (IR) and radio frequency (RF) guided threats. ***FY 2020 Plans:*** Will continue sensor system development and perform unit testing on sensor components; will document and publish sensor component and subsystem performance results; will collect and analyze clutter and threat data in a relevant environment with sensor subsystem and incorporate that data into modeling and simulation infrastructure; will perform an assessment of the sensor subsystem architectural approaches and the viability of each approach to operate against unknown/unexploited and emerging threats; will demonstrate agile radio frequency (RF) components in a relevant environment and assess the viability of meeting RF countermeasure requirements using those components; will characterize RF components and produce models for modeling and simulation integration. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603270A / Project K16.	-	-	6.534
Accomplishments/Planned Programs Subtotals	-	-	20.836

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AK3 / *Aviation Survivability Advanced Technology*

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AK5 / *Multi-Role Small Guided Missile Advanced Tech*	

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
AK5: *Multi-Role Small Guided Missile Advanced Tech*	-	0.000	0.000	2.426	-	2.426	0.000	4.000	10.384	12.489	0.000	29.299

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603313A Missile and Rocket Advanced Technology, Project:
* 704 Advanced Missile Demo

A. Mission Description and Budget Item Justification

This Project investigates and demonstrates a holistic lethality solution for current Army Aviation and Future Vertical Lift (FVL) offensive and defensive multi-role armament technologies for fire control, armament systems, munitions and integration of threat agnostic countermeasures.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Modular Missile Advanced Technology	-	-	2.426
Description: This effort matures and demonstrates armament solutions adaptable to current aviation and Future Vertical Lift (FVL) applications in small caliber, medium caliber, counter measure technologies with a focus on light lethal aerodynamic systems.			
FY 2020 Plans: Will complete the integration of modular missile technology subsystems into the guided forward firing missile configuration and perform laboratory testing and simulation evaluations. Will demonstrate in a ground-launched flight test series, which includes guidance and control performance of the guided forward firing missile configuration, payload, guidance electronics unit, control actuation subsystem, propulsion subsystem and subsystem interface bus.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AK5 / *Multi-Role Small Guided Missile Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This work was previously performed in PE 0603313A / Project 704.			
Accomplishments/Planned Programs Subtotals	-	-	2.426

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AK7 / *Adv Rotorcraft Armaments Protection Sys Adv Tech*	

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
AK7: *Adv Rotorcraft Armaments Protection Sys Adv Tech*	-	0.000	0.000	3.139	-	3.139	3.931	11.931	12.170	12.306	0.000	43.477

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603004A, Project:
* 232 Advanced Lethality & Survivability Demo

A. Mission Description and Budget Item Justification

This Project investigates and demonstrates a holistic lethality solution for Future Vertical Lift (FVL) offensive and defensive applications. Develop components for use in multi-role armament solutions for fire control, armament systems, munitions and integration of threat agnostic countermeasures.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Aviation Armament System Technologies	-	-	3.139
Description: This effort matures and demonstrates armament solutions adaptable to current aviation and future vertical lift applications in small caliber, medium caliber, counter measure technologies with a focus on light lethal aerodynamic systems. ***FY 2020 Plans:*** Will improve performance of medium caliber ammunition in 20mm and 30mm for a multi-role armaments solution on the Future Vertical Lift aircraft system. Effort will optimize lightweight 20mm and 30mm munitions for air combat systems and provide multi-purpose fuze and warhead functionalities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603004A / Project 232.			
Accomplishments/Planned Programs Subtotals	-	-	3.139

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AK7 / *Adv Rotorcraft Armaments Protection Sys Adv Tech*

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AK8 / *Air Launched Effects Advanced 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
AK8: *Air Launched Effects Advanced Technology*	-	0.000	0.000	3.215	-	3.215	3.865	4.196	4.635	4.394	0.000	20.305

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603303A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project develops and demonstrates the ability to launch a UAS from a manned or unmanned future vertical lift aircraft at tactical altitudes and to control the UAS from the cockpit or a crew station. This Project will assess the enabled capabilities and determine their relevance to current Army Aviation engagement and survivability portfolios.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Air Launched Effects	-	-	3.215
Description: Develop and demonstrate the ability to launch a Future Unmanned Aircraft System (FUAS) from a Future Vertical Lift (FVL) platform at tactical altitudes, and to control the UAS from the cockpit or a crew station. Assess the enabled capabilities and determine their relevance to current Army Aviation engagement and survivability portfolios. These air-launched FUAS will employ a variety of non-lethal effects including: electronic attack, decoy, communications relay.			
FY 2020 Plans: Will demonstrate the ability to launch a UAS from a manned rotorcraft at tactical altitudes, and to control the UAS from an onboard crew station; integrate reconnaissance, surveillance, targeting, and communications relay payloads into the UAS; evaluate the mission effectiveness of organic UAS assets in support of the manned aircraft?s mission.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AK8 / *Air Launched Effects Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This work was previously performed in PE 0603003A / Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	3.215

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AL1 / *Adv Teaming for Tactical Aviation Oper Adv Tech*	

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
AL1: *Adv Teaming for Tactical Aviation Oper Adv Tech*	-	0.000	0.000	20.964	-	20.964	41.368	40.618	40.322	46.814	0.000	190.086

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 436 Rotarywing MEP Integ
PE 0603710A Night Vision Advanced Technology, Project:
* K86 Night Vision, Abn Sys

A. Mission Description and Budget Item Justification

This Project develops, demonstrates and drafts frameworks for certifiable autonomy of teaming behaviors and autonomous decision making for Future Vertical Lift (FVL) and Future Unmanned Aircraft System (FUAS) platform formations in combined arms operations.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Teaming Demonstration	-	-	20.964
Description: Develop and demonstrate teaming behaviors and autonomous decision making for mixed Future Vertical Lift (FVL) and Future Unmanned Aircraft System (FUAS) platform formations in combined arms operations that are beyond Manned-Unmanned Teaming (MUM-T) technologies. Focus areas include: resilient autonomous algorithms; self-organizing unmanned formations; distributed command and control; and navigation. This effort will also demonstrate multi-platform distributed apertures of multispectral sensors for threat detection and awareness and improved reliability through adaptation in autonomous systems.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AL1 / *Adv Teaming for Tactical Aviation Oper Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will mature and integrate advanced teaming technologies into mission systems packages for test and evaluation; simulate autonomous teaming behaviors and operations in foundational mission based vignettes; draft frameworks for certifiable autonomy. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 436 and part of PE 0603710 / Project K86.			
Accomplishments/Planned Programs Subtotals	-	-	20.964

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 / 3					R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*				Project (Number/Name) AL3 / *HPC for Rotorcraft Applications Adv Tech*			
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**
AL3: *HPC for Rotorcraft Applications Adv Tech*	-	0.000	0.000	4.958	-	4.958	5.051	5.141	5.306	5.365	0.000	25.821

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Project:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

This Project develops and demonstrates the use of high-fidelity computational modeling for Future Vertical Lift platforms through the utilization of DoD High Performance Computing (HPC) and software tools for cutting-edge modeling and simulation, as well as adding software capabilities for workflow automation and design space exploration. Efforts in this project are also applicable to the family of Future Vertical Lift (FVL) and Advanced Unmanned Aircraft System (AUAS) platforms.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Engineered Resilient Systems for Future Vertical Lift	-	-	4.958
Description: This effort matures and demonstrates capabilities (tools and methodologies) to rapidly create high-fidelity computational modeling to support the simulation of system performance for different Army missions with relevant environmental physics in various geographic settings worldwide; provide input to and obtain output from combat simulations for different echelons pertaining to system performance; and conduct system trades that consider system performance in different operational environments and mission contexts. This effort focuses on Future Vertical Lift and Advanced Unmanned Aircraft System platforms.			
FY 2020 Plans: Will support Future Vertical Lift through the advancement of workflow automation processes for rotorcraft platforms; will integrate mission effectiveness into the resulting trade spaces; will leverage emerging data analytics techniques and machine learning			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AL3 / *HPC for Rotorcraft Applications Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
algorithms to optimize insight prior to acquisition decision points; and mature novel methodologies that incorporate the use of high-fidelity, physics-based simulations to enable multi-disciplinary design and optimization. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603734A / Project T08.			
Accomplishments/Planned Programs Subtotals	-	-	4.958

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AL6 / *Degraded Vis Environ Mitigation (DVE-M) Adv Tech*	

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
AL6: *Degraded Vis Environ Mitigation (DVE-M) Adv Tech*	-	0.000	0.000	29.151	-	29.151	0.000	0.000	0.000	0.000	0.000	29.151

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech
PE 0603710A Night Vision Advanced Technology, Project:
* K86 Night Vision, Abn Sys

A. Mission Description and Budget Item Justification

This Project develops, matures, and demonstrates advanced sensors, cueing, and flight controls to provide the ability to maintain terrain and obstacle situational awareness during all Degraded Visual Environment Mitigation (DVE-M) environments on current Army Aviation and Future Vertical Lift (FVL) platforms. The program provides an opportunity for DoD, North Atlantic Treaty Organization (NATO) nations, global industry, and academia to participate with their own assets in order to foster information exchange and collaboration.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Degraded Visual Environment Mitigation (DVE-M)	-	-	16.855
Description: Develop and mature advanced sensor cueing and flight controls to provide ability to maintain terrain and obstacle situational awareness during all DVEs both aircraft induced (brown-out & white-out) and environmentally induced (fog, rain, snow etc.). Flight testing on fleet aircraft is an integral component of the demonstration.			
FY 2020 Plans: Will develop and demonstrate integrated cutting-edge sensors, advanced flight controls, and refined cueing schemes to provide the ability to maintain terrain and obstacle situational awareness during Degraded Visual Environments (DVEs) such as aircraft-induced (brown-out & white-out) and environmentally-induced (fog, rain, snow etc.). Will flight test a mission adaptive autonomy			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AL6 / *Degraded Vis Environ Mitigation (DVE-M) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
system adapted for use on a partial-authority helicopter. Efforts include flight trials in various climates and environments which also presents an opportunity for DoD, North Atlantic Treaty Organization (NATO) nations, industry, and academia to participate with their own assets to foster information exchange and collaboration. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 313.			
Title: Sensors for DVE-M ***Description:*** This effort will mature and demonstrate combinations of sensors (radar and infrared) and sensor fusion technologies to assess their degree of effectiveness to improve safety of flight under degraded visual conditions. Effort includes development of 3 dimensional (3D) local area maps derived/refined by data from onboard sensors. 3D maps will be utilized to generate two dimensional (2D) views of the environment for presentation to pilots/crew and also support demonstration of autonomous behaviors including flight guidance and safe landing zone determination. Effort will result in an improved understanding of the complex sensor/fusion trade space to improve development of requirements and acquisition strategies for Future Vertical Lift (FVL) and the current fleet. ***FY 2020 Plans:*** Will complete initial flight testing and optimize DVE sensor subsystem; will integrate sensor subsystem with cueing and flight guidance/control subsystems onto single testbed aircraft. Will demonstrate combined DVE system in three DVEs. Will complete final technical report capturing lessons learned and recommendations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603710A / Project K86.	-	-	12.296
Accomplishments/Planned Programs Subtotals	-	-	29.151

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AL7 / *Full Spectrum Targeting Advanced 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
AL7: *Full Spectrum Targeting Advanced Technology*	-	0.000	0.000	5.425	-	5.425	9.917	10.124	10.326	10.442	0.000	46.234

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603710A Night Vision Advanced Technology, Project:
* K86 Night Vision, Abn Sys

A. Mission Description and Budget Item Justification

This Project demonstrates next generation targeting concepts for Future Vertical Lift (FVL) and Future Unmanned Aircraft System (FUAS) platforms.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Full Spectrum Targeting	-	-	5.425
Description: This effort will mature and demonstrate key targeting sensor system and automation (i.e. Artificial Intelligence / Machine Learning (AI/ML)) technologies essential to enable the Future Vertical Lift (FVL) and Future Unmanned Aircraft System (FUAS) modernization priorities. Effort will leverage advancements in laser, infrared imaging focal plane arrays, and multi/ hyperspectral system technologies to develop a stabilized, turreted payload that can actively and/or passively image in multiple spectral bands simultaneously providing robust targeting and situational awareness capabilities for the prevailing battlefield conditions. Effort will demonstrate the ability of multi/hyperspectral sensing to autonomously identify tactical threats and reduce cognitive workloads through sensor fusion and automated spectral selection.			
FY 2020 Plans: Will mature laser imaging and automation components; will collect broadband and multi / hyperspectral data and optimize for increased automation; will complete initial payload design consistent with FVL size, weight, and power constraints.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AL7 / *Full Spectrum Targeting Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This work was previously performed in PE0603710A / Project K86.			
Accomplishments/Planned Programs Subtotals	-	-	5.425

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 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AM3 / *Aircraft and Aircrew Protection Advanced Tech*	

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
AM3: *Aircraft and Aircrew Protection Advanced Tech*	-	0.000	0.000	4.548	-	4.548	5.229	5.334	5.441	5.502	0.000	26.054

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This project demonstrates integrated, scalable, and structural platform solutions for Future Vertical Lift (FVL) and Future Unmanned Aircraft Systems (FUAS) platforms that improves crashworthiness, damage tolerance, sustainment, survivability and break-through weight efficiency while maintaining mission performance requirements.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

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.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Aircraft and Aircrew Protection	-	-	4.548
Description: Demonstrate integrated, scalable, and structural platform solutions for Future Vertical Lift (FVL) and Future Unmanned Aircraft Systems (FUAS) platforms that improves crashworthiness, damage tolerance, sustainment, survivability and break-through weight efficiency while maintaining mission performance requirements. ***FY 2020 Plans:*** Will mature and demonstrate integrated, advanced structural assemblies that enable FVL and FUAS platform improved crashworthiness, damage tolerance, weight efficiency, sustainment, and survivability. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	4.548

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AM3 / *Aircraft and Aircrew Protection Advanced Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A