Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army											Date: May 2021	
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*							
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
Total Program Element	-	180.163	220.334	179.677	-	179.677	-	-	-	-	-	-
AI4: *Joint Multi-Role (JMR) Demonstration Advanced Tech*	-	18.239	-	-	-	-	-	-	-	-	-	-
AI6: *Next Gen Tactical UAS TD Advanced Technology*	-	9.589	-	-	-	-	-	-	-	-	-	-
AI8: *Alternative Concept Engine Advanced Technology*	-	2.808	2.507	3.828	-	3.828	-	-	-	-	-	-
AJ1: *Future UAS Engine Advanced Technology*	-	1.659	2.724	-	-	-	-	-	-	-	-	-
AJ3: *Next Generation Rotorcraft Transmission Adv Tech*	-	1.052	1.342	1.404	-	1.404	-	-	-	-	-	-
AJ5: *Digital Vehicle Management & Control Advanced Tech*	-	1.105	6.515	-	-	-	-	-	-	-	-	-
AJ7: *Advanced Rotors Advanced Technology*	-	2.397	2.407	2.477	-	2.477	-	-	-	-	-	-
AJ9: *Integ Mission Equip for Vert Lift Systems Adv Tech*	-	15.170	21.719	24.063	-	24.063	-	-	-	-	-	-
AK3: *Aviation Survivability Advanced Technology*	-	19.978	11.168	3.966	-	3.966	-	-	-	-	-	-
AK5: *Multi-Role Small Guided Missile Advanced Tech*	-	2.326	2.888	5.867	-	5.867	-	-	-	-	-	-
AK7: *Adv Rotorcraft Armaments Protection Sys Adv Tech*	-	3.010	6.177	10.541	-	10.541	-	-	-	-	-	-
AK8: *Air Launched Effects Advanced Technology*	-	3.083	28.542	28.905	-	28.905	-	-	-	-	-	-
AL1: *Adv Teaming for Tactical Aviation Oper Adv Tech*	-	20.102	40.157	39.953	-	39.953	-	-	-	-	-	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army												Date: May 2021
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*	-	4.780	4.862	5.073	-	5.073	-	-	-	-	-	-
AL6: *Degraded Vis Environ Mitigation (DVE-M) Adv Tech*	-	30.302	-	-	-	-	-	-	-	-	-	-
AL7: *Full Spectrum Targeting Advanced Technology*	-	5.202	9.610	9.393	-	9.393	-	-	-	-	-	-
AL9: *Holistic Sit Awareness and Dec Making Adv Tech*	-	-	4.871	19.529	-	19.529	-	-	-	-	-	-
AM3: *Aircraft and Aircrew Protection Advanced Tech*	-	4.361	-	-	-	-	-	-	-	-	-	-
AM5: *Opt Energy Stg & Therm Mgmt for FVL Surv Adv Tech*	-	-	1.925	-	-	-	-	-	-	-	-	-
BP8: *Future Vertical Lift Air Platform Adv Tech (CA)*	-	35.000	68.750	-	-	-	-	-	-	-	-	-
CA8: *Adv Rotocraft Armaments Protection Sys*	-	-	0.963	1.234	-	1.234	-	-	-	-	-	-
CC4: *FVL Radar Advanced Technologies*	-	-	3.207	4.000	-	4.000	-	-	-	-	-	-
CG1: *Holistic Team Survivability Adv Tech*	-	-	-	6.424	-	6.424	-	-	-	-	-	-
CH6: *Adapt & Resilnt Tact Autnmy Cont & Struct Adv Tech*	-	-	-	4.561	-	4.561	-	-	-	-	-	-
CH7: *Power & Thermal Management for FVL Adv Tech*	-	-	-	3.402	-	3.402	-	-	-	-	-	-
CH8: *UAS Survivability Adv Technology*	-	-	-	5.057	-	5.057	-	-	-	-	-	-

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army	Date: May 2021
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*

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), PE 0602183A Air Platform Applied Research and PE 0603043A Air Platform 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) and the Army Engineering Research and Development Center (ERDC).

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	174.892	156.194	190.050	-	190.050
Current President's Budget	180.163	220.334	179.677	-	179.677
Total Adjustments	5.271	64.140	-10.373	-	-10.373
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-11.748	-			
• Congressional Rescissions	-	-			
• Congressional Adds	35.000	68.750			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-12.252	-			
• SBIR/STTR Transfer	-5.729	-4.610			
• Adjustments to Budget Years	-	-	-10.373	-	-10.373

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: BP8: *Future Vertical Lift Air Platform Adv Tech (CA)*		
Congressional Add: *Joint Tactical Aerial Resupply Vehicle*	6.000	8.000
Congressional Add: *Advanced Helicopter Seating System*	5.000	15.000
Congressional Add: *Adhesive Technology*	3.000	-
Congressional Add: *Helicopter Emergency Oil Systems*	2.000	2.000
Congressional Add: *UAV Fuel Systems Enhancements*	2.000	2.000
Congressional Add: *Surface Tolerant Advanced Adhesives*	5.000	5.000
Congressional Add: *Ferrium Steels for Improved Drive Systems*	4.000	5.000
Congressional Add: *Stretch Broken Composite Material Forms*	8.000	-
Congressional Add: *Program increase - UH-60 main rotor blade modernization*	-	5.000
Congressional Add: *Program increase - soldier information interface for aviation fleet management tool*	-	2.250

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army	Date: May 2021
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*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Congressional Add: *Program increase - displays and safety in DVE*	-	4.000
Congressional Add: *Program increase - digital engineering demonstration*	-	8.000
Congressional Add: *Program increase - tethered UAS for all?terrain vehicles*	-	12.500
Congressional Add Subtotals for Project: BP8	35.000	68.750
Congressional Add Totals for all Projects	35.000	68.750

Change Summary Explanation

FY2020 funding change due to $35.000 M in Congressional adds, and -$11.748M in Congressional Rescissions

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AI4: *Joint Multi-Role (JMR) Demonstration Advanced Tech*	-	18.239	-	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2021 (FY21), this Project terminates.

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 2020	FY 2021	FY 2022
Title: Joint Multi-Role (JMR) Technology Demonstration	18.239	-	-
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.			
Accomplishments/Planned Programs Subtotals	18.239	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army										Date: May 2021		
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 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
AI6: *Next Gen Tactical UAS TD Advanced Technology*	-	9.589	-	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2021 (FY21) this Project is realigned to:
Program Element (PE) 0603465A Future Vertical Lift Advanced Technology
* Project AK8 Air Launched Effects Advanced Technology

The FY20 funding requested in this Project was reduced in the FY20 Appropriation Conference Report.

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

Work in this effort is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Next Gen Tactical UAS Technology Demonstration	9.589	-	-
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.			
Accomplishments/Planned Programs Subtotals	9.589	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AI8: *Alternative Concept Engine Advanced Technology*	-	2.808	2.507	3.828	-	3.828	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Alternative Concept Engine (ACE)	2.808	2.507	1.720
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 2021 Plans: Complete ACE fabrication. Will conduct engine performance demonstration and testing. Engine test metrics will include variable output speed, fuel efficiency, high power to weight ratio, and durability. Engine technologies will be demonstrated to Technology Readiness Level (TRL) 6 for Future Vertical Lift applications.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
Will complete engine sand ingestion and performance demonstration testing. Engine test metrics will include variable output speed, power turbine efficiency, high power to weight ratio, and durability. Engine technologies will be demonstrated to Technology Readiness Level (TRL) 6 for Future Vertical Lift applications. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle glide path of this effort with ramp down of testing efforts in FY22.			
Title: Improved Propulsion Technology Demonstration (IPTD) ***Description:*** Effort will develop and execute an advanced engine integration, maintenance, and capability improvement strategy to produce key technology advancements on Future Long Range Assault Aircraft (FLRAA) engine systems, including the ACE engine technologies as appropriate. Full engine validation testing will be completed to TRL 6 providing improved propulsion system performance, maintainability, and durability while reducing integration risk for FVL FLRAA Platform. ***FY 2022 Plans:*** Will perform trade-off analysis and design of advanced engine technologies in engine integration, maintainability, and technology to produce improved engine performance, maintainability, and durability to meet FLRAA capability needs. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22, funding from PE 0603465A, Project AJ1 Future UAS Engine Advanced Technology, is realigned to this effort.	-	-	2.108
Accomplishments/Planned Programs Subtotals	2.808	2.507	3.828

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AJ1: *Future UAS Engine Advanced Technology*	-	1.659	2.724	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022 this Project was realigned to:
Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology) / AI8 (Alternative Concept Engine Advanced Technology)

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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Reliable Advanced Small Power Systems	1.659	2.724	-
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 2021 Plans:*** Perform Reliable Advanced Small Power System engine design optimization. Complete fabrication and integration of engine components, hardware and assembly for engine test. Engine test metrics will include Horsepower to Weight ratio, Specific Fuel Consumption and Noise Signature. ***FY 2021 to FY 2022 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
In FY22 this effort is realigned to, PE 0603465A (Future Vertical Lift Advanced Technology) / AI8 (Alternative Concept Engine Advanced Technology).			
Accomplishments/Planned Programs Subtotals	1.659	2.724	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AJ3: *Next Generation Rotorcraft Transmission Adv Tech*	-	1.052	1.342	1.404	-	1.404	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Next Generation Rotorcraft Transmission	1.052	1.342	-
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 2021 Plans:*** Variable speed transmission and controls will be integrated into an iron-bird ground test facility. The integrated system will go through endurance testing to demonstrate functionality and reliability consistent with project goals. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding is realigned in FY22 to the High Reduction-Ratio Transmission effort within this project.			
Title: High Reduction-Ratio Transmission.	-	-	1.404
Description: This effort will mature and demonstrate the technologies necessary for development, design, fabrication, and testing of a high reduction-ratio transmission in two stages or less (60:1 reduction ratio) with high efficiency and improved reliability against corrosion and seal leakage. Technology demonstrations from this effort will be applicable to Future Vertical Lift (FVL) platforms.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2022 Plans: Begin design of a transmission that demonstrates a 60:1 reduction ratio two-stage gearbox design that provides significant weight and volume reduction for extended range and component life for manned and unmanned applications. Design will include advanced gear materials and advanced seals for high reliability and reduced life-cycle costs. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding is realigned in FY22 from the Next Generation Rotorcraft Transmission effort within this project.			
Accomplishments/Planned Programs Subtotals	1.052	1.342	1.404

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army											Date: May 2021	
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 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
AJ5: *Digital Vehicle Management & Control Advanced Tech*	-	1.105	6.515	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2022 (FY22) this Project was administratively realigned to:
Program Element (PE) 0603465A / Future Vertical Lift Advanced Technology
* Project CH6 Adapt & Resilnt Tact Autnmy Cont & Struct Adv 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. Develops and demonstrates structures technologies and mission-adaptive autonomy and control algorithms that provide level 1 handling qualities, resilience to extreme and hostile environments, damage-mitigation by reconfiguration of redundant controls, increased agility and speed with minimal fatigue, increased payload and weight efficiency, optional pilotage and manned-unmanned teaming capabilities, cognitive off-loading, and reduction of structural maintenance burden.

Work in this Project is fully coordinated with Program Element (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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Digital Vehicle Management and Control	1.105	-	-
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.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
Title: Adaptive and Resilient Tactical Autonomy, Controls, and Structures (ARTACS) Adv Tech	-	6.515	-
Description: Develop, integrate, and demonstrate autonomy, controls, and advanced structures technologies to ensure mission success for manned/unmanned, multiple capability set FVL platforms in the contested environment of multi-domain operations. ***FY 2021 Plans:*** Develop, integrate, and demonstrate autonomy, structures, and controls technologies that enable multi-domain operations performance, efficiency, and versatility, and enhance extreme environment reliability and availability. Conduct trade studies to optimize the synergy of applicable technologies that will include weight-optimized, fatigue-tolerant, multifunctional, structural configurations, advanced modeling techniques for Future Vertical Lift platforms, advanced flight controls for configurations with redundant effectors at high speed, and state-of-the-art algorithms for autonomy, optional pilotage, and teaming. Complete the development of the Rotorcraft Aircrew Systems Concept Airborne Laboratory (RASCAL) Version 2.0 in-flight laboratory to enable demonstration of relevant technologies in load alleviation, component life extension, damage tolerance, advanced flight controls, autonomy, optional pilotage, manned/unmanned teaming, and air-launched effects. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** This effort is realigned in FY22 to 0603465A (Future Vertical Lift Advanced Technology) / CH6 (Adaptive & Resilient Tactical Autonomy, Controls, and Structures (ARTACS) Advanced Tech).			
Accomplishments/Planned Programs Subtotals	1.105	6.515	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AJ7: *Advanced Rotors Advanced Technology*	-	2.397	2.407	2.477	-	2.477	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Advanced Rotors Technology	2.397	2.407	-
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 2021 Plans: Conduct detailed design of high speed, highly efficient rotor system for FUAS platforms. Complete component technology bench testing. Conduct planning for fabrication of demonstration hardware.			
FY 2021 to FY 2022 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
In FY22, this effort is realigned to the High Speed, Highly Efficient Rotors effort within this project.			
Title: High Speed, Highly Efficient Rotors ***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) increased system durability, efficiency, speed, range, and payload. Technologies include: integrated high speed, low drag rotor technologies for high speed configurations; interactional aerodynamics tailoring between rotor and body & auxiliary lift/ propulsors; light weight, low volume, efficient and high authority electro-mechanical actuators (EMAs); reliable and robust actuators/hubs/controls for Independent Blade Control (IBC)/ swashplateless rotors; active/passive flow control; and automated track and balance. ***FY 2022 Plans:*** Will complete detailed design of high speed, highly efficient rotor system for FVL platforms. Will commence fabrication of demonstration hardware. Will commence structural test planning. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22, this effort is realigned from the Advanced Rotors Technology effort within this Project	-	-	2.477
Accomplishments/Planned Programs Subtotals	2.397	2.407	2.477

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army											Date: May 2021	
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 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
AJ9: *Integ Mission Equip for Vert Lift Systems Adv Tech*	-	15.170	21.719	24.063	-	24.063	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

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

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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Integrated Mission Equipment for Vertical Lift Systems	15.170	21.719	24.063
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 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 2021 Plans: Develop the initial verification process and conduct experiments for the Architecture Verification Environment (AVE). Complete mechanization of the AVE validation process to achieve TRL 5 and will use to validate FVL architecture for the Future Long Range Assault Aircraft (FLRAA) Mid-Tier Acquisition Request for Proposal and Contract Award. Begin laboratory testing of digital backbone candidate technologies, testing core software infrastructure in a laboratory, continuing safety accreditation process of infrastructure, and beginning acquisition of core mission capabilities. Complete Mission System Flying Testbed (FTB)			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
requirements and design, identifying initial demonstration mission systems, acquiring FTB components and beginning aircraft modifications. ***FY 2022 Plans:*** Will complete purchasing, assembly, and checkout of the Architecture Verification Environment (AVE) facility to provide validation and verification of the FY21 National Defense Authorization Act (NDAA) Modular Open Systems Approach (MOSA) requirements. Will mature the verification process and conduct MOSA validation and verification on Future Vertical Lift (FVL), Enduring Fleet and S&T developed artifacts to identify and close gaps for FVL. Will develop MOSA engineering processes and training materials for wider adoption of MOSA. Will acquire candidate Digital Backbone technologies to evaluate in the AVE facility and update the Digital Backbone Objective Architecture. Will acquire core, reusable mission capabilities (e.g., route planning, digital map) to test Model Based System Engineering (MBSE), airworthiness and cyber qualification methods. Will expand the cloud-based Architecture Collaboration Environment (ACE) capabilities and maintain Authority to Operate (ATO) to develop MBSE specifications for the Digital Backbone, core software infrastructure capabilities, and Mission Systems Flying Testbed (MSFTB) to be integrated on UH-60M Black Hawk . Will acquire core software infrastructure capabilities, that are airworthy, and cyber security certifiable, for the MSFTB and conduct laboratory integration assessments. Will acquire and install the Digital Backbone A-Kit in a UH-60M aircraft. Will design and acquire the MSFTB ground and flight test equipment and begin component assembly in the ground lab environment. Will perform a model-based source selection of multiple MSFTB Mission System Integrators for future down-selection based on FY21 NDAA MOSA requirements ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase in FY22 supports more testing and demonstrations for core software infrastructure and digital backbone on UH-60M.			
Accomplishments/Planned Programs Subtotals	15.170	21.719	24.063

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AK3: *Aviation Survivability Advanced Technology*	-	19.978	11.168	3.966	-	3.966	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

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. Also matures and demonstrates UAS survivability technologies to enable manned/unmanned team based approaches to enable operation in contested peer/near peer environments
Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift 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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Survivability Against Integrated Networked Threats	4.802	3.655	3.966
Description: This effort increases rotorcraft survivability by reducing platform signatures, providing the means to more efficiently counter enemy detection and tracking systems			
FY 2021 Plans: Continue the development and refinement of Aircraft Survivability Correlator algorithms. Develop and refine own-ship and team-based survivability behaviors. Integrate holistic technologies to enhance Future Vertical Lift survivability. Integrate components in preparation for System Integration Laboratory experimentations.			
FY 2022 Plans: Will mature Survivability Correlator software and supporting components, such as the interfaces to available sensors and effectors, for demonstration. Will integrate relevant sensors and effectors, verify functionality, and demonstrate own-ship Aircraft Survivability Correlator capabilities. Will continue development of team-based survivability technologies.			
FY 2021 to FY 2022 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
FY22 funding increase to reflect demonstrations of Aircraft Survivability capabilities.			
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.	8.642	-	-
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.	6.534	-	-
Title: Cognitive Countermeasures Maturation and Demonstration ***Description:*** This effort matures and demonstrates adaptive countermeasure technologies that provide platform protection against guided threats. It provides countermeasure electronics for adaptive decision making and countermeasure components that enable systems to counter the characteristics of agile threats. ***FY 2021 Plans:*** Mature electronic countermeasure module and measure initial performance; demonstrate countermeasure components to detect, identify, and locate threats; mature supporting RF electronics and components for electronic countermeasure demonstration. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** This effort ends in FY21.	-	2.000	-
Title: EW Air Sensors / CM ***Description:*** This effort matures and demonstrates sensor and countermeasure technologies that provide platform protection and integrated cueing against advanced and emerging threats to aviation platforms. It provides advanced sensors and effectors capable of detecting and responding to threats with diverse signatures. ***FY 2021 Plans:*** Mature hardware and supporting components for demonstration; complete proof-of-concept hardware; perform data collection with hardware to verify functionality. ***FY 2021 to FY 2022 Increase/Decrease Statement:***	-	4.483	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
This effort is realigned in FY22 to PE 0603465A FVL Adv Tech, Project CG1 Holistic Team Survivability Adv Tech.			
Title: UAS Survivability Demonstration	-	1.030	-
Description: UAS Survivability Technology (UST) addresses the evolving threat environment to support the Maneuver Force within the Multi-Domain Battle concept. UST will develop and demonstrate increased UAS Survivability in a peer / near-peer environment with minimal impacts to aircraft performance. This work supports Future Vertical Lift and Advanced Unmanned Aircraft Systems. ***FY 2021 Plans:*** Develop UAS Survivability behaviors and mission profiles. Develop UAS susceptibility and electromagnetic vulnerability reduction technologies. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding realigned in FY22 to PE 0603465A FVL Adv Tech, Project CH8 UAS Survivability Adv Technology.			
Accomplishments/Planned Programs Subtotals	19.978	11.168	3.966

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AK5: *Multi-Role Small Guided Missile Advanced Tech*	-	2.326	2.888	5.867	-	5.867	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2021, funds were realigned from:
PE 0603464A (Long Range Precision Fires Advanced Technology) / AH3 (Single Multimission Attack Missile Adv Tech)
PE 0603464A / AH1 (Multiple Simul Engagement Technologies Adv Tech).

A. Mission Description and Budget Item Justification

This Project matures and demonstrates a holistic lethality solution for current Army Aviation and Future Vertical Lift (FVL) Modernization Priority. This effort matures and demonstrates critical technology and designs component for future affordable rockets and missiles to provide overwhelming defeat of conventional and asymmetrical threats in all environments. Matures and demonstrates component technologies to enable an expeditionary short-to-medium range loitering missile with man-in-the-loop capability for situational awareness, targeting, and lethal effects against hard and soft targets.

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Modular Missile Advanced Technology ***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.	2.326	-	-
Title: Single Multi-Mission Attack Missile ***Description:*** Matures and demonstrates component technologies for an expeditionary short-to- medium range loitering missile with man-in- the-loop capability for situational awareness, targeting, and lethal effects against hard and soft targets.	-	2.888	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
FY 2021 Plans: Demonstrate component technologies in a surrogate flight testbed; will evaluate performance of datalink, navigation, fire control, and warhead hardware and software in representative flight environment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** This effort completes in FY21 as planned.			
Title: Multiple Simultaneous Engagement Technologies (MSET) ***Description:*** Matures and demonstrates critical component technology and designs for future missiles that provide simultaneous multiple launch, control, and supervised autonomous terminal engagement of multiple missiles against stationary and moving hard/soft targets, image-based target discrimination/shared situation awareness/lock-on, and multi-missile control digital datalink with inter-missile cooperative networked communications. The end-state is a multi-missile Organic C2 solution that handles all aspects of sensor integration, fire control, and airspace management. This capability will support overwhelming lethal effects against anti-access/aerial denial (A2AD) / Integrated Air Defense Systems (IADS). ***FY 2022 Plans:*** Will mature and demonstrate component technologies through system level simulation integration and initial Hardware In the Loop (HWIL) component integration. Will continue to mature and improve component technologies utilizing simulation and HWIL results with the objective to suppress, defeat and/or destroy near peer A2AD/IADS threats at maximum survivable ranges. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** This planned new effort continues maturation and demonstration of technologies being developed in PE 0602148A/AK4 Multi-Role Small Guided Missile Technology, PE 0602147A/AH2 SMAM Technologies and PE 0602147A/AG9 MSET Technologies necessary to equip the warfighter with the capability of simultaneous multiple launch, control, and supervised autonomous terminal engagement of loitering missiles.	-	-	5.867
Accomplishments/Planned Programs Subtotals	2.326	2.888	5.867

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AK7: *Adv Rotorcraft Armaments Protection Sys Adv Tech*	-	3.010	6.177	10.541	-	10.541	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

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, focused on but not limited to Future Attack Reconnaissance Aircraft. 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 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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Aviation Armament System Technologies ***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.	3.010	-	-
Title: ARAPS-FARA ***Description:*** This effort matures and demonstrates a holistic medium caliber lethality solution for Future Vertical Lift offensive applications. Develops components for use in multi-role armament solutions for fire control, software, armament systems, and munitions. ***FY 2021 Plans:*** Mature and demonstrate a 20mm medium caliber armament system for integration onto Future Vertical Lift. Demonstrate a novel 20mm multi-purpose munition with advanced capabilities versus current air launched munitions. ***FY 2022 Plans:***	-	5.744	9.934

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will mature aviation specific fire control software and algorithms to support aviation requirements for turreted medium caliber weapon targeting solutions including Future Vertical Lift Future Attack Reconnaissance Aircraft?s. Will integrate and optimize a 20mm armament system onto a representative aviation platform. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** FY22 increase is due to integrating and optimizing the 20mm armament system on a representative platform.			
Title: ARAPS-Dispenser ***Description:*** This effort matures and demonstrates a dispenser countermeasure, a component of the holistic survivability solution for Future Vertical Lift defensive applications. Develop components for use in multi-role countermeasure solutions for fire control, software and countermeasure systems. ***FY 2021 Plans:*** Mature a countermeasure dispenser solution that provides increased survivability for current and future aviation platforms. ***FY 2022 Plans:*** Will optimize design of countermeasure dispenser to further address survivability for current and future aviation platforms. Will demonstrate capabilities of an optimized counter measure dispenser. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort in design optimization of dispenser.	-	0.433	0.607
Accomplishments/Planned Programs Subtotals	3.010	6.177	10.541

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AK8: *Air Launched Effects Advanced Technology*	-	3.083	28.542	28.905	-	28.905	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2021, funds were realigned from:
PE 0603465A (Future Vertical Lift Advanced Technology) / AI6 (Next Gen Tactical UAS TD Advanced Technology)

A. Mission Description and Budget Item Justification

This project develops and demonstrates the ability to launch an Unmanned Aircraft System (UAS) from a manned or unmanned Future Vertical Lift (FVL) aircraft at tactical altitudes and to control the UAS from the cockpit or a crew station; and assesses the enabled capabilities and determine their relevance to current Army Aviation engagement and survivability portfolios.

Work in this Project is fully coordinated with Program Element (PE) 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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Air Launched Effects	3.083	28.542	28.905
Description: Develop and demonstrate the ability to launch a Future Unmanned Aircraft Systems (FUAS) from 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, and communications relay.			
FY 2021 Plans: Integrate mission payloads and behaviors into an air launched UAS and demonstrate reconnaissance, surveillance, electronic warfare, and decoy multi-domain operational concepts; demonstrate and evaluate modular open system architecture approaches			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
for attainable air and ground launched unmanned air vehicles; assess mission effectiveness of individual and teamed organic UAS assets in support of the manned aircraft. Develop and integrate advanced autonomy algorithms to decrease operator workload. ***FY 2022 Plans:*** Will integrate synthetic aperture radar payload, enhanced target acquisition software, and complimentary autonomous behaviors into air launched effects UAS, and evaluate increased capability to detect, identify, locate, and report threats through flight testing. Will integrate decoy payloads and associated individual UAS autonomous employment behaviors into air launched effects, and evaluate system performance through flight testing. Will integrate advanced communications payload into air launched effects UAS and evaluate effectiveness for Joint all-domain operations. Will mature and integrate a modular open systems approach (MOSA) based mission equipment package in accordance with approved hardware and software architectures to allow rapid technology insertion and payload integration on the future family of air launched effects air vehicles. Will mature and evaluate air launched UAS recovery system, enabling cost savings and improved mission capability through asset reuse. Will demonstrate improvements in mission effectiveness enabled through these air launched effects enhancements as a part of a multi-domain combined arms team through participation in Joint service all-domain experiments. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	3.083	28.542	28.905

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AL1: *Adv Teaming for Tactical Aviation Oper Adv Tech*	-	20.102	40.157	39.953	-	39.953	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates and drafts frameworks for autonomous 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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Advanced Teaming Demonstration	20.102	32.378	32.055
Description: Develop and demonstrate teaming behaviors and autonomous decision making for mixed FVL and FUAS platform formations in combined arms operations that are beyond current 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 2021 Plans: Mature and demonstrate advanced teaming technologies focused on collaborative lethal attack in GPS denied conditions; integrate attack teaming hardware and software into mission systems packages for test and evaluation; simulate autonomous team attack behaviors in foundational mission based vignettes; and test and evaluate modular open systems based frameworks for certifiable team autonomy.			
FY 2022 Plans: Will mature and integrate advanced teaming technologies into mission systems teaming architecture for mixed formations of manned and unmanned aircraft, and demonstrate through flight testing multi-Unmanned Aircraft System (UAS) collaborative reconnaissance, surveillance, target acquisition (RSTA), coordinated attack, and decoy in GPS denied and communications			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
degraded conditions. Will simulate autonomous decoy and electronic attack synchronized UAS team behaviors in mission representative vignettes. Will verify modular open systems integration approaches for rapidly upgradable and transitionable team autonomy. Will integrate collaborative autonomous behaviors including team mission command, autonomous RSTA execution, electronic warfare mission planning to disrupt or jam, coordinated RF homing and sensing using multiple aircraft equipped with aided target recognition, decoy mission management to divulge threats, and team adaptions network disruptions, into teams of UAS, including air launched effects, and demonstrate advanced teaming concepts of operations and improvements in mission effectiveness as a part of a multi-domain combined arms team through participation in Joint service all-domain experiments. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Sensors / Multi-Function Imagers for Future Aviation ***Description:*** Mature and demonstrate multi-function sensing system concepts to enable teaming behaviors and autonomous decision making for both manned and unmanned aviation platforms. This effort will enable tactical operations in complex environments (e.g. high threat, degraded visuals, and urban) through the use of sensing modules suitable for multiple tactical applications. The multifunction sensor approach will mitigate the need for additional dedicated sensor modules thus reducing the total cost and logistics burden for future aviation systems. ***FY 2021 Plans:*** Optimize tactical packaging design for universal multispectral sensor modules leveraging state-of-the-art digital readout dual band infrared sensor technologies developed within the Digital Dual Use Sensors effort for demonstration of multifunction sensing concepts. Demonstrate the suitability of the sensor module to support both pilotage and threat warning applications. Optimize sensor placement locations for both the Future Attack Reconnaissance Aircraft (FARA) and Future Long-Range Assault Aircraft (FLRAA) variants of FVL based on currently available designs ***FY 2022 Plans:*** Will mature digital readout dual band infrared sensor technologies for both pilotage and threat warning applications. Will mature digital readout integrated circuit based multispectral camera modules. Will demonstrate both laboratory and field test measurements to corroborate the higher sensitivity and fast frame rate performance of the novel multispectral cameras. Will integrate multispectral camera modules onto a manned airborne testbed platform. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	-	7.779	7.898
Accomplishments/Planned Programs Subtotals	20.102	40.157	39.953

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AL3: *HPC for Rotorcraft Applications Adv Tech*	-	4.780	4.862	5.073	-	5.073	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This effort develops and demonstrates the use of high-fidelity computational fluid dynamics 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 Future Unmanned Aircraft System (FUAS) platforms.

Work in this Project is fully coordinated with Program Element (PE) PE 0602148A (Future Vertical Lift 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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Engineered Resilient Systems for Future Vertical Lift ***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 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 next generation tactical unmanned aircraft system platforms.	4.780	-	-
Title: Engineered Resilient Systems (ERS) for Army Aviation ***Description:*** This effort supports Future Vertical Lift by exploiting advancements in physics-based software tools to provide rapid engineering analysis of proposed rotorcraft platforms, providing high-fidelity computational modeling of candidate Future Attack Reconnaissance Aircraft (FARA) platforms during the FARA down-selection, increasing the speed of simulations by automating simulation setup and execution on DoD HPC systems, and maturing and demonstrating the use of advanced machine learning techniques for aviation datasets to inform both the development of FVL systems and current operations. ***FY 2021 Plans:***	-	4.862	3.102

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
Optimize the execution of high-fidelity computational modeling of candidate Future Attack Reconnaissance Aircraft (FARA) platforms during the next phase of FARA down-selection. Improve the engineering analysis of FARA systems through the inclusion of mission effectiveness modeling and increased simulation fidelity. Demonstrate the use of physics-informed machine learning techniques to increase the accuracy of design software for future FVL lines of effort. ***FY 2022 Plans:*** Will improve the accuracy and continue to optimize the execution of low, medium, and high-fidelity computational modeling that supports ongoing analysis of the Future Attack Reconnaissance Aircraft (FARA) and Future Long-Range Assault Aircraft (FLRAA) platforms. Will improve the engineering analysis of the FARA and FLRAA systems through the inclusion of acoustic modeling and surrogate techniques. Will advance surrogate modeling techniques to increase the speed of analysis for FVL platforms. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects the planned lifecycle of this effort with the reduction of physics-informed machine learning techniques in FY22.			
Title: Engineered Resilient Systems (ERS) for Advanced Army Aviation Concepts ***Description:*** This effort supports Future Vertical Lift (FVL) by utilizing advanced machine-assisted design algorithms to explore design spaces and choose resilient platform variants. Advanced computational techniques will leverage automated design processes to expand computational testbeds in support of testing and evaluation. Increase high accuracy physics in modeling and simulation to optimize platforms for all operational environments and mission scenarios. Provide multi-fidelity computational models of candidate Future Attack Reconnaissance Aircraft (FARA), Future Long-Range Assault Platforms (FLRAA), and Future Tactical Unmanned Aircraft Systems (FTUAS) platforms to support acquisition decision-makers. ***FY 2022 Plans:*** Will optimize the execution of low, medium, and high-fidelity computational modeling that supports analysis of FVL Family of Systems, Air-Launched Effects, and candidate Future Tactical Unmanned Aircraft Systems (FTUAS) platforms. Will provide tools for evaluating Air-Launched Effects and UAS platform's ability to support mission objectives and platform effectiveness through the expansion of computational testbeds. Will demonstrate the use of advanced machine-assisted design techniques to increase the speed of analysis for FVL Family of Systems and UAS platforms. Will evaluate the expansion of computational modeling capability to secret and above secret high-performance computing. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase reflects the planned start of this effort in FY22 to focus on higher-fidelity physics models and advanced computational methods such as machine-assisted design algorithms.	-	-	1.971
Accomplishments/Planned Programs Subtotals	4.780	4.862	5.073

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AL6: *Degraded Vis Environ Mitigation (DVE-M) Adv Tech*	-	30.302	-	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2020 (FY20) 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

In Fiscal Year 2021 (FY21) this Project is terminated.

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.

Work in this effort is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Degraded Visual Environment Mitigation (DVE-M) ***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.	17.306	-	-
Title: Sensors for DVE-M	12.996	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
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.			
Accomplishments/Planned Programs Subtotals	30.302	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AL7: *Full Spectrum Targeting Advanced Technology*	-	5.202	9.610	9.393	-	9.393	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Full Spectrum Targeting	5.202	9.610	9.393
Description: This effort will mature and demonstrate key targeting sensor system 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 2021 Plans: Exploit broadband and multi/hyperspectral data from prior year collection to mature and demonstrate novel automated processing approaches for target detection, recognition, and identification. Validate performance of broadband and multi/hyperspectral automated processing algorithms. Complete initial data processing architecture design and demonstrate functionality and performance. Optimize and complete packaging of a high performance dual band megapixel infrared imaging sensor for the integrated targeting system demonstrator.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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 2020	FY 2021	FY 2022
Will mature and integrate a novel dual-band infrared sensor along with advanced active / passive optical components and active / passive sensors into a steerable turret. Will mature approaches for spectral imaging for target detection using the steerable turret to conduct data collections with multiple spectral bands against military targets in relevant environments. Will mature approaches for detection of hidden, obscured, and decoy targets to improve sensor target recognition and identification performance. Will demonstrate automated processing techniques in multiple spectral bands suitable for detection, recognition and identification of FVL and FUAS relevant target sets. Will develop techniques for sensor fusion and automated selection of optimal spectral bands to reduce FVL and FUAS cognitive burden. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	5.202	9.610	9.393

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AL9 / *Holistic Sit Awareness and Dec Making Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AL9: *Holistic Sit Awareness and Dec Making Adv Tech*	-	-	4.871	19.529	-	19.529	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

This project matures technologies from 0601248A AL8 Holistic Situational Awareness and Decision Making Technology project for further maturation and demonstration.

In FY22, work and funds were integrated into this project from: PE 0603118: Soldier Lethality Advanced Technology, Project BC4: Soldier Decision-Making & Comms Performance Advanced Tech Task 14: Early Human Systems Integration (HSI) Demonstration.

A. Mission Description and Budget Item Justification

This Project matures and demonstrates a pilotage and decision aiding system that allows for care free operations in complex and hostile environments through: demonstration of a comprehensive human machine interface for all SA domains (terrain & obstacles, threat, weather, & environment); and demonstration of decision aiding technologies to reduce cognitive loading of air crews during operations in complex and hostile environments.

Work in this Project is fully coordinated with Program Element (PE) PE 0602148A (Future Vertical Lift 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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Holistic Situational Awareness and Decision Making	-	4.871	9.629
Description: This program directly contributes to Future Vertical Lift (FVL) to ensure Future Aircraft pilots have the necessary situational awareness, accurate understanding of the tactical mission, and ability to decide faster than our adversaries. ***FY 2021 Plans:*** Demonstrate the decision-aiding algorithms, next-generation crew stations, and architectures needed to operate in complex and high-threat environments. Demonstrate how these systems effectively enable pilots to understand, process, and decide on the various information sources such as: threat awareness, manned-unmanned teaming with Unmanned Aircraft Systems (UAS), management of aviation survivability equipment, weapons targeting/handover, pilotage and navigation, operation in			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AL9 / *Holistic Sit Awareness and Dec Making Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
degraded visual environments, aircraft system management, GPS-denied operations, air-launched effects, blue force tracking, and communications. ***FY 2022 Plans:*** Will demonstrate FVL Air Mission Commander (AMC) increased effectiveness when equipped with the combined capabilities of a fused world model that includes both geo-referenced sensor output and abstract situational data, decision aiding tools, autonomous flight controls, and pilot cueing; Will participate in flight demonstration(s) to assess this capability?s impact on increasing mission effectiveness and reducing pilot cognitive workload ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase change due to increased flight demonstration activity, increased data collection of AMC effectiveness in a relevant environment and data management demands.			
Title: Multi-function RF for FVL Platforms ***Description:*** This effort matures and demonstrates multi-function radio-frequency (RF) sensor technologies to support the Future Vertical Lift (FVL) family of systems. It provides integrated software and hardware technologies that enable the use of common electronics and system components to support varied functions, such as enhanced situational awareness, threat-detection and localization, targeting, communications, and aircraft pilotage. This will result in improved performance for these critical functions and reduced requirements for size, weight, and power for mission equipment across FVL platforms. ***FY 2022 Plans:*** Will analyze the technical requirements of multiple functions and perform engineering analysis to determine technical specifications; will develop technical models of multi-function RF components and assess expected performance against mission requirements; will initiate development of multi-function RF components. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding realigned from Holistic Situational Awareness and Decision Making effort in this Project to this new effort in FY22.	-	-	7.930
Title: Early Human Systems Integration Demonstrations ***Description:*** Human Systems Integration (HSI) analysis assesses and matures technologies to optimize pilot situational awareness and workload management, crew task automation and decision-aiding, information management, and advanced crew station interfaces. The objective of this effort is to reduce crew decision and task execution timelines in a tactically challenging mission environment. ***FY 2022 Plans:***	-	-	1.970

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AL9 / *Holistic Sit Awareness and Dec Making Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will perform HSI analysis during simulation and flight demonstration to assess and enhance technologies for advanced crew station interfaces, pilot decision-aids, and information management to reduce decision timelines. Will collect pilot performance data and provide knowledge products to assess and help mature crew-enabling technologies. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22, work and funds are realigned from PE 0603118 ?Soldier Lethality Advanced Technology?, Project BC4 ?Soldier Decision-Making & Comms Performance Advanced Tech? to this effort.			
Accomplishments/Planned Programs Subtotals	-	4.871	19.529

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AM3: *Aircraft and Aircrew Protection Advanced Tech*	-	4.361	-	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2021 (FY21) this Project is realigned to:
PE 0603465A Future Vertical Lift Advanced Technology * Project AJ5 Digital Vehicle Management & Control Advanced Tech)
and the Project terminates.

A. Mission Description and Budget Item Justification

This Project demonstrates and provides 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 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.

Work in this project is performed by the United States Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Aircraft and Aircrew Protection ***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.	4.361	-	-
Accomplishments/Planned Programs Subtotals	4.361	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AM5 / *Opt Energy Stg & Therm Mgmt for FVL Surv Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AM5: *Opt Energy Stg & Therm Mgmt for FVL Surv Adv Tech*	-	-	1.925	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In FY22, this Project is administratively realigned to Program Element (PE) 0603465A
* Project CH7 Power & Thermal Management for FVL Adv Tech

A. Mission Description and Budget Item Justification

This Project develops and demonstrates at the system level, integrated power technologies (including power generation, distribution, and control along with advanced energy storage) and thermal management technologies to provide significantly higher electrical power capability to Future Vertical Lift (FVL) aircraft while addressing consequential size, weight, pulsed power, and thermal issues. Provides power capability for advanced electric aeromechanical effectors, advanced mission systems for route planning and teaming, and for advanced survivability and electronic warfare capability.

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

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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Optimized Energy for C5ISR Platforms Advanced Technology	-	1.925	-
Description: Enable advanced survivability systems on FVL platforms through component development improved high power and energy storage technologies, higher capacity lower Size, Weight, and Power (SWaP) cooling systems, and more efficient electrical architectures.			
FY 2021 Plans: Improve management strategies for loads based on SWaP requirements and aircraft platform constraints which include architectures and intelligent control variants. Mature the high resolution characterization of cyclical, step, and high power load profiles that are generated by lasers and other high power, short duration burst technology to demonstrate modular energy storage technology needed to support the loads. Optimize thermal management technologies to mitigate waste heat generated			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AM5 / *Opt Energy Stg & Therm Mgmt for FVL Surv Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
from inefficiencies in power conversion. Demonstrate hybrid energy storage technologies to support cyclic loads such as hybrid batteries or ultra-capacitor technology. Mature intelligent controls for platform-integrated power systems. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22, the work for this project is administratively realigned under PE 0603465A (Future Vertical Lift Technology / CH7 (Power and Thermal Management for FVL Adv Tech)			
Accomplishments/Planned Programs Subtotals	-	1.925	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) BP8 / *Future Vertical Lift Air Platform Adv Tech (CA)*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BP8: *Future Vertical Lift Air Platform Adv Tech (CA)*	-	35.000	68.750	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Congressional Interest Item funding provided for Future Vertical Lift Air Platform Advanced Technology.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Future Vertical Lift Air Platform Advanced Technology.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
Congressional Add: Joint Tactical Aerial Resupply Vehicle	6.000	8.000
FY 2020 Accomplishments: Program Increase to support advanced research on Joint Tactical Aerial Resupply Vehicle. Work will be executed under the direction of the Army Futures Command.		
FY 2021 Plans: Conduct advanced research in Joint Tactical Aerial Resupply Vehicle. Work executed by Army Futures Command.		
Congressional Add: Advanced Helicopter Seating System	5.000	15.000
FY 2020 Accomplishments: Program Increase to support advanced research on Advanced Helicopter Seating System. Work will be executed under the direction of the Army Futures Command.		
FY 2021 Plans: Conduct advanced research in Advanced Helicopter Seating System. Work executed by Army Futures Command.		
Congressional Add: Adhesive Technology	3.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** BP8 / *Future Vertical Lift Air Platform Adv Tech (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
FY 2020 Accomplishments: Program Increase to support advanced research on Adhesive Technology. Work will be executed under the direction of the Army Futures Command.		
Congressional Add: Helicopter Emergency Oil Systems ***FY 2020 Accomplishments:*** Program Increase to support advanced research on Helicopter Emergency Oil Systems. Work will be executed under the direction of the Army Futures Command. ***FY 2021 Plans:*** Conduct advanced research in Helicopter Emergency Oil Systems. Work executed by Army Futures Command.	2.000	2.000
Congressional Add: UAV Fuel Systems Enhancements ***FY 2020 Accomplishments:*** Program Increase to support advanced research on UAV Fuel Systems Enhancements. Work will be executed under the direction of the Army Futures Command. ***FY 2021 Plans:*** Conduct advanced research in UAV Fuel Systems Enhancements. Work executed by Army Futures Command.	2.000	2.000
Congressional Add: Surface Tolerant Advanced Adhesives ***FY 2020 Accomplishments:*** Program Increase to support advanced research on Surface Tolerant Advanced Adhesives. Work will be executed under the direction of the Army Futures Command. ***FY 2021 Plans:*** Conduct advanced research in Surface Tolerant Advanced Adhesives. Work executed by Army Futures Command.	5.000	5.000
Congressional Add: Ferrium Steels for Improved Drive Systems	4.000	5.000

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** BP8 / *Future Vertical Lift Air Platform Adv Tech (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
FY 2020 Accomplishments: Program Increase to support advanced research on Ferrium Steels for Improved Drive Systems. Work will be executed under the direction of the Army Futures Command. ***FY 2021 Plans:*** Conduct advanced research in Ferrium Steels for Improved Drive Systems. Work executed by Army Futures Command.		
Congressional Add: Stretch Broken Composite Material Forms ***FY 2020 Accomplishments:*** Program Increase to support advanced research on Stretch Broken Composite Material Forms. Work will be executed under the direction of the Army Futures Command.	8.000	-
Congressional Add: Program increase - UH-60 main rotor blade modernization ***FY 2021 Plans:*** Conduct advanced research in UH-60 Main Rotor Blade Modernization. Work executed by Army Futures Command.	-	5.000
Congressional Add: Program increase - soldier information interface for aviation fleet management tool ***FY 2021 Plans:*** Conduct advanced research in Soldier Information Interface for Aviation Fleet Management Tool. Work executed by Army Futures Command.	-	2.250
Congressional Add: Program increase - displays and safety in DVE ***FY 2021 Plans:*** Conduct advanced research in Displays and Safety in DVE. Work executed by Army Futures Command.	-	4.000
Congressional Add: Program increase - digital engineering demonstration ***FY 2021 Plans:*** Conduct advanced research in Digital Engineering Demonstration.	-	8.000

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** BP8 / *Future Vertical Lift Air Platform Adv Tech (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
Work executed by Army Futures Command.		
Congressional Add: Program increase - tethered UAS for all?terrain vehicles	-	12.500
FY 2021 Plans: Conduct advanced research in Tethered UAS for All-Terrain Vehicles. Work executed by Army Futures Command.		
Congressional Adds Subtotals	35.000	68.750

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) CA8 / *Adv Rotocraft Armaments Protection Sys*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
CA8: *Adv Rotocraft Armaments Protection Sys*	-	-	0.963	1.234	-	1.234	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2021 (FY21), this Project was realigned from:
Program Element (PE) 0603465A Future Vertical Lift Advanced Technology
* Project AK7 Adv Rotorcraft Armaments Protection Sys Adv Tech
* Project AK6 Adv Rotorcraft Armaments Protection Sys Tech

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, focused on but not limited to Future Long Range Assault Aircraft (FLRAA). 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 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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Advanced Rotorcraft Armanents Protection System-Future Long Range Assault Aircraft	-	0.963	1.234
Description: This effort matures and demonstrates a holistic small caliber lethality solution for FVL offensive applications. Integrates and demonstrates components for use in multi-role armament solutions for fire control, software, and armament systems.			
FY 2021 Plans: Mature a small caliber remote weapon system for integration on FVL. Demonstrate the increased capability of a remotely operated, stabilized armament system versus current aviation armament solutions.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** CA8 / *Adv Rotocraft Armaments Protection Sys*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will mature designs for enhanced lethality with use of stabilization and holistic fire control in aviation platforms for gunner applications. Will mature architecture and interfaces in conformance with Future Airborne Capability Environment (FACE). ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase reflects planned lifecycle of this effort in maturation of architecture and interfaces in conformance with FACE			
Accomplishments/Planned Programs Subtotals	-	0.963	1.234

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) CC4 / *FVL Radar Advanced Technologies*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
CC4: *FVL Radar Advanced Technologies*	-	-	3.207	4.000	-	4.000	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2021 (FY21) this Project was realigned from:
Program Element PE 0603772A / Advanced Tactical Computer Science and Sensor Technology
* Project 234 Sensors And Signals Processing

A. Mission Description and Budget Item Justification

This Project develops Next Generation Reconfigurable Radar Aperture for detection, tracking and precision targeting, navigation and fire control for both reconnaissance, surveillance, and target acquisition (RSTA) and intelligence, surveillance and reconnaissance (ISR).

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

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Multi-mission Airborne Radar	-	3.207	4.000
Description: Advanced Digital radio frequency (RF) processing integration with final demonstration subsystem and system level radar hardware and software designs.			
FY 2021 Plans: Analyze radar modes and operations and conduct detailed system design review. Perform full processing chain modeling and simulation to validate the models. Optimize wide-band tuning applications for RF systems and exercise third party implementation through multi-function demonstrations.			
FY 2022 Plans: Will leverage internal and joint partnerships to advance radar mode software development based upon the results of the system design review, market research and modeling and simulation efforts. Will develop advanced Airborne Moving Target Indicator			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** CC4 / *FVL Radar Advanced Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
mode, leveraging existing Air Force airborne search, scan, and track modes, to provide enhanced situational awareness and identification of airborne blue & red forces. Will develop Increment 1 Terrain Profiling radar mode. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase in line with the planned lifecycle of the program to reflect development of advanced Airborne Moving Target Indicator mode and first increment of terrain profiling mode.			
Accomplishments/Planned Programs Subtotals	-	3.207	4.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) CG1 / *Holistic Team Survivability Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
CG1: *Holistic Team Survivability Adv Tech*	-	-	-	6.424	-	6.424	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022, this is an administrative realignment with transitions from Program Element PE 0603465A Future Vertical Lift Advanced Technology
* AK3 Aviation Survivability Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates increased Future Vertical Lift Family of Systems Survivability (FVL FoS) in an advanced integrated air defense systems environment through a multi-layered approach. The approach focuses on maturing and demonstrating technologies for reducing aircraft susceptibility and vulnerability during pre-mission planning, mission execution (combat survivability and safety), and post-mission repair and return to service.

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Advanced RF Countermeasures	-	-	6.424
Description: This effort matures and demonstrates adaptive sensor and countermeasure technologies that provide platform protection against guided threats. It develops software and hardware to increase probability of detection and defeat of threats to aviation platforms using modeling and simulation (M&S), hardware in the loop (HIL) assessment, and field events. It provides integrated software and sensor technologies to counter the characteristics of advanced and agile threats.			
FY 2022 Plans: Will develop technical designs of electronics to support detect, decoy, and disrupt functions for Future Vertical Lift Platforms; will perform technical analysis of threat characteristics, analyze threat progression, and research new attack vectors to disrupt			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** CG1 / *Holistic Team Survivability Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
or degrade threat performance; will update technical models of electronics to analyze performance and determine technical specifications; will perform laboratory and field demonstrations of targeted payloads in critical technology areas. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding for this effort is realigned in FY22 from PE 0603465A FVL Adv Tech, Project AK3 Aviation Survivability for maturation and demonstration of adaptive sensor and countermeasure technologies that provide holistic platform protection against guided threats.			
Accomplishments/Planned Programs Subtotals	-	-	6.424

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) CH6 / *Adapt & Resilnt Tact Autnmy Cont & Struct Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
CH6: *Adapt & Resilnt Tact Autnmy Cont & Struct Adv Tech*	-	-	-	4.561	-	4.561	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2022 (FY22) this Project was administratively realigned from:
Program Element (PE) 0603465A / Future Vertical Lift Advanced Technology
* Project AJ5 Digital Vehicle Management and Control Advanced Tech.

A. Mission Description and Budget Item Justification

This Project matures, and demonstrates advanced autonomy, controls, and structures technologies that provide manned/unmanned Future Vertical Lift (FVL) platforms the decisive tactical overmatch of near-peer adversaries needed for combat mission success. Matures and demonstrates modeling capabilities, control law development, and handling quality criteria required for fully realizing capabilities of advanced configurations of Army aircraft. Develops and demonstrates structures technologies and mission-adaptive autonomy (MAA) and control algorithms that provide level 1 handling qualities, resilience to extreme and hostile environments, damage-mitigation by reconfiguration of redundant controls, increased agility and speed with minimal fatigue, increased payload and weight efficiency, optional pilotage and manned-unmanned teaming capabilities, cognitive off-loading, and reduction of structural maintenance burden.

Work in this Project is fully coordinated with Program Element (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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Adaptive and Resilient Engineered Structures (ARES) Technology Demonstration	-	-	3.448
Description: Mature, integrate, and demonstrate advanced structures technologies providing performance, survivability, and sustainment benefits with broad applicability across platform scale and role, enabling mission success for manned/unmanned FVL platforms in the contested environment of multi-domain operations.			
FY 2022 Plans: Will mature and integrate advanced structures technologies that enable multi-domain operations performance, efficiency, survivability, and sustainment, and enhance extreme environment reliability and availability. Will mature and integrate			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** CH6 / *Adapt & Resilnt Tact Autnmy Cont & Struct Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
leveraged trade studies optimizing the synergy of applicable technologies including weight-saving, fatigue-tolerant, affordable, multifunctional, and damage-tolerant configurations for primary and secondary structure. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding is realigned in FY22 from PE 0603465A, Project AJ5 Digital Vehicle Management and Control Advanced Tech			
Title: Adaptive Tactical Autonomy and Control (ATAC) Technology Demonstration ***Description:*** Mature, integrate, and demonstrate advanced vehicle management, flight control, and autonomy technologies that enable FVL aircraft to achieve superior maneuverability and agility at all speeds, effectively exploit extreme/degraded environmental conditions as a force multiplier, fight and win in presence of failure or damage, and operate on a cognitive-loading-spectrum from piloted to fully autonomous. ***FY 2022 Plans:*** Will implement and demonstrate advanced flight control technologies and state-of-the-art autonomy algorithms on Army owned and operated flying laboratories to achieve Technology Readiness Level (TRL) 6. Will mature control strategies for seamless pilot interaction with scalable autonomy as needed for optionally piloted operations. Will demonstrate pilot interface technologies for enhanced situational awareness and optimal cognitive loading across the entire range of mission environments. Will mature high-speed extensions to handling qualities criteria for military rotorcraft including specialized response types and Mission Task Elements (MTE). ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding is realigned in FY22 from PE 0603465A, Project AJ5 Digital Vehicle Management and Control Advanced Tech	-	-	1.113
Accomplishments/Planned Programs Subtotals	-	-	4.561

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) CH7 / *Power & Thermal Management for FVL Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
CH7: *Power & Thermal Management for FVL Adv Tech*	-	-	-	3.402	-	3.402	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2022 this Project is administratively realigned from:
Program Element (PE) 0603465A Future Vertical Lift Adv Technology
* Project AM5 Opt Energy Stg & Therm Mgmt for FVL Survivability & Adv Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates at the system level, integrated electrical power technologies (including power generation, distribution, and control along with advanced energy storage) and thermal management technologies to provide significantly higher electrical power capability to Future Vertical Lift (FVL) aircraft while addressing consequential size, weight, pulsed power, and thermal issues. Provides power capability for advanced electric aeromechanical effectors, advanced mission systems that for example, execute algorithms for route planning and teaming, and for advanced survivability and electronic warfare capability. Will demonstrate software-in-the-loop performance of power & thermal management technologies to provide significantly higher electrical power capability to FVL aircraft while addressing consequential SWAP-C & thermal issues.

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

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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Optimized Energy for C5ISR Platforms Advanced Technology	-	-	1.915
Description: Enable advanced Control, Communications, Computers, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) and survivability systems on FVL platforms through component development of improved high power and energy storage technologies, higher capacity lower Size, Weight, and Power (SWaP) cooling systems, and more efficient electrical architectures			
FY 2022 Plans: Will improve performance of energy storage technologies to meet the SWaP requirements of target air platforms. Will mature the high resolution characterization of C5ISR devices such as advanced radars and sensors to demonstrate the ability for energy			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** CH7 / *Power & Thermal Management for FVL Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
storage technologies to meet the electrical power demands of the system. Will demonstrate the effectiveness of integrating power management strategies for electrical sources when powering C5ISR devices. Will demonstrate intelligent controls for platform-integrated power systems. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22, the work for this project is administratively realigned from PE 0603465A (Future Vertical Lift Technology /AM5 (Opt Energy Stg & Therm Mgmt for FVL Surv Adv Tech)			
Title: Power & Thermal Management Tech Demo ***Description:*** Exploits fabrication, and systems integration lab validation testing to TRL 6 of power and thermal management technologies to provide significantly higher electrical power capability to FVL aircraft while addressing thermal issues and reducing system weight/volume ***FY 2022 Plans:*** Will perform design of power and thermal management system components to reduce Size, Weight, and Power (SWaP) of target platforms. Will perform design integration efforts to optimally incorporate advanced system components into a power and thermal management system, providing increased electrical power capability and reduced weight, volume, and cost to Future Vertical Lift aircraft. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22, the work for this project is administratively realigned from PE 0603465A (Future Vertical Lift Technology /AM5 (Opt Energy Stg & Therm Mgmt for FVL Surv Adv Tech)	-	-	1.487
Accomplishments/Planned Programs Subtotals	-	-	3.402

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) CH8 / *UAS Survivability Adv Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
CH8: *UAS Survivability Adv Technology*	-	-	-	5.057	-	5.057	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2022 (FY22) this Project is realigned from:
Program Element (PE) 0603465A Future Vertical Lift Advanced Technology
* Project AK3 Aviation Survivability Advanced Technology

A. Mission Description and Budget Item Justification

This Project integrates the new technologies of Future Vertical Lift and Air Platform Technologies to address an evolving threat environment by improving UAS survivability in contested environments. This is achieved without impacting UAS performance through tailored signature management for UAS missions, survivability-enhanced mission profiles, UAS survivability behaviors, resilient systems and architectures and electromagnetic (EM) vulnerability reduction. UAS Survivability Advanced Technology will mature UAS survivability technologies and demonstrate increased UAS Survivability in a peer / near-peer environment with minimal impacts to aircraft performance. This work supports Future Vertical Lift and Advanced Unmanned Aircraft Systems.

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

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.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: UAS Survivability Demonstration	-	-	5.057
Description: This effort focuses on maturing UAS susceptibility and vulnerability reduction technologies to provide increased UAS survivability with minimum impacts to mission performance and UAS system cost and addresses the evolving threat environment to support the Maneuver Force within the Multi-Domain Battle concept. Will develop and demonstrate increased UAS Survivability in a peer / near-peer environment with minimal impacts to aircraft performance, with objectives of tailored signature management for UAS missions, survivability-enhanced mission profiles, UAS survivability behaviors, resilient systems/architectures, and EM vulnerability reduction.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** CH8 / *UAS Survivability Adv Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will mature Unmanned Air Systems survivability components for demonstration; will perform data collection to verify technology functionality; will continue to develop, for demonstration Unmanned Air Systems survivability susceptibility and vulnerability reduction technologies; will develop/leverage candidate capabilities concepts for mission effectiveness analysis. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22 this effort is realigned from PE 0603465A, Project AK3 Aviation Survivability Advanced Technology for demonstration of increased UAS Survivability in a peer/near-peer environment.			
Accomplishments/Planned Programs Subtotals	-	-	5.057

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A