Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army											Date: April 2022	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
Total Program Element	-	169.536	133.158	69.348	-	69.348	70.393	54.454	54.510	64.216	0.000	615.615
AI5: *Next Gen Tactical UAS TD Technology*	-	7.518	-	-	-	-	-	-	-	-	0.000	7.518
AI9: *Future UAS Engine Technology*	-	2.939	3.129	-	-	-	-	-	-	-	0.000	6.068
AJ2: *Next Generation Rotorcraft Transmission Technology*	-	3.971	4.153	-	-	-	-	1.503	2.449	1.503	0.000	13.579
AJ4: *Digital Vehicle Management and Control Technology*	-	6.222	-	-	-	-	-	-	-	-	0.000	6.222
AJ6: *Advanced Rotors Technology*	-	2.377	2.447	-	-	-	-	-	-	-	0.000	4.824
AJ8: *Experimental and Computational Aeromechanics Techn*	-	5.076	5.977	-	-	-	-	-	-	-	0.000	11.053
AK2: *Aviation Survivability Technology*	-	21.158	2.161	1.236	-	1.236	-	-	-	-	0.000	24.555
AK4: *Multi-Role Small Guided Missile Technology*	-	7.463	3.736	-	-	-	-	-	-	-	0.000	11.199
AK9: *Adv Teaming for Tactical Aviation Operations Tech*	-	13.531	13.978	14.546	-	14.546	14.798	14.785	14.786	14.782	0.000	101.206
AL2: *High Performance Computing for Rotorcraft App Tech*	-	1.148	1.169	-	-	-	-	-	-	-	0.000	2.317
AL4: *High Speed and Efficient VTOL Vehicle Technology*	-	1.444	1.466	-	-	-	-	-	-	-	0.000	2.910
AL5: *Air Vehicle Structures and Dynamics Technology*	-	2.792	2.799	-	-	-	-	-	-	-	0.000	5.591

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army											Date: April 2022	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*							
AL8: *Holistic Situational Awareness and Dec Making Tech*	-	1.757	0.889	-	-	-	-	-	-	-	0.000	2.646
AM4: *Opt Energy Stg & Therm Mgmt for FVL Survivability*	-	8.531	-	-	-	-	-	-	-	-	0.000	8.531
BP7: *Future Vertical Lift Air Platform Tech (CA)*	-	75.000	42.000	-	-	-	-	-	-	-	0.000	117.000
BZ7: *Future Vertical Lift Medical Technologies*	-	7.911	7.818	7.503	-	7.503	7.494	7.249	7.237	7.347	0.000	52.559
CC3: *FVL Radar Technologies*	-	0.698	0.444	-	-	-	-	5.159	3.570	3.569	0.000	13.440
CG9: *Adapt & Resilnt Tact Autnmy Cont & Struct Tech*	-	-	6.507	-	-	-	-	-	-	-	0.000	6.507
CH2: *Air Launched Effects Technology*	-	-	7.567	4.168	-	4.168	4.293	3.464	3.361	3.256	0.000	26.109
CH3: *Holistic Team Survivability Technology*	-	-	11.217	10.819	-	10.819	10.992	10.982	10.986	3.461	0.000	58.457
CH4: *Power & Thermal Management for FVL Tech*	-	-	7.175	7.613	-	7.613	7.713	7.721	7.697	7.694	0.000	45.613
CI4: *Adaptive Avionics Technologies**	-	-	-	-	-	-	1.001	3.591	3.592	3.591	0.000	11.775
CI5: *High Speed Maneuverable Missile (HSMM) Tech*	-	-	8.526	23.463	-	23.463	24.102	-	0.832	19.013	0.000	75.936

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2023

A. Mission Description and Budget Item Justification

This Program Element (PE) is directly aligned to the Future Vertical Lift (FVL) Army Modernization Priority. This PE conducts air vehicle and mission system component design, fabrication, and evaluation to enable Army Future Vertical Lift. Emphasis is on developing aviation 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.

Research in this PE contributes to the Army Science and Technology (S&T) air systems portfolio and is fully coordinated with efforts in PE 0603465A (Future Vertical Lift Advanced Technology), PE 0602183A (Air Platform Applied Research) and PE 0603043A (Air Platform Advanced Technology).

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army	Date: April 2022
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*

The cited research is consistent with the Under Secretary of Defense for Research and Engineering S&T focus areas and the Army Modernization Strategy.

Research 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 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	169.536	91.411	0.000	-	0.000
Current President's Budget	169.536	133.158	69.348	-	69.348
Total Adjustments	0.000	41.747	69.348	-	69.348
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	42.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	69.348	-	69.348
• FFRDC Transfer	-	-0.253	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2021	FY 2022
Project: BP7: *Future Vertical Lift Air Platform Tech (CA)*		
Congressional Add: *Program Increase - High Strength Functional Composites*	5.000	5.000
Congressional Add: *Program Increase - Additive Manufacturing of Multifunctional Composite Aerospace Components*	5.000	-
Congressional Add: *Program Increase: Advanced Rotary Wing Materials and Structures*	5.000	-
Congressional Add: *Program Increase: Adaptive Flight Control Technology*	4.000	7.000
Congressional Add: *Program Increase: Lightweight Hybrid Composite Medium Caliber Barrels*	20.000	-
Congressional Add: *Program Increase: Technology Transfer and Innovation*	5.000	-
Congressional Add: *Program Increase - Self-Sealing Fuel Tanks Technology*	6.000	-
Congressional Add: *Program Increase - High Density eVTOL Power Source*	15.000	15.000
Congressional Add: *Program Increase - Individual Blade and Higher Harmonic Control*	10.000	5.000
Congressional Add: *Missile Technology Transfer and Innovation*	-	5.000
Congressional Add: *Rotor Blade Operational Readiness*	-	5.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Army	Date: April 2022
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2021	FY 2022
Congressional Add Subtotals for Project: BP7	75.000	42.000
Congressional Add Totals for all Projects	75.000	42.000

Change Summary Explanation

Fiscal Year 2023 (FY23) funding increase reflects the fact that the FY22 President's Budget request did not include out-year funding.

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) AI5 / *Next Gen Tactical UAS TD Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AI5: *Next Gen Tactical UAS TD Technology*	-	7.518	-	-	-	-	-	-	-	-	0.000	7.518

A. Mission Description and Budget Item Justification

This Project utilizes improved computer modeling fidelity to investigate the effects that potential Future Unmanned Aircraft System (FUAS) capabilities could have on air vehicle design considerations and operational concepts. This project improves government capability to design and assess novel Unmanned Aircraft System (UAS) concepts. This Project develops and investigates the ability to launch a UAS from a manned or unmanned future vertical lift aircraft at tactical altitudes and to control the UAS from the cockpit or a crew station. This Project will assess the enabled capabilities and determine their relevance to current Army Aviation engagement and survivability portfolios.

Research in this Project is fully coordinated with Program element (PE) 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Systems Concepts Studies for Air Launched Effects	7.518	-	-
Description: Investigates and models air vehicle concepts to understand the effects that potential operational Air Launched Effects capabilities will have on air vehicle properties.			
Accomplishments/Planned Programs Subtotals	7.518	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) AI9 / *Future UAS Engine Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AI9: *Future UAS Engine Technology*	-	2.939	3.129	-	-	-	-	-	-	-	0.000	6.068

Note

In Fiscal Year 2023 (FY23) funding is administratively realigned to Program Element (PE) 0602183A (Air Platform Applied Research) / Project CW6 (Future UAS Propulsion Technology).

A. Mission Description and Budget Item Justification

This Project designs and evaluates current and Future Unmanned Aircraft Systems (FUAS) advanced engine/power system component technologies to support the goals of multi-fuel capability, reduced fuel consumption, engine size, weight, and cost, as well as improved reliability, survivability, and maintainability.

Work in this Project is fully coordinated with PE 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Multi-fuel Capable Hybrid Electric Propulsion	2.939	3.014	-
Description: Applied research to enable intelligent and robust propulsion performance and noise signature reduction via multi-fuel and optimized hybrid electric capability for small engines (20kW to 150kW) powering future aircraft systems. The research focuses on the establishment of concepts to enable reduced fuel consumption, engine size, weight, and cost as well as improved group 3 and 4 FUAS reliability, survivability, and maintainability.			
FY 2022 Plans: Will combine robust ignition assistant, non-intrusive ignition sensing method, and real-time fuel property sensor to prove the concept of external energy assisted ignition of low ignition quality jet fuels; will complete reduced-order design tool for aviation turbocharger and design of aviation turbocharger, will investigate the major components for lightweight compact aviation electrified turbocharger; will validate the hybrid-electric optimization tool with experimentally obtained data.			
FY 2022 to FY 2023 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AI9 / *Future UAS Engine Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Funding administratively realigned to PE 0602183A (Air Platform Applied Research) / Project CW6 (Future UAS Propulsion Technology) in FY23.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.115	-
Accomplishments/Planned Programs Subtotals	2.939	3.129	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) AJ2 / *Next Generation Rotorcraft Transmission Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AJ2: *Next Generation Rotorcraft Transmission Technology*	-	3.971	4.153	-	-	-	-	1.503	2.449	1.503	0.000	13.579

Note

In Fiscal Year 2023 (FY23) this Project is administratively realigned to Program Element (PE) 0602183A (Air Platform Applied Research / Project CW8 (Next Generation Aviation Transmission Apl Tech).

A. Mission Description and Budget Item Justification

This Project investigates Future Vertical Lift (FVL) advanced drive train technologies that increase performance and double current drivetrain life cycles while improving their reliability and maintainability.

Work in this Project is fully coordinated with PE 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: High Reduction Ratio Transmission Components	3.971	4.001	-
Description: Effort investigates advanced materials and component designs that allow 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. ***FY 2022 Plans:*** Will develop and fabricate corrosion resistant steel transmission components and advanced seals that improve reliability for High Reduction Ratio Transmission (HRT) design. Will begin testing of components to verify material performance under high loads, high speeds, and corrosive environments ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding is administratively realigned to PE 0602183A (Air Platform Applied Research) / Project CW8 (Next Generation Aviation Transmission Apl Tech) in FY23.			
Title: FY2022 SBIR/STTR Transfer	-	0.152	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AJ2 / *Next Generation Rotorcraft Transmission Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	3.971	4.153	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army											Date: April 2022	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*				Project (Number/Name) AJ4 / *Digital Vehicle Management and Control Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
AJ4: *Digital Vehicle Management and Control Technology*	-	6.222	-	-	-	-	-	-	-	-	0.000	6.222

A. Mission Description and Budget Item Justification

This Project investigates potential manned Future Vertical Lift (FVL) and Future Unmanned Aircraft System (FUAS) fly-by-wire & fly-by-light rotor/flight control and autonomy for active rotor and compound concepts. It also investigates, matures, and harmonizes leap-ahead autonomy, structures, controls technologies, concepts, and capabilities which enable combat mission success across the family of manned/unmanned FVL platforms.

Research in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Adaptive and Resilient Tactical Autonomy, Controls, and Structures Tech ***Description:*** Develop autonomy, controls, and structures technologies to ensure mission success for manned/unmanned, multiple capability set Future Vertical Lift platforms in the contested environment of multi-domain operations.	6.222	-	-
Accomplishments/Planned Programs Subtotals	6.222	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) AJ6 / *Advanced Rotors Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AJ6: *Advanced Rotors Technology*	-	2.377	2.447	-	-	-	-	-	-	-	0.000	4.824

Note

In Fiscal Year 2023 (FY23) this Project is administratively realigned to Program Element (PE) 0602183A (Air Platform Applied Research) / Project CW3 (Advanced Rotors Applied Technology).

A. Mission Description and Budget Item Justification

This Project investigates Future Vertical Lift (FVL) technologies that mature high speed and highly efficient rotor and hub system designs.

Work in this Project is fully coordinated with PE 0603465A (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 Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Advanced Rotors Technology ***Description:*** Investigate advanced rotor blade and hub technologies to support goals of increased speed and reduced drag by developing low weight rotors and hub configurations that increase hover and cruise efficiency.	2.377	-	-
Title: Advanced Hubs ***Description:*** Investigate advanced rotor system and hub technologies to support goals of increased speed and lift by developing configurations and technologies that reduce drag and enable more efficient rotor system performance. ***FY 2022 Plans:*** Will conduct design trades to start technology down-selection for advanced rotor system hubs; and will commence conceptual design studies. ***FY 2022 to FY 2023 Increase/Decrease Statement:***	-	2.358	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AJ6 / *Advanced Rotors Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
In FY23, this effort is administratively realigned to Program Element 0602183A / Air Platform Applied Research, project CW3 / Advanced Rotors Applied Technology.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.089	-
Accomplishments/Planned Programs Subtotals	2.377	2.447	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army											Date: April 2022	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*				Project (Number/Name) AJ8 / *Experimental and Computational Aeromechanics Techn*			
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
AJ8: *Experimental and Computational Aeromechanics Techn*	-	5.076	5.977	-	-	-	-	-	-	-	0.000	11.053

Note

In Fiscal Year 2023 (FY23) this Project is administratively realigned to Program Element (PE) 0602183A (Air Platform Applied Research) / Project CW5 (Experimental and Computational Aeromechanics Tech).

A. Mission Description and Budget Item Justification

This Project investigates new high fidelity computational methods to simulate aerodynamic effects and test methods of emerging rotorcraft lift technologies that could be incorporated into Future Vertical Lift (FVL) designs.

Research in this Project is fully coordinated with PE 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Experimental Aeromechanics for FVL	2.909	3.632	-
Description: Develop and explore new methods to simulate aerodynamic effects for future FVL configurations. ***FY 2022 Plans:*** Will conduct test of new winged compound rotorcraft configurations at high speed with auxiliary propulsion to provide fundamental understanding and validation data for computational tools; will investigate state of the art of measurement & diagnostics techniques for rotorcraft; will test rotor blade structural deformation and boundary layer transition using embedded sensor. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** In FY23, this effort is administratively realigned to PE 0602183A (Air Platform Applied Research) / Project CW5 (Experimental and Computational Aeromechanics Tech).			
Title: Computational Aeromechanics for FVL	2.167	2.121	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AJ8 / *Experimental and Computational Aeromechanics Techn*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: Investigate experimental aeromechanics technologies and test methods for FVL. ***FY 2022 Plans:*** Will verify and validate new high-fidelity computational tools for aeromechanics analysis of FVL rotorcraft with a focus on interactional aerodynamics problems that are seen in these new FVL designs. Will automate the application of these computational tools in order to maximize their impact on FVL aircraft development. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** In FY23, this effort is administratively realigned to PE 0602183A (Air Platform Applied Research) / Project CW5 (Experimental and Computational Aeromechanics Tech).			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.224	-
Accomplishments/Planned Programs Subtotals	5.076	5.977	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) AK2 / *Aviation Survivability Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AK2: *Aviation Survivability Technology*	-	21.158	2.161	1.236	-	1.236	-	-	-	-	0.000	24.555

A. Mission Description and Budget Item Justification

This Project investigates advanced technologies to reduce Future Vertical Lift (FVL) platform susceptibility and vulnerability to damage from guided and unguided threats, as well as technologies to defeat small arms, rocket and missile threats. It also investigates and develops an integrated team-based system of systems survivability approach for Integrated Air Defense Systems breaching through purpose driven mix of improved survivability situational awareness, signature management, vulnerability reduction, route and maneuver optimization, expendables, advanced sensors, and Electro-optical (EO) & Radio Frequency (RF) jamming across distributed platforms.

Research in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Cognitive Countermeasures Technology Development ***Description:*** This effort investigates and matures novel materials, components, and techniques to counter legacy and emerging threats to FVL platforms. Emphasis will be placed on technologies and approaches to enable a robust, holistic countermeasure (CM) capability for target defeat, regardless of threat characteristics or guidance mode.	1.991	-	-
Title: Reconfigurable Transformational Optics/Task based Display ***Description:*** This effort will deliver reconfigurable micro- and nano-scale filtering devices enabling frequency agile multi-task sensors. This will permit enhanced survivability of the FVL platforms with restored visual overmatch in any (day/night) environment. This will allow visual penetration of natural obscurants (e.g. brownout, white out) or custom man-made obscurants (e.g. engineered smokescreens) from a single sensor, as well as narrowband filtering for active imaging through obscurants. Improved detection and identification capability will result from filtering out scattered light and enabling 3-dimensional ranging through environmental obscurants. Wavelength agile imaging systems will be delivered that are capable of penetrating and imaging through a variety of obscurants and that are compatible with the FVL platforms.	5.283	-	-
Title: Multispectral Threat Warning and Countermeasures	0.997	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AK2 / *Aviation Survivability Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: This effort investigates and evaluates software and warning sensor/counter measure components to increase probability to detect and defeat current and evolving small arms and man-portable air defense system (MANPADS) type threats for FVL platforms using modeling and simulation (M&S) and hardware in the loop (HWIL) simulations.			
Title: Tunable Pyrotechnics Technologies ***Description:*** Develop and investigate technologies for nano, reactive, and advanced/novel materials to enable, customize and ? tune? a family of Countermeasure Decoys for FVL platforms. ***FY 2022 Plans:*** Will design and develop novel miniaturized Radio Frequency Countermeasure (CM) components. Will conduct experiments to verify radio frequency output from pyrotechnic sub-component. Will design and develop new pyrotechnic formulations, validate existing models through simulations, and update models as required for Advanced Seeker Countermeasures. ***FY 2023 Plans:*** Will conduct experiments on miniaturized electronics and antenna for active Radio Frequency countermeasure technologies. Will design and develop modeling and simulation techniques supporting countermeasure development and future applications. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding decrease due to realignment to PE 0602141A (Lethality Technology) / Project AH9 (Advanced Warheads Technology) for exploration of novel pyrotechnics technologies for application across all Army priorities.	2.612	2.081	1.236
Title: Advanced Survivability Concepts ***Description:*** This effort will provide analysis of the rapidly evolving and emerging threat environment and impacts to FVL platforms. This effort will also provide advanced teaming algorithms for survivability.	4.148	-	-
Title: Electronic Warfare Air Sensors / Countermeasure ***Description:*** This effort investigates and develops Electronic Warfare (EW) survivability technologies to enable the detection and defeat of advanced threats. It provides algorithms, sensors, and effectors that are robust to advanced threat characteristics and operate effectively across the distributed team of FVL aircraft.	6.127	-	-
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:***	-	0.080	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AK2 / *Aviation Survivability Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	21.158	2.161	1.236

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) AK4 / *Multi-Role Small Guided Missile Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AK4: *Multi-Role Small Guided Missile Technology*	-	7.463	3.736	-	-	-	-	-	-	-	0.000	11.199

Note

In Fiscal Year 2023 (FY23) funding for this effort is realigned to Project Element (PE) 0603465A (Future Vertical Lift Advanced Technology) / Project AK5 (Multi-Role Small Guided Missile Advanced Tech).

A. Mission Description and Budget Item Justification

The Project investigates, designs, and evaluates modular missile component technologies compatible with Future Vertical Lift (FVL) and Future Unmanned Aircraft Systems (FUAS) aviation platforms in a Multi-Domain Battle/Cross-domain Maneuver operational environment. Also investigates critical component technologies and designs for future missiles that can be launched simultaneously, can operate autonomously and/or under human supervision, and can form advanced, cooperative teams to defeat one or more hard/soft targets which are stationary and/or moving.

Work in this Project is fully coordinated with PE 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Multi-Role Guided Missile - Extended Range Technology	4.362	-	-
Description: Identify, demonstrate, analyze, and assess key component technologies to support non-line-of-sight missile development providing man-in-the-loop situational awareness, targeting, and high value target defeat for Aviation platforms that can successfully operate in Anti-Access/Area Denial / Integrated Air Defense System (A2AD/IADS) environments.			
Title: Multiple Simul Engagement Technologies (MSET)	3.101	3.599	-
Description: Investigate critical missile and fire control component technologies and designs for future missiles that can be launched simultaneously, can operate autonomously and/or under human supervision, and can form advanced, cooperative teams to defeat one or more hard/soft targets which are stationary and/or moving targets.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AK4 / *Multi-Role Small Guided Missile Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will combine lower-level component simulations to form system-level simulation. Will verify component performance predictions to aid in design refinement and overall performance predictions. Will mature component designs based on simulation results. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Effort continues in PE 0603465A (Future Vertical Lift Advanced Technology) / Project AK5 (Multi-Role Small Guided Missile Advanced Tech) for maturation and demonstration of component technologies.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.137	-
Accomplishments/Planned Programs Subtotals	7.463	3.736	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) AK9 / *Adv Teaming for Tactical Aviation Operations Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AK9: *Adv Teaming for Tactical Aviation Operations Tech*	-	13.531	13.978	14.546	-	14.546	14.798	14.785	14.786	14.782	0.000	101.206

A. Mission Description and Budget Item Justification

This Project investigates and develops subsystem and component level technologies that enable advanced teaming behaviors for mixed platform formations in combined arms operations. Primary component technologies to develop are in the areas of resilient autonomy algorithms, team-based communications and situational awareness management, decision aiding for weapons systems engagement, autonomous terrain and collision avoidance, and human autonomy interface design.

Research in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Advanced Teaming Concepts	9.643	8.052	8.495
Description: Investigates and develops subsystem and component level technologies that enable advanced manned and unmanned teaming behaviors for mixed air and ground platform formations in combined arms operations. ***FY 2022 Plans:*** Will further develop and enhance technologies that provide UAS team of teams coordinated mission planning and execution, fused team situational awareness for autonomous mission adaptation, and electronic warfare employment all while operating in GPS denied and communications degraded conditions. ***FY 2023 Plans:*** Will design autonomy and teaming technologies that enable seamless unmanned aircraft systems (UAS) team of teams operations, including dynamic retasking with autonomous team reconfigurability, across multiple domains and in highly-contested, complex environments. Will design and enhance technologies for team coordination over long ranges with degraded networks and autonomous navigation in featureless (e.g. water) or highly cluttered (e.g. urban) environments. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Intelligent Unmanned Aerial System Teaming Technologies	3.888	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AK9 / *Adv Teaming for Tactical Aviation Operations Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: Enables the establishment of component technologies to support resilient, multi-modal, survivable UAS teams that can plan and act on time-scales beyond human capability and have a robust shared understanding of contested and dynamic environments to support effective tactical engagement. Specific topics include 1) novel artificial-intelligence algorithms and methods for adaptive team composition and control, 2) increased team knowledge base and understanding of local and global world models, 3) hierarchical, composable, and adaptive learning methods for increased mission resilience, and 4) understanding interaction and scalability between, amongst, and across heterogeneous team members and the environment.			
Title: Enhanced Optics for Long Range Targeting ***Description:*** This effort will deliver advanced airborne optics and reconfigurable filtering devices to enable agile, multi-task sensors for compact, long-range targeting, enhanced survivability and lethality of the Future Vertical Lift (FVL) and Future Unmanned Aircraft System (FUAS). This effort will restore visual overmatch in any (day/night) environment through visual penetration of all obscurants (e.g. brownout, white out, engineered smokescreens) from a single sensor, as well as narrowband filtering for active imaging through obscurants while maintaining advanced target acquisition. Improved detection and identification and long range target acquisition capability will result from filtering out scattered light and enabling 3-dimensional ranging through environmental obscurants. ***FY 2022 Plans:*** Will investigate materials and efficiency of non-traditional off-axis style optical systems for range performance; will design and develop field-selectable spectral bandpass filters for operation near cryogenic dewars to penetrate obscurants while minimizing photon noise, enabling multi-task sensing (e.g. long range targeting, brownout penetration, disturbed earth detection) from a single sensor; will investigate active sensor components for three-dimensional (3-D) Imaging; will conduct experiments on the material growth process for a new optical lens for multi-band targeting sensors to enable greater sensitivity and range performance. ***FY 2023 Plans:*** Will conduct experiments on the efficacy, performance, and durability of newly available optical materials. Will validate optical performance of field-selectable spectral bandpass filters to determine impacts to multiple tasks needed in a dynamic airborne environment. Will mature optical lens material manufacturability of novel dual-band crystalline materials for use in advanced targeting applications. Will conduct experiments to determine the range resolution achievable for day/night airborne active 3-D imaging. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	-	5.416	6.051
Title: FY2022 SBIR/STTR Transfer	-	0.510	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AK9 / *Adv Teaming for Tactical Aviation Operations Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	13.531	13.978	14.546

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army											Date: April 2022	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*				Project (Number/Name) AL2 / *High Performance Computing for Rotorcraft App Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
AL2: *High Performance Computing for Rotorcraft App Tech*	-	1.148	1.169	-	-	-	-	-	-	-	0.000	2.317

Note

In Fiscal Year 2023 (FY23) this Project is administratively realigned to Program Element (PE) 0602183A (Air Platform Applied Research) / Project DC2 (High Performance Computing for Rotorcraft Apl Tech).

A. Mission Description and Budget Item Justification

This Project investigates and validates aeromechanics modeling and simulation tools for Future Vertical Lift (FVL) platforms. Research efforts in this Project are also applicable to the family of FVL manned and unmanned platforms.

Work in this Project is fully coordinated with PE 0603465A (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 2021	FY 2022	FY 2023
Title: High Performance Computing for Rotorcraft App Tech	1.148	1.126	-
Description: Investigate new high performance and parallel computing efforts in support of FVL platforms. ***FY 2022 Plans:*** Will develop new computational software tools for rotorcraft aeromechanics analysis that leverage the power of high-performance computers to produce high-accuracy results for vehicles with complex aerodynamic interactions among their component parts. Will improve the computational speed of these high-fidelity simulations so that they can be routinely used in rotorcraft design and optimization processes for FVL vehicles. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** In FY23, this effort is administratively realigned to PE 0602183A (Air Platform Applied Research) / Project DC2 (High Performance Computing for Rotorcraft Apl Tech).			
Title: FY2022 SBIR/STTR Transfer	-	0.043	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AL2 / *High Performance Computing for Rotorcraft App Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	1.148	1.169	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) AL4 / *High Speed and Efficient VTOL Vehicle Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AL4: *High Speed and Efficient VTOL Vehicle Technology*	-	1.444	1.466	-	-	-	-	-	-	-	0.000	2.910

Note

In Fiscal Year 2023 (FY23) this Project is administratively realigned to Program Element (PE) 0602183A (Air Platform Applied Research) / Project CW7 (High Speed and Efficient VTOL Vehicle Tech).

A. Mission Description and Budget Item Justification

This Project establishes component technologies in the area of materials, design, and dynamic models to enable next generation capability for Future Vertical Lift (FVL) platforms. Objectives of this Project are focused on improving both performance (i.e. range, payload, endurance) and reliability/maintainability metrics, where outcomes from these efforts are applicable to the Family of Future Vertical Lift manned and unmanned platforms.

Work in this Project is fully coordinated with PE 0603465A (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 2021	FY 2022	FY 2023
Title: High Speed & Efficient Vertical Take-off and Landing	1.444	1.412	-
Description: This research effort establishes concepts in vertical take-off and landing in the area of propulsion to enable improved, efficient hover and high-speed cruise at longer range without added weight. ***FY 2022 Plans:*** Will apply deep learning methods to build a diagnostic analytical tool for UH-60 Black Hawk; will select materials and design for a half-weight hybrid transmission gear. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Administrative realignment to PE 0602183A (Air Platform Applied Research) / Project CW7 (High Speed and Efficient VTOL Vehicle Tech) in FY23.			
Title: FY2022 SBIR/STTR Transfer	-	0.054	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AL4 / *High Speed and Efficient VTOL Vehicle Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	1.444	1.466	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) AL5 / *Air Vehicle Structures and Dynamics Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AL5: *Air Vehicle Structures and Dynamics Technology*	-	2.792	2.799	-	-	-	-	-	-	-	0.000	5.591

Note

In Fiscal Year 2023 (FY23) this Project is administratively realigned to Program Element (PE) 0602183A (Air Platform Applied Research) / Project CW4 (Air Vehicle Structures and Dynamics Tech).

A. Mission Description and Budget Item Justification

This Project establishes validated modeling tools needed to develop aeroelastically stable rotor technologies to enable high speed flight and longer flight envelopes in Future Vertical Lift (FVL) platforms. Efforts in this Project are also applicable to the family of FVL manned and unmanned platforms.

Research in this Project is fully coordinated with PE 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Aeromechanics and Aeroelasticity of Future Air Vehicle Platforms	2.792	2.696	-
Description: Establish improved experimentally validated modeling tools and methodologies that can be used to understand the physics of aeroelastic stability and design in next generation rotorcraft platform configurations for FVL platforms. This involves the development of an experimental capability, (TRAST), which will be used to generate novel experimental data. This data will be used to increase fundamental understanding of the whirl flutter instability, which currently limits the high speed performance of tiltrotor rotorcraft. This effort will inform FVL requirement definition and technology maturation. This effort also establishes low noise rotor concepts and investigates the intersection of artificial intelligence and classical mechanics to enable novel mechanics and new approaches in structural dynamics for FVL applications to enable higher Operating Tempo (OPTEMPO) operations.			
FY 2022 Plans: Will investigate fluid-structure interaction models to inform the structural design of an adaptive unmanned aerial system (UAS) with enhanced aerodynamic performance; will develop tools and methods for multi-disciplinary and multi-dimensional design optimization of future and non-traditional UAS and assessment of emergent technologies; will conduct wind tunnel experiments to investigate the effects of hinge-less rotor and control parameters on tiltrotor aircraft stability to enable faster, more efficient,			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AL5 / *Air Vehicle Structures and Dynamics Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
and sustainable tiltrotor aircraft; will perform analysis and wind-tunnel experimentation to assess passive and active whirl-flutter mitigation technologies; will perform high-fidelity computational aeromechanics modeling of novel blade concepts to enable rotor with improved performance and noise characteristics; will couple acoustics prediction models with the comprehensive analysis codes to enable acoustics characterization of rotorcraft configurations at conceptual design stage. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Administrative realignment to PE 0602183A (Air Platform Applied Research) / Project CW4 (Air Vehicle Structures and Dynamics Tech) in FY23.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.103	-
Accomplishments/Planned Programs Subtotals	2.792	2.799	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army											Date: April 2022	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*				Project (Number/Name) AL8 / *Holistic Situational Awareness and Dec Making Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
AL8: *Holistic Situational Awareness and Dec Making Tech*	-	1.757	0.889	-	-	-	-	-	-	-	0.000	2.646

Note

In Fiscal Year (FY) 2023, funding is realigned to Program Element (PE) 0602141A (Lethality Technology) / Project CG4 (Advanced Radar Concepts and Technologies).

A. Mission Description and Budget Item Justification

This Project focuses on modeling and simulation of pilotage and decision aiding system technology that allows for care free operations in complex and hostile environments.

Work in this Project is fully coordinated with PE 0603465A (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 United States (US) Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Wideband RF Sensors	0.892	-	-
Description: This effort develops the technical underpinnings of radar and other active and passive radio frequency (RF) sensing modalities for several key Army requirements, with a focus on cost effective radar concepts to enhance the situational awareness and navigation capabilities of US Army rotorcraft to operate safely in a Degraded Visibility Environment (DVE). This research uses a combination of advanced computational electromagnetic models and algorithms, radar measurements, active and passive RF sensing technologies, and advanced signal processing.			
Title: Situational Awareness Radar for DVE mitigation	0.865	0.857	-
Description: This effort investigates technologies and algorithms for compact radars that will provide a hazard warning capability to airborne platforms in all environmental conditions, including those with zero visibility. This hazard warning capability will detect collision threats and specific projectile hazards around the entire aircraft using a suite of small form-factor radars. Algorithms are created to interpret the data produced by these radars and distinguish threats from benign clutter. Innovative radar architectures and device technologies are investigated and demonstrated to enhance and extend performance.			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AL8 / *Holistic Situational Awareness and Dec Making Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
FY 2022 Plans: Will investigate forward looking synthetic aperture radar (FLSAR) technology to assess capabilities for terrain navigation in DVE; will conduct experiments in relevant field conditions using laboratory radar testbed; develop and implement signal processing for creating three-dimensional imagery of ground obstacles. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding reprioritized to support the creation of Distributed Radar Architectures in PE 0602141A (Lethality Technology) / Project CG4 (Advanced Radar Concepts and Technologies) in FY23.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.032	-
Accomplishments/Planned Programs Subtotals	1.757	0.889	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) AM4 / *Opt Energy Stg & Therm Mgmt for FVL Survivability*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
AM4: *Opt Energy Stg & Therm Mgmt for FVL Survivability*	-	8.531	-	-	-	-	-	-	-	-	0.000	8.531

A. Mission Description and Budget Item Justification

This Project investigates emerging power generation, energy storage, and thermal management technologies needed for future Command, Control, Communications, Computers, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR), and survivability equipment that could be incorporated onto Future Vertical Lift (FVL) and other Army platforms. Provides power capability for advanced electric aeromechanical effectors, advanced mission systems algorithms for route planning and teaming and advanced electronic warfare devices.

Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Optimized Energy for C5ISR Platforms ***Description:*** This effort investigates power and thermal management associated with high power C5ISR capabilities on ground and air platforms enabling enhanced mobility and mission flexibility. This effort funds research to improve FVL aircraft and other Army platforms power efficiency through the use of on-demand hybrid power architectures, while also researching ways to eliminate platform thermal constraints. This effort will also investigate very high density power sources and energy storage for high rate pulsed power, power management, and thermal management for dynamic high rate pulsed power.	4.867	-	-
Title: Power & Thermal Management Components ***Description:*** This effort develops power and thermal management component technologies to meet the power and thermal demands of Future Vertical Lift aircraft while minimizing system size and weight. Technology will be validated through component level test.	3.664	-	-
Accomplishments/Planned Programs Subtotals	8.531	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** AM4 / *Opt Energy Stg & Therm Mgmt for FVL Survivability*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) BP7 / *Future Vertical Lift Air Platform Tech (CA)*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BP7: *Future Vertical Lift Air Platform Tech (CA)*	-	75.000	42.000	-	-	-	-	-	-	-	0.000	117.000

Note

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

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Future Vertical Lift Platform 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 2021	FY 2022
Congressional Add: Program Increase - High Strength Functional Composites ***FY 2021 Accomplishments:*** Conducted applied research in High Strength Functional Composites. Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for High Strength Functional Composites	5.000	5.000
Congressional Add: Program Increase - Additive Manufacturing of Multifunctional Composite Aerospace Components ***FY 2021 Accomplishments:*** Conducted applied research in Additive Manufacturing of Multifunctional Composite Aerospace Components. Work executed by Army Futures Command.	5.000	-
Congressional Add: Program Increase: Advanced Rotary Wing Materials and Structures ***FY 2021 Accomplishments:*** Conducted applied research in Advanced Rotary Wing Materials and Structures. Work executed by Army Futures Command.	5.000	-
Congressional Add: Program Increase: Adaptive Flight Control Technology ***FY 2021 Accomplishments:*** Conducted applied research in Adaptive Flight Control Technology.	4.000	7.000

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** BP7 / *Future Vertical Lift Air Platform Tech (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for Adaptive Flight Control Technology		
Congressional Add: Program Increase: Lightweight Hybrid Composite Medium Caliber Barrels ***FY 2021 Accomplishments:*** Conducted applied research in Lightweight Hybrid Composite Medium Caliber Barrels. Work executed by Army Futures Command.	20.000	-
Congressional Add: Program Increase: Technology Transfer and Innovation ***FY 2021 Accomplishments:*** Conducted applied research in Technology Transfer and Innovation. Work executed by Army Futures Command.	5.000	-
Congressional Add: Program Increase - Self-Sealing Fuel Tanks Technology ***FY 2021 Accomplishments:*** Conducted applied research in Self-Sealing Fuel Tanks Technology. Work executed by Army Futures Command.	6.000	-
Congressional Add: Program Increase - High Density eVTOL Power Source ***FY 2021 Accomplishments:*** Conducted applied research in High Density eVTOL Power Source. Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for High Density eVOTL Power Source	15.000	15.000
Congressional Add: Program Increase - Individual Blade and Higher Harmonic Control ***FY 2021 Accomplishments:*** Conducted applied research in Individual Blade and Higher Harmonic Control. Work executed by Army Futures Command. ***FY 2022 Plans:*** Congressional Interest Item funding provided for Individual Blade and Higher Harmonic Control	10.000	5.000
Congressional Add: Missile Technology Transfer and Innovation	-	5.000

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** BP7 / *Future Vertical Lift Air Platform Tech (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
FY 2022 Plans: Congressional Interest Item funding provided for Missile Technology Transfer and Innovation		
Congressional Add: Rotor Blade Operational Readiness	-	5.000
FY 2022 Plans: Congressional Interest Item funding provided for Rotor Blade Operational Readiness		
Congressional Adds Subtotals	75.000	42.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) BZ7 / *Future Vertical Lift Medical Technologies*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
BZ7: *Future Vertical Lift Medical Technologies*	-	7.911	7.818	7.503	-	7.503	7.494	7.249	7.237	7.347	0.000	52.559

A. Mission Description and Budget Item Justification

This Project involves research to prevent injury and performance degradation in Aviators, Unmanned Arial System (UAS) Operators and other Warfighters in training and operations; refines risk assessment and performance models based on operational stressors, e.g., sleep deprivation, work load, fatigue; and delivers biomedical-based spinal injury criteria and assessment methodologies. This research provides medical information important to the design and operational use of future vertical lift aircraft, and when appropriate, ground vehicles.

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Medical Standards to Support Future Vertical Lift (FVL)	7.911	7.818	7.503
Description: This effort develops and delivers medical guidelines and strategies to assure optimal Soldier performance and protection on the future technologically-intensive battlefield. Key elements of the program include: 1) tailored medical selection and retention standards for FVL; 2) medical strategies to maintain and enhance human performance in Multi-domain operations (MDO); 3) human-centered technology design guidance to accommodate the range of aircrew; 4) improved protection standards to reduce FVL occupant injury; and 5) operator state monitoring tools to enable scalable autonomy in FVL aircraft.			
FY 2022 Plans: Will develop the holistic medical aspects of a Situational Awareness and Decision-Making (HAS-DM) Program. Will evaluate transcranial stimulation to enhance alertness and situational awareness in extended operations. Will determine medical optimal feedback modes to FVL operators for use in scalable autonomy. Will assess medical impacts of FVL scalable autonomy at system level in degraded operator modes. Will evaluate composite workload for real time operator state monitoring. Will develop aircraft and human medical indicators of operator workload and state. Will develop helmet stability and dynamic retention standards for aviation helmets. Will evaluate aviation survivability development and tactics (ASDAT) in a retrospective study on combat-related injury.			
FY 2023 Plans: Will refine Army Regulation Update 40-501 to ensure medically fit aircrew. Will develop Health Hazard Assessment methods and criteria to protect FVL occupants from Head Supported Mass, impulsive noise/ shock, and repeated jolt. Will develop			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** BZ7 / *Future Vertical Lift Medical Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
recommendations for multisensory cuing for Degraded Visual Environment (DVE) operations. Will develop recommended human variables for operator state assessment and a holistic aircrew workload/ performance stress model. Will refine spinal fracture thresholds and FVL aviator/crew seat requirements. Will improve standards for assessing flight helmet stability and crash retention; Will assess FVL flight envelope physiological effects and countermeasures. Will develop proposed responses of autonomous system to FVL aircrew. Will develop recommendation package for enhanced FVL crashworthiness. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Decrease related to funding realigned to Program Element 0603465A (Future Vertical Lift Advanced Technology / Project CJ5 (Future Vertical Lift Medical Advanced Technology) to support advanced technology research in this topic area.			
Accomplishments/Planned Programs Subtotals	7.911	7.818	7.503

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) CC3 / *FVL Radar Technologies*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
CC3: *FVL Radar Technologies*	-	0.698	0.444	-	-	-	-	5.159	3.570	3.569	0.000	13.440

Note

In Fiscal Year 2023 (FY23), funding is decreased to reflect completion of radar functionality study.

A. Mission Description and Budget Item Justification

This Project develops underlying technologies applicable to next generation radar apertures used for detection, tracking and precision targeting, navigation and fire control for multiple modalities.

Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology).

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

Research in this Project is performed by the Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Battlefield Surveillance & Targeting Radar Technology	0.698	0.428	-
Description: Advanced Reconnaissance, Surveillance and Target Acquisition Waveform Designs for advanced multi-beam Ground Moving Target Indicator (GMTI) and Synthetic Aperture Radar (SAR) systems.			
FY 2022 Plans: Will conduct radar functionality study to investigate frequency, power/duty cycle, timing and aperture allocation requirements to inform and prioritize radar mode development strategy			
FY 2022 to FY 2023 Increase/Decrease Statement: Funding decrease in FY23 reflects completion of radar functionality study in FY22.			
Title: FY2022 SBIR/STTR Transfer	-	0.016	-
Description: Funding transferred in accordance with Title 15 USC ?638			
FY 2022 Plans: Funding transferred in accordance with Title 15 USC ?638			
FY 2022 to FY 2023 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** CC3 / *FVL Radar Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	0.698	0.444	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technol ogy*	Project (Number/Name) CG9 / *Adapt & Resilnt Tact Autnmy Cont & Struct Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
CG9: *Adapt & Resilnt Tact Autnmy Cont & Struct Tech*	-	-	6.507	-	-	-	-	-	-	-	0.000	6.507

A. Mission Description and Budget Item Justification

This Project develops methodologies for advanced flight dynamics models, robust flight controls for superior handling qualities, and improved survivability, redundancy management with reduced structural loads on the aircraft. Designs algorithms for autonomy, optionally piloted operations and manned-unmanned teaming. This Project directly supports Future Vertical Lift (FVL) modernization priority capabilities by investigating, maturing, and harmonizing leap-ahead autonomy, structures, and controls technologies, concepts, and capabilities which enable combat mission success across the family of manned/unmanned FVL platforms.

Work in this Project is fully coordinated with PE 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Adaptive and Resilient Engineered Structures (ARES) Technologies	-	1.501	-
Description: Develop 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 develop weight-efficient unitized structural assembly concepts. Will develop innovative weight-efficient blast-tolerant structural concepts. Will apply advanced material systems to develop strong, resilient rotor blade spar designs. Will develop weight-efficient multifunctional structural concepts with integral electromagnetic shielding. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** In FY23, this effort is administratively realigned to PE: 0602183A (Air Platform Applied Research) / Project CU7 (Control & Autonomy for Tactical Superiority Tech) and Project CU8 (Structures Tech for Enduring Efficient Resilience).			
Title: Adaptive Tactical Autonomy and Control (ATAC) Technologies	-	4.769	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** CG9 / *Adapt & Resilnt Tact Autnmy Cont & Struct Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Description: Develop 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 collaborate with Original Equipment Manufacturers (OEM) using flight data from extended Joint Multi-Role Technology Demonstrator (JMR-TD) flight tests to validate Army?s flight-dynamics modeling techniques for modern configurations. Will apply lessons learned to improve Army models of Future Attack Reconnaissance Aircraft (FARA) and Future Long Range Assault Aircraft (FLRAA) and help validate/improve OEM models. Will correlate JMR-TD flight and simulation data with new and existing handling qualities criteria to expand requirements to high speed. Will continue developing Damage Tolerant Control (DTC) technologies and state-of-the-art autonomy algorithms for advanced configurations and military Unmanned Aerial Vehicles (UAV) / Air-Launched Effects (ALE). ***FY 2022 to FY 2023 Increase/Decrease Statement:*** In FY23, this effort is administratively realigned to PE: 0602183A (Air Platform Applied Research) / Project CU7 (Control & Autonomy for Tactical Superiority Tech) and Project CU8 (Structures Tech for Enduring Efficient Resilience).			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.237	-
Accomplishments/Planned Programs Subtotals	-	6.507	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) CH2 / *Air Launched Effects Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
CH2: *Air Launched Effects Technology*	-	-	7.567	4.168	-	4.168	4.293	3.464	3.361	3.256	0.000	26.109

A. Mission Description and Budget Item Justification

This Project utilizes improved analytic modeling to investigate the effects that potential unmanned system capabilities could have on air vehicle design considerations and operational concepts. This Project improves government capability to design and assess novel Unmanned Aircraft System (UAS) concepts. This Project also develops and investigates the ability to launch a UAS from a manned or unmanned future vertical lift aircraft at tactical altitudes and to control the same after launch from nearby Future Verticle Lift (FVL) aircraft, as well as development of the associated payloads (recon, battle damage assessment, targeting, comms, decoy). This Project will assess the enabled capabilities and determine their relevance to current Army Aviation engagement and survivability portfolios.

Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Systems Concepts Studies for Air Launched Effects	-	7.291	4.168
Description: Investigates and models air vehicle concepts to understand the effects that potential operational Air Launched Effects capabilities will have on air vehicle properties.			
FY 2022 Plans: Will conduct configuration trade and analysis studies to develop novel UAS concepts that will serve to inform Air Launched Effects system specification. Will investigate critical design attributes to inform UAS system performance, weight, and cost. Will develop analytic modeling capabilities to improve timeliness, accuracy, and detail of conceptual design for unmanned systems.			
FY 2023 Plans: Will conduct assessment of vehicle concepts and technology for Versatile Air Launched Effects. Will develop UAS component models to improve propulsion architecture modeling, aircraft weight prediction, and improve performance and cost assessment.			
FY 2022 to FY 2023 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** CH2 / *Air Launched Effects Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
In Fiscal Year 2023 (FY23), funding was partially realigned from this effort administratively to Program Element (PE) 0602183A (Air Platform Applied Research) / Project CU9 (Systems Design Technology).			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.276	-
Accomplishments/Planned Programs Subtotals	-	7.567	4.168

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) CH3 / *Holistic Team Survivability Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
CH3: *Holistic Team Survivability Technology*	-	-	11.217	10.819	-	10.819	10.992	10.982	10.986	3.461	0.000	58.457

A. Mission Description and Budget Item Justification

This Project will investigate and design advanced survivability technologies to develop a holistic team-based solution that delivers advanced sensing and electronic warfare (EW) effects across a family of aircraft to optimally penetrate and survive in the anti-access/area denial (A2AD) environment. This Project will take an integrated team-based system of systems survivability approach through a purpose-driven mix of improved survivability situational awareness, signature management, vulnerability reduction, route and maneuver optimization, expendables, advanced sensors, and electro-optics (EO) & radio frequency (RF) jamming for existing and future air platforms. This Project will also provide advanced teaming algorithms for survivability. This Project develops and evaluates multi layered survivability concepts and supporting technologies for increased survivability of Future Vertical Lift Family of Systems (FVL FoS) in an advanced and evolving integrated air defense systems environment.

Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Advanced Survivability Concepts	-	4.036	3.402
Description: This effort will provide analysis of the rapidly evolving and emerging threat environment and impacts to Future Vertical Lift Family of Systems FVL FoS platforms, developing and evaluating full spectrum survivability concept, collaborative team based survivability algorithms and behaviors			
FY 2022 Plans: Will begin development of full spectrum susceptibility and vulnerability reduction component technologies that enhance holistic end-to-end survivability. Development of algorithms, behaviors, and human machine interface for team-based survivability.			
FY 2023 Plans: Will investigate damage prediction algorithms given a threat/ballistic impact. Will investigate RF materials development for durability improvement and weight reduction. Will continue development of algorithms, behaviors, and human machine interface			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** CH3 / *Holistic Team Survivability Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
for team-based survivability. Will begin investigation and analysis of Electro Optical/ Infrared coatings for FVL applications, leveraging new coatings technologies. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding reflects planned reduction of survivability modeling, simulation and analysis tool development efforts			
Title: Distributed Electronic Warefare Effects ***Description:*** This effort investigates and develops critical EW components and techniques to enable the FVL capability to operate and survive in A2/AD environments. It provides scalable low size, weight, power, and cost (SWaP-C) signal processing components and decision-making algorithms that adapt and counter the characteristics of advanced and emerging threats. ***FY 2022 Plans:*** Will develop novel algorithms to incorporate distributed sensor data into threat declaration algorithms; will develop methodology to optimize decision-making behaviors of sensor and countermeasure technologies to counter advanced threats; will investigate novel methods to adaptively update behavior of sensor and countermeasure technologies to react to changing threats and environmental conditions; will analyze impact of threat progression on measured performance. ***FY 2023 Plans:*** Will conduct single node bench experimentation of hardware performance and software algorithm functionality to inform further development and optimization. Will validate software technology readiness level assessments. Will optimize operational capability of a payload based on technology maturation and EW technical community inputs. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	-	6.772	7.417
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.409	-
Accomplishments/Planned Programs Subtotals	-	11.217	10.819

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** CH3 / *Holistic Team Survivability Technology*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) CH4 / *Power & Thermal Management for FVL Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
CH4: *Power & Thermal Management for FVL Tech*	-	-	7.175	7.613	-	7.613	7.713	7.721	7.697	7.694	0.000	45.613

A. Mission Description and Budget Item Justification

This Project directly supports Future Vertical Lift (FVL) Modernization Priority capabilities by investigating and developing power and thermal management technologies to provide significantly higher electrical power capability to FVL aircraft while addressing consequential size, weight, and thermal issues. This Project provides power capability for advanced electric aeromechanical effectors, advanced mission systems algorithms for route planning and teaming, and advanced electronic warfare devices. This also Project investigates emerging electrical power generation and distribution, energy storage, and thermal management technologies needed for future Command, Control, Communications, Computers, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) and survivability equipment for application to FVL and other Army platforms. Enables significantly increased aircraft electrical power capability for advanced electric aeromechanical effectors, advanced mission systems to include algorithms for route planning and teaming, and for advanced electronic warfare devices while minimizing size and weight.

Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Optimized Energy for C5ISR Platforms	-	4.726	5.185
Description: This effort investigates electrical power and thermal management associated with high power C5ISR capabilities on ground and air platforms enabling enhanced mobility and mission flexibility. This effort funds research to improve FVL aircraft and other Army platforms power efficiency through the use of on-demand hybrid electrical power architectures, while also researching ways to eliminate platform thermal constraints. This effort will also investigate safer battery chemistries which enable very high density electrical power sources and energy storage to be flight certified for high rate pulsed power, electrical power management, and thermal management for dynamic high rate pulsed power.			
FY 2022 Plans: Will apply models based on size, weight, and power requirements of air platforms to inform design and development of energy storage components needed to support high power, short duration bursts. Will design and develop phase change material and pumped two-phase based thermal management components to support rejection of waste heat due to inefficiencies in power conversion. Will conduct experiments on both energy storage and thermal management components to determine performance			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** CH4 / *Power & Thermal Management for FVL Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
against advanced C5ISR devices such as advanced radars and sensors. Will conduct experiments to determine the effectiveness of power electronic components and power management strategies. ***FY 2023 Plans:*** Will investigate intrinsically safe chemistries for energy storage components able to deliver light weight, high energy power to support aviation electronic warfare capabilities. Will mature thermal management components to support rejection of waste heat generated by platform mission equipment. Will conduct experiments on real world thermal management components in order to validate models. Will investigate advanced cold plate designs for two-phase heat rejection to reduce size, weight, and power draw. Will conduct experiments on thermal energy storage using phase change materials to better manage waste heat from high heat flux loads. Will investigate efficient power electronics which will further reduce the waste heat generated by the aircraft. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Power & Thermal Management Components ***Description:*** This effort develops electrical power and thermal management component technologies to meet the power and thermal demands of Future Vertical Lift aircraft while minimizing system size and weight. Technology will be validated through component level test. ***FY 2022 Plans:*** Will perform design and fabrication of efficient, distributed, and adaptable cooling systems enabling increased electrical power capability while reducing weight and cost to Future Vertical Lift aircraft electrical power and thermal management systems. ***FY 2023 Plans:*** Will perform fabrication and validation testing of efficient, distributed, and adaptable cooling systems that enable increased electrical power capability while reducing weight and cost to Future Vertical Lift aircraft electrical power and thermal management systems. Will perform design of power dense generator technology thereby reducing system weight and volume while improving system efficiency and reliability for future and enduring fleets. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	-	2.187	2.428
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:***	-	0.262	-

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** CH4 / *Power & Thermal Management for FVL Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	-	7.175	7.613

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army			Date: April 2022
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) CI5 / *High Speed Maneuverable Missile (HSMM) Tech*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
CI5: *High Speed Maneuverable Missile (HSMM) Tech*	-	-	8.526	23.463	-	23.463	24.102	-	0.832	19.013	0.000	75.936

A. Mission Description and Budget Item Justification

The Project investigates, designs, and evaluates missile component technologies compatible with Future Vertical Lift (FVL) and Future Unmanned Aircraft Systems (FUAS) aviation platforms in a Multi-Domain Battle/Cross-domain Maneuver operational environment. Efforts provide technologies to support a smaller, faster, maneuverable missile capable of long range non-line-of-sight attack in contested/degraded environments. Technology development increases aviation lethality and platform survivability by increasing missile standoff range, speed, and maneuverability, a faster rate of fire, shorter times of flight, and multi-threat lethal effects. Enables cross domain applications for aviation and ground vehicle platforms, including handoff capability, to engage threats in dead zones, and to operate in contested environments.

Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology).

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: High Speed Maneuverable Missile (HSMM) Technology	-	8.215	23.463
Description: Efforts provide technology development to support a maneuverable missile capable of both short range direct attack and long range non-line-of-sight attack with reduced time to target; reduced size and weight for increased load-out; capable of air launched missions in degraded/contested environments.			
FY 2022 Plans: Will continue component maturation based on PE 0602148A (Future Vertical Lift Technology) / Project AK4 (Multi-Role Small Guided Missile Technology) efforts. Will investigate options for multi-mode propulsion to increase range and speed with desired trajectory for effectiveness and survivability. Will determine appropriate missile test bed. Will validate preliminary design accurately reflects platform interfaces and requirements to include maneuverability, long range precision strike capability in degraded/contested environments, and reduced time to target.			
FY 2023 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Army		Date: April 2022
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*	**Project (Number/Name)** CI5 / *High Speed Maneuverable Missile (HSMM) Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Will continue component development and evolve critical component designs including navigation sensors, warheads, fire control, and digital missile datalinks. Will advance the design and development of a missile test bed. Will develop detailed design of the advanced propulsion system to increase range and speed with desired trajectory for effectiveness and survivability. Will assess that detailed designs accurately reflect platform interfaces and requirements to include maneuverability, long range precision strike capability in degraded/contested environments, and reduced time to target. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** In FY23 this project funding was increased to accelerate FVL CFT lethality capabilities.			
Title: FY2022 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2022 to FY 2023 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.311	-
Accomplishments/Planned Programs Subtotals	-	8.526	23.463

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A