Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Air Force											Date: March 2024	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602203F / *Aerospace Propulsion*							
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
Total Program Element	-	201.798	184.867	339.477	0.000	339.477	349.289	356.433	398.813	406.627	Continuing	Continuing
622401: *Structures*	-	0.000	0.000	76.135	0.000	76.135	77.898	79.468	85.722	87.448	Continuing	Continuing
622403: *Flight Controls and Pilot-Vehicle Interface*	-	0.000	0.000	42.659	0.000	42.659	43.570	44.519	62.051	63.304	Continuing	Continuing
622405: *High Speed Systems Technology*	-	0.000	0.000	41.137	0.000	41.137	42.083	42.949	45.778	46.708	Continuing	Continuing
623012: *Advanced Propulsion Technology*	-	17.335	18.638	18.430	0.000	18.430	18.838	19.224	20.739	21.159	Continuing	Continuing
623048: *Combustion and Mechanical Systems*	-	4.653	4.845	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
623066: *Turbine Engine Technology*	-	76.045	73.533	76.546	0.000	76.546	80.462	82.068	88.610	90.181	Continuing	Continuing
623145: *Aerospace Power Technology*	-	59.325	39.602	38.640	0.000	38.640	39.461	40.271	44.090	44.963	Continuing	Continuing
625171: *Missile Rocket Propulsion*	-	35.991	39.233	36.945	0.000	36.945	37.788	38.558	41.808	42.646	Continuing	Continuing
625330: *Aerospace Fuel Technology*	-	8.449	9.016	8.985	0.000	8.985	9.189	9.376	10.015	10.218	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program investigates, develops, and analyzes aerospace system technologies for military applications that remove operational limitations and advance warfighter capabilities critical to the future threat. The specific areas of applied research are in:

- Structures: Develops and exploits advanced aerodynamic vehicle configurations, new materials, fabrication processes, design techniques, and incorporates vehicle, inter-vehicle, and intra-vehicle control systems enabling advanced capabilities for the Air Force.

- Flight Controls and Pilot-Vehicle Interface: Develops technologies that enable maximum affordable capability focusing on manned and autonomous collaborative platforms for military applications that remove operational limitations and enable advanced vehicle designs and mission systems.

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Air Force	Date: March 2024
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*

- High Speed Systems Technology: Develops high speed/hypersonic aerospace systems technologies to include advanced high temperature structures and advanced aerodynamic vehicle configurations enabling future high speed weapons and platforms; intelligence, surveillance, and reconnaissance systems; and multi-domain vehicles.

- Advanced Propulsion Technology: Develops high speed (to include hypersonic) aerospace vehicles as well as high-speed air breathing propulsion enabling revolutionary capabilities for near peer-to-peer competition.

- Combustion and Mechanical Systems: Evaluates lubricants, for advanced turbine engines, and combined cycle engines with emphasis on low cost and high speed applications.

- Turbine Engine Technology: Develops engine technology to address military specific needs for manned systems, autonomous collaborative platforms, and munition applications in various class sizes.

- Aerospace Power Technology: Develops electrical and thermal control technologies for military applications that remove operational limitations enabling advanced vehicle designs and high-power mission systems.

- Missile Rocket Propulsion: Develops rocket propulsion technologies for the design, development, and fabrication of strategic systems and tactical missiles enabling timely and affordable capacity.

- Aerospace Fuel Technology: Evaluates fuels and related technologies to enable increased performance and affordability of high speed and munition capabilities.

In FY 2025, the RDT&E Budget Activity 02 (BA02) Aerospace Vehicles Technologies efforts and activities under PE 0602201F, are transferred to PE 0602203F, Aerospace Propulsion for increased integration between airframe, flight control, propulsion, electrical, power and thermal management.

In FY 2025, the entirety of PE 0602201F, Aerospace Vehicle Technologies, Project 622401 Structures, is transferred to PE 0602203F, Aerospace Propulsion, Project 622401 Structures.

In FY 2025, the entirety of PE 0602201F, Aerospace Vehicle Technologies, Project 622404, Aeromechanics, is transferred to PE 0602203F, Aerospace Propulsion, Project 622401 Structures.

In FY 2025, the entirety of PE 0602201F, Aerospace Vehicle Technologies, Project 622403, Flight Controls and Pilot-Vehicle Interface, is transferred to PE 0602203F,Aerospace Propulsion, Project 622403 Flight Controls and Pilot-Vehicle Interface.

In FY 2025, the entirety of P E 0602201F, Aerospace Vehicle Technologies, Project 622405, High Speed Systems Technology, is transferred to PE 0602203F, Aerospace Propulsion, Project 622405 High Speed Systems Technology.

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Air Force	Date: March 2024
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*

Efforts in this program have been coordinated through the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602102F, 0602201F,0602202F, 0602204F, 0602602F, 0602605F, 0602788F, 0602298F, and 1206601SF.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

Funds in this program element may be used to investigate specified technology advancements in multiple domains.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	212.361	184.867	178.396	0.000	178.396
Current President's Budget	201.798	184.867	339.477	0.000	339.477
Total Adjustments	-10.563	0.000	161.081	0.000	161.081
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	11.904	0.000			
• SBIR/STTR Transfer	-5.553	0.000			
• Other Adjustments	-16.914	0.000	161.081	0.000	161.081

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Project: 623066: *Turbine Engine Technology*		
Congressional Add: *Program Increase - Modular open system architecture for turbine engine technology*	7.803	-
Congressional Add Subtotals for Project: 623066	7.803	-
Project: 623145: *Aerospace Power Technology*		

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Air Force	Date: March 2024
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Congressional Add: *Emergency power and cooling thermal management growth*	8.267	-
Congressional Add: *Modular cooling capacity for tactical aircraft*	3.477	-
Congressional Add: *Program Increase - high mach turbine engine*	9.754	-
Congressional Add: *High voltage aircraft power*	1.950	-
Congressional Add: *Improving reliability of electrical systems for future aircraft*	4.877	-
Congressional Add Subtotals for Project: 623145	28.325	-
Congressional Add Totals for all Projects	36.128	-

Change Summary Explanation

FY 2025 funding increased compared to FY 2024 by $154.61 million. The increase is due to the transfer of PE 0602201F, Aerospace Vehicle Technology, efforts to PE 0602203F, Aerospace Propulsion.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force											Date: March 2024	
Appropriation/Budget Activity 3600 / 2				R-1 Program Element (Number/Name) PE 0602203F / *Aerospace Propulsion*			Project (Number/Name) 622401 / *Structures*					
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
622401: *Structures*	-	0.000	0.000	76.135	0.000	76.135	77.898	79.468	85.722	87.448	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops advanced structures concepts to exploit new materials and fabrication processes and investigates new concepts and design techniques. New structural concepts include low-cost design and fabrication techniques, incorporating subsystem hardware items, and adaptive mechanisms into the aerospace structures and/or skin of the platform.

In FY 2025, the entirety of PE 0602201F, Aerospace Vehicle Technologies, Project 622401 Structures and Project 622404 Aeromechanics, is transferred to PE 0602203F, Aerospace Propulsion, Project 622401 Structures. This is an administrative realignment to provide increased execution flexibility and not a new start.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Vehicle Design Technologies	0.000	0.000	17.730
Description: Develop methodologies to reduce the cost and time involved from design to full-scale testing of structural concepts and aerospace systems. ***FY 2024 Plans:*** For FY 2024 and prior years, this work is performed under PE 0602201F, Aerospace Vehicle Technologies, Project 622401, Structures, Vehicle Design Technologies effort. ***FY 2025 Plans:*** - Continue the development of advanced high fidelity aircraft design tools. - Continue the development of new design methods that link vehicle system requirements to mission operation performance. - Continue the integration of model-based systems engineering design tools with quantified risk methodologies. - Continue integration of affordable manufacturing considerations in air vehicle design. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $17.730 million. $0.407 million decreased due to reduced emphasis in vehicle design. $18.137 million increased due to transfer of Vehicle Design Technologies effort from PE 0602201F, Aerospace Vehicle Technologies, Project 622401, Structures, Vehicle Design Technologies effort.			
Title: Structural Concepts	0.000	0.000	24.496
Description: Develop design methods, processes, and lightweight, adaptive, and multifunctional structural concepts to capitalize on new materials, multi-role considerations, and technology integration into aircraft systems.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 622401 / *Structures*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2024 Plans: Develop design methods, processes, and lightweight, adaptive, and multifunctional structural concepts to capitalize on new materials, multi-role considerations, and technology integration into aircraft systems. ***FY 2025 Plans:*** - Continue development of low-cost agile manufacturing concepts for structures in support of the development of a next variant of a low-cost unmanned aerospace system. - Continue digital and systems engineering assessments for the development of airworthiness certification criteria for advanced airframe structures. - Continue the validation of innovative structural design methods to dramatically reduce weight and complexity of aircraft structures. - Continue the demonstration of the fatigue life of bonded unitized composite structures for the next generation of aircraft. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $24.496 million. $0.442 million decreased due to reduced emphasis in structural concepts. $24.938 million increased due to realignment of Structural Concepts effort from PE 0602201F, Aerospace Vehicle Technologies, Project 622401, Structures, Structural Concepts effort.			
Title: Next Generation Aerodynamic Technologies ***Description:*** Develop and assess technologies for the next generation of multi-role large aircraft. ***FY 2024 Plans:*** For FY 2024 and prior years, this work is performed under PE 0602201F, Aerospace Vehicle Technologies, Project 622401, Structures, Next Generation Aerodynamic Technologies effort. ***FY 2025 Plans:*** - Continue the development of advanced, high fidelity, aerodynamic analysis tools for aircraft conceptual design. - Continue assessment of innovative next generation vehicle concepts. - Continue digital modeling and simulation development for the assessment of fuel and energy use. - Initiate the assessment of fuel and energy saving techniques for fleet application. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $7.679 million. $0.361 million of the increase is due to increased emphasis in aerodynamic technologies for autonomous collaborative platforms. $7.318 million of the increase is due to realignment of Next	0.000	0.000	7.679

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 622401 / *Structures*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Generation Aerodynamic Technologies effort from PE 0602201F, Aerospace Vehicle Technologies, Project 622401, Structures, Next Generation Aerodynamic Technologies effort.			
Title: Aircraft Integration Technologies ***Description:*** Develop enabling technologies to allow efficient and effective integration of propulsion, weapons, and subsystems into current and future air vehicles. ***FY 2024 Plans:*** For FY 2024 and prior years, this work is performed under PE 0602201F, Aerospace Vehicle Technologies, Project 622401, Structures, Aircraft Integration Technologies effort. ***FY 2025 Plans:*** - Complete the development of novel kinetic weapons integration technologies for enhanced weapon payload in affordable platforms. - Continue the development of a modeling and simulation approach to the design and integration of embedded propulsion systems. - Initiate the demonstration of integrated propulsion for next generation air vehicle conceptual design. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $16.836 million. $0.336 million decreased due to completion of kinetic weapons integration technologies in affordable platforms. $17.174 million of the increase is due to realignment of Aircraft Integration Technologies effort from PE 0602201F, Aerospace Vehicle Technologies, Project 622401, Structures, Next Generation Aerodynamic Technologies effort.	0.000	0.000	16.838
Title: Aerodynamic Systems Technologies ***Description:*** Develop aerodynamic assessment prediction methods centered on expanding the design capabilities of future air vehicles. ***FY 2024 Plans:*** For FY 2024 and prior years, this work is performed under PE 0602201F, Aerospace Vehicle Technologies, Project 622404, Aeromechanics, Aerodynamic Systems Technologies effort. ***FY 2025 Plans:*** - Continue the assessment and development of incorporating active flow control techniques into advanced, mission utility informed, aircraft vehicle configuration design techniques. - Complete design assessments of long-endurance unmanned platforms. - Continue the development of prediction methods which include air vehicle stability and control	0.000	0.000	9.392

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 622401 / *Structures*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
requirements. - Initiate the technology maturation of long-endurance unmanned aircraft vehicle design. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $9.392 million. $0.743 million decrease is due to design assessment completion of long-endurance unmanned platforms. $10.135 million increase is due to realignment of Aerodynamic Systems Technologies effort from PE 0602201F, Aerospace Vehicle Technologies, Project 622404, Aeromechanics, Aerodynamic Systems Technologies effort.			
Accomplishments/Planned Programs Subtotals	0.000	0.000	76.135

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force			Date: March 2024
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / *Aerospace Propulsion*	Project (Number/Name) 622403 / *Flight Controls and Pilot-Vehicle Interface*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
622403: *Flight Controls and Pilot-Vehicle Interface*	-	0.000	0.000	42.659	0.000	42.659	43.570	44.519	62.051	63.304	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops technologies that enable affordable mass and maximum capabilities for manned, remotely-piloted, and autonomous aerospace vehicles. Advanced control, automation, and autonomy technologies are developed for optimal vehicle performance throughout the flight envelope and evaluated in virtual simulation environments through full-scale testing. Resulting technologies contribute significantly towards the development of reliable autonomous collaborative platforms, high-speed aircraft, and extended-life legacy aircraft.

In FY 2025, the entirety of PE 0602201F, Aerospace Vehicle Technologies, Project 622403 Flight Controls and Pilot-Vehicle Interface, is transferred to PE 0602203F, Aerospace Propulsion, Project 622403 Flight Controls and Pilot-Vehicle Interface. This is an administrative realignment to provide increased execution flexibility and not a new start.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Flight Controls Technologies	0.000	0.000	10.120
Description: Develop technologies for advanced control-enabled capabilities, including flight controls, components, integrated vehicle management systems, and software and system certification techniques for both manned aircraft and autonomous collaborative platforms.			
FY 2024 Plans: For FY 2024 and prior years, this work is performed under PE 0602201F, Aerospace Vehicle Technologies, Project 622403, Flight Controls and Pilot-Vehicle Interface, Advanced Flight Controls Technologies effort.			
FY 2025 Plans: - Continue the development of a trusted autonomy approach, integrating certification and assurance processes and autonomy development including tool development to enhance the use of formal methods in autonomy development to accelerate validation of autonomy algorithms and transition timelines. - Continue the development, demonstration, and assessment of advanced autonomy capabilities for dynamic tasking in complex environments including development of knowledge-based AI decision architecture toward robust mission management for heterogeneous teams of autonomous collaborative platforms. - Continue the development of autonomy optimization and assurance in dynamic and uncertain environment including rigorous extensions to optimization techniques to enable better autonomous behavior under uncertainty.			
FY 2024 to FY 2025 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 622403 / *Flight Controls and Pilot-Vehicle Interface*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2025 increased compared to FY 2024 by $10.120 million. $0.642 million of the increase is due to increased emphasis in of flight control technologies for autonomous collaborative platforms. $9.478 million of the increase is due to realignment of Advanced Flight Controls Technologies effort from PE 0602201F, Aerospace Vehicle Technologies, Project 622403, Flight Controls and Pilot-Vehicle Interface, Advanced Flight Controls Technologies effort.			
Title: Manned and Unmanned Teaming Technologies ***Description:*** Develop technology for flight control systems that will permit safe interoperability between manned aircraft and autonomous collaborative platforms and effective teaming in adverse and contested environments. ***FY 2024 Plans:*** For FY 2024 and prior years, this work is performed under PE 0602201F, Aerospace Vehicle Technologies, Project 622403, Flight Controls and Pilot-Vehicle Interface, Manned and Unmanned Teaming Technologies effort. ***FY 2025 Plans:*** - Complete the development of tactical autonomy for manned-unmanned teams in contested, dynamic mission environments. - Continue the development of mission management autonomy for manned-unmanned team to include extending an autonomy framework for autonomous collaborative platforms to be able to leverage existing autonomy library. - Continue the development, demonstration, and assessment of autonomous behaviors to address mission capability gaps to include modeling, simulation, and assessment of dynamic task allocation behaviors to better inform this and other autonomy developments. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $24.552 million. $1.407 million of the increase is due to increased emphasis in autonomy teaming for autonomous collaborative platforms. $23.144 million of the increase is due to realignment of Manned and Unmanned Teaming Technologies effort from PE 0602201F, Aerospace Vehicle Technologies, Project 622403, Flight Controls and Pilot-Vehicle Interface, Manned and Unmanned Teaming Technologies effort.	0.000	0.000	24.552
Title: Flight Controls Technologies Modeling and Simulation ***Description:*** Develop tools and methods for capitalizing on simulation-based research and development of future aerospace vehicles. ***FY 2024 Plans:*** For FY 2024 and prior years, this work is performed under PE 0602201F, Aerospace Vehicle Technologies, Project 622403, Flight Controls and Pilot-Vehicle Interface, Flight Controls Technologies Modeling and Simulation effort. ***FY 2025 Plans:***	0.000	0.000	7.987

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 622403 / *Flight Controls and Pilot-Vehicle Interface*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Complete manned-unmanned teaming evaluations including rapid development of new integrated capabilities. - Continue analyses of concepts for future advanced development capabilities. - Continue modeling and simulation efforts to assess emerging aerospace technologies in complex and dynamic battlespace environments. - Continue digital engineering efforts to create a digital continuum of military utility and cost effectiveness analysis for investment planning from technology development to technology transition. - Initiate foundational and applied research into mission engineering. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $7.987 million. $0.694 million of the increase is due to increased emphasis of applied research into mission engineering. $7.293 million of the increase is due to realignment of Flight Controls Technologies Modeling and Simulation effort from PE 0602201F, Aerospace Vehicle Technologies, Project 622403, Flight Controls and Pilot-Vehicle Interface, Flight Controls Technologies Modeling and Simulation effort.			
Accomplishments/Planned Programs Subtotals	0.000	0.000	42.659

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force			Date: March 2024
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / *Aerospace Propulsion*	Project (Number/Name) 622405 / *High Speed Systems Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
622405: *High Speed Systems Technology*	-	0.000	0.000	41.137	0.000	41.137	42.083	42.949	45.778	46.708	Continuing	Continuing

A. Mission Description and Budget Item Justification

This effort investigates, analyzes, and develops high speed/hypersonic aerospace vehicle technologies. Advanced high temperature structures concepts are explored and developed to exploit new materials, fabrication processes, and design techniques. Advanced aerodynamic vehicle configurations are developed and analyzed through simulations, experiments, and multi-disciplinary analyses. Advanced subsystem, integration and analysis technologies are developed and simulated for hypersonic vehicles. These technologies will enable future high speed weapons and platforms; intelligence, surveillance, and reconnaissance systems; and space access vehicles.

In FY 2025, the entirety of PE 0602201F, Aerospace Vehicle Technologies, Project 622405 High Speed Systems Technology, is transferred to PE 0602203F, Aerospace Propulsion, Project 622405 High Speed Systems Technology. This is an administrative realignment to provide increased execution flexibility and not a new start.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: High Speed Systems Technology	0.000	0.000	23.885
Description: Develop design analysis methods and technologies for high speed systems at extreme flight conditions.			
FY 2024 Plans: For FY 2024 and prior years, this work is performed under PE 0602201F, Aerospace Vehicle Technologies, Project 622405, High Speed Systems Technology, High Speed Systems Technology effort.			
FY 2025 Plans: - Continue critical technology maturation for high speed/ hypersonic systems with secondary emphasis on longer range flight and heavier payloads. - Continue maturation of innovative aerospace structural concepts, analytical methods, service life predictions, airframe/engine integration, fluid/thermal/structural interactions and thermal management techniques. - Continue development of high speed system concepts, including flight research concepts, to provide revolutionary capabilities for affordable expendable systems and robust reusable systems. - Continue efforts to characterize high-speed vehicle system phenomena, develop and validate fundamental high-speed component technologies through computational analysis, ground, and flight testing. - Initiate critical technology maturation for high speed/ hypersonic systems with primary emphasis on reusable platforms/systems, including: validated modeling, simulation, and analysis techniques, mission system integration, operability and performance over expanded mission requirements, vehicle durability, and vehicle-level thermal management.			
FY 2024 to FY 2025 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 622405 / *High Speed Systems Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2025 increased compared to FY 2024 by $23.885 million. $0.645 million of the increase is due to increased emphasis of critical technology maturation for high speed/hypersonic systems. $23.240 million of the increase is due to realignment of High Speed Systems Technology effort from PE 0602201F, Aerospace Vehicle Technologies, Project 622405, High Speed Systems Technology, High Speed Systems Technology effort.			
Title: High Speed Vehicle Aeromechanics and Integration	0.000	0.000	17.252
Description: Develop new and improved components, concepts, and designs for sustained flight of high-speed/hypersonic expendable and re-useable vehicles. Conduct analyses of high speed/hypersonic vehicles to enable revolutionary capabilities. ***FY 2024 Plans:*** For FY 2024 and prior years, this work is performed under PE 0602201F, Aerospace Vehicle Technologies, Project 622405, High Speed Systems Technology, High Speed Vehicle Aeromechanics and Integration effort. ***FY 2025 Plans:*** - Continue to mature critical technologies for high speed/hypersonic flight with primary emphasis on reusable systems and secondary emphasis on longer range and heavier payloads. - Continue development of multi disciplinary design and analysis techniques and tools with emphasis on the digital engineering environment. - Continue development of high speed system concepts that provide revolutionary capabilities through configuration research. - Continue investigation of aeromechanic technologies to evaluate uncertainty, improve instrumentation accuracy and safe multi-body physics - Continue efforts to characterize high-speed aeromechanics phenomena and develop and validate fundamental high-speed component technologies through computational analysis, ground, and flight testing. - Continue investigation of advanced aeromechanic technologies to extend system range through improvement of system lift/drag ratio and maintain robust stability and control at all flight conditions. - Continue investigation of computational and ground based experimental approaches to improved air induction systems over a wide range of flight conditions. - Initiate critical technology maturation for high speed/ hypersonic systems with primary emphasis on reusable platforms/systems, including: validated modeling, simulation, and analysis techniques, mission system integration, operability and performance over expanded mission requirements, vehicle durability, and vehicle-level thermal management. -Initiate critical vehicle aeromechanics and integration technology maturation for high speed/ hypersonic systems with primary emphasis on reusable platforms/systems, including: validated modeling, simulation, and analysis techniques, mission system integration, operability and performance over expanded mission requirements, vehicle durability, and vehicle-level thermal management. ***FY 2024 to FY 2025 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 622405 / *High Speed Systems Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2025 increased compared to FY 2024 by $17.252 million. $0.466M of the increase is due to increased emphasis of vehicle aeromechanics and integration for high speed systems. $16.786 million of the increase is due to realignment of High Speed Vehicle Aeromechanics and Integration effort from PE 0602201F, Aerospace Vehicle Technologies, Project 622405, High Speed Systems Technology, High Speed Vehicle Aeromechanics and Integration effort.			
Accomplishments/Planned Programs Subtotals	0.000	0.000	41.137

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force			Date: March 2024
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / *Aerospace Propulsion*	Project (Number/Name) 623012 / *Advanced Propulsion Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
623012: *Advanced Propulsion Technology*	-	17.335	18.638	18.430	0.000	18.430	18.838	19.224	20.739	21.159	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops combined/advanced cycle air breathing high-speed and hypersonic propulsion technologies to provide revolutionary propulsion options for the Air Force. These new engine technologies will enable future high-speed/hypersonic weapons and aircraft concepts. The primary focus is on hydrocarbon-fueled engines capable of operating over a broad range of flight Mach numbers. Efforts include modeling, simulations, and proof of concept demonstrations of critical components; advanced component development; and ground-based demonstrations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Hypersonic Scramjet Technologies	17.335	18.638	18.430
Description: Develop robust high-speed and hypersonic propulsion technologies, including hydrocarbon fueled scramjet, ramjet, and combined cycle engine components and technologies to improve performance, operability, durability, and scalability for future platforms.			
FY 2024 Plans: Continue development and demonstration of advanced, high speed engine components to improve operating margin and operating time for expendable and reusable applications; complete scaling laws element of research. Continue development of low internal drag flame stabilization devices, instrumentation, endothermic fuels, and flight test engine components. Continue development of design and analysis techniques and tools as well as experimental approaches to enable enhanced high-speed air induction system starting, operability, and performance for propulsion integration concepts over a wide range of flight conditions. Continue propulsion studies and design efforts required for the development and demonstration of an engine flight test that expands the flight environment of current high speed propulsion systems.			
FY 2025 Plans: - Continue development and demonstration of advanced, high speed engine components to improve operating margin and operating time for expendable and reusable applications. - Continue development of low internal drag flame stabilization devices, instrumentation, endothermic fuels, and flight test engine components. - Continue development of design and analysis techniques and tools as well as experimental approaches to enable enhanced high-speed air induction system starting, operability, and performance for propulsion integration concepts over a wide range of flight conditions. - Continue propulsion studies and design efforts required for the development and demonstration of an engine flight test that expands the flight environment of current high speed propulsion systems.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623012 / *Advanced Propulsion Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Initiate critical technology maturation for high speed and hypersonic propulsion systems with primary emphasis on reusable platforms/systems, including validated modeling, simulation, and analysis techniques, engine operability and performance over expanded flight Mach number ranges, propulsive system durability, and thermal management. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 decreased compared to FY 2024 by $0.208 million due to completion of scaling laws research.			
Accomplishments/Planned Programs Subtotals	17.335	18.638	18.430

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force			Date: March 2024
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / *Aerospace Propulsion*	Project (Number/Name) 623048 / *Combustion and Mechanical Systems*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
623048: *Combustion and Mechanical Systems*	-	4.653	4.845	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates lubricants, for advanced turbine engines, and combined cycle engines with emphasis on low cost and high speed applications.

In 2025, Lubricant Technologies effort in this project will transfer to Program 0602203F, Aerospace Propulsion, Project 623066, Turbine Engine Technology, in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Lubricant Technologies	4.653	4.845	0.000
Description: Develop, test, and model advanced turbine engine lubricants and applied lubrication technologies. ***FY 2024 Plans:*** Complete developing innovative fluids by; defining target requirements for new polyolester oils, conduct Research & Development for new/enhanced turbine engine oils for legacy & emerging engines, qualify new & updated engine oil products for legacy & emerging engines. Continue the development of lubricant modeling through characterization of heat generation, lubrication system cooling effectiveness, failure progression of bearing materials under relevant engine conditions, and overall system performance of advanced bearing concepts for model validation. Complete supporting the warfighter on field-related mechanical system issues. Continue performance validation study of lubricant & lubrication system components via full-scale high-fidelity laboratory parametric testing at representative engine operating conditions. Continue development of applied rotor dynamics models for design. Initiate studies on bearings nonoil lubrication technologies for limited life systems. ***FY 2025 Plans:*** In 2025, Lubricant Technologies effort in this project will transfer to Program 0602203F, Aerospace Propulsion, Project 623066, Turbine Engine Technology, in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 decreased compared to FY 2024 by $4.845 million due to a transfer to Program 0602203F, Aerospace Propulsion, Project 623066, Turbine Engine Technology, in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.			
Accomplishments/Planned Programs Subtotals	4.653	4.845	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623048 / *Combustion and Mechanical Systems*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force			Date: March 2024
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / *Aerospace Propulsion*	Project (Number/Name) 623066 / *Turbine Engine Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
623066: *Turbine Engine Technology*	-	76.045	73.533	76.546	0.000	76.546	80.462	82.068	88.610	90.181	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops air breathing engine technology to address military specific needs for manned systems, autonomous vehicles, and munition applications. This project develops turbine engine components and evaluates revolutionary air breathing propulsion technology by utilizing military utility and physics-based analysis.

In FY 2025, Lubricant Technologies efforts will transfer from PE 0602203F, Aerospace Propulsion, Project 623048, Combustion and Mechanical Systems, to this Project 623066 Turbine Engine Technology, to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Turbine Engine Components	23.761	26.339	26.339
Description: Develop core turbofan/turbojet engine components (i.e., compressors, and turbines) for strike and air superiority capabilities. ***FY 2024 Plans:*** Continue development of improved aerodynamic design tools and analysis methods to extend engine operability and efficiency. Continue transonic fan distortion tolerance and transfer study to enable design-for-integration and reliable assessment for embedded engines. Continue high lift /high work turbine study to reduce turbine stage /blade count. Initiate design of compressors and turbines for limited life and affordability. ***FY 2025 Plans:*** - Continue development of improved aerodynamic design tools and analysis methods to extend engine operability and efficiency by advancing rules and tools to perform integrated engine design to meet modeling, simulation, and analysis defined capabilities. - Continue transonic fan distortion tolerance and transfer study to enable design-for-integration and reliable assessment for embedded engines by advancing design activities for distortion tolerant fan components. - Continue high lift /high work turbine study to reduce turbine stage /blade count. - Continue design of compressors and turbines for limited life and affordability. - Initiate demonstration of high efficiency, high durability propulsion components tailored for embedded systems. - Initiate engine component validated methodologies to trade engine life, cost and performance. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Not Applicable			
Title: Turboshaft/Turboprop and Turbofan Engine Technologies	4.896	4.896	0.553

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623066 / *Turbine Engine Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: Develop components for turboshaft/turboprop and small turbofan engines for trainers, special operations aircraft, and long range strike. ***FY 2024 Plans:*** Continue the exploration of new small engine technologies that can operate in high-speed applications; Complete evaluation of risk reduction technologies to increase usage time of systems. Complete utilizing validation data to develop improved test protocol for small engine designs. Continue exploration of new small and medium size engine technologies for increased fuel efficiency, propulsive capability, power and thermal management, and reduced life cycle cost. Continue identification of new architectures and critical technologies for integrated power and thermal systems. Continue identification of requirements and develop models for simulation of highly integrated systems. ***FY 2025 Plans:*** - Complete exploration of new small engine technologies that can operate in high-speed applications. - Complete exploration of new small and medium size engine technologies for increased fuel efficiency, propulsive capability, power and thermal management, and reduced life cycle cost. - Complete identification of new architectures and critical technologies for integrated power and thermal systems. - Complete identification of requirements and develop models for simulation of highly integrated systems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 decreased compared to FY 2024 by $4.343 million. Funding decreased due to completion of turboshaft/turboprop and small engine technology development and increased emphasis in turbine engine components.			
Title: Revolutionary Propulsion Technology ***Description:*** Develop, test, and evaluate revolutionary propulsion concepts for gas turbine, pressure gain propulsion, and combined cycle engines for missiles, manned and unmanned systems. ***FY 2024 Plans:*** Complete identification of control technology elements applicable to integrated propulsion/power/thermal solutions. Continue evaluation of integration of advanced augmentors and ramburners. Continue exploration of new expendable and attritable architectures. Continue the development and evaluation of advanced, integrated propulsion technologies for supersonic expendable, attritable, and reusable strike and Intelligence, Surveillance, and Reconnaissance (ISR) systems. Continue studies for exploration of advanced propulsion technologies. Initiate studies in hypersonic combined cycles. ***FY 2025 Plans:*** - Continue evaluation of integration of advanced augmentors and ramburner. - Complete exploration of new expendable and affordable architectures.	17.321	18.587	18.587

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623066 / *Turbine Engine Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Complete the development and evaluation of advanced, integrated propulsion technologies for supersonic expendable, affordable, and reusable strike and Intelligence, Surveillance, and Reconnaissance (ISR) systems. - Continue studies for exploration of advanced propulsion technologies. - Continue studies in hypersonic combined cycles. - Initiate operational benefits and military utility analysis of air breathing propulsion technologies. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Not Applicable			
Title: Engine Technologies for Autonomous Vehicles and Munitions ***Description:*** Develop methodologies to design low cost and limited life engine components for autonomous vehicles and munitions. ***FY 2024 Plans:*** Continue evaluation of power and thermal modeling of advanced architectures into aircraft system level multidisciplinary analysis and optimization tools: explore new control methods for integrated propulsion, power and thermal management. Continue exploration of new expendable and attritable architectures. Continue exploration of new engine concepts for missile and unmanned systems. Continue lifetime demonstration of limited life engine components. Initiate Multi-disciplinary design & optimization, systems engineering & digital engineering frameworks. Initiate development of predictive analysis tools to enable reliable, sufficiently durable component designs for Autonomous Collaborative Platforms (ACP). ***FY 2025 Plans:*** - Complete evaluation of power and thermal modeling of advanced architectures into aircraft system level multidisciplinary analysis and optimization tools: explore new control methods for integrated propulsion, power, and thermal management. - Complete exploration of new expendable and affordable architectures. - Complete exploration of new engine concepts for missile and unmanned systems. - Complete lifetime demonstration of limited life engine components. - Continue Multi-disciplinary design & optimization, systems engineering & digital engineering frameworks. - Continue development of predictive analysis tools to enable reliable, sufficiently durable component designs for Autonomous Collaborative Platforms (ACP). - Initiate component failure mode investigations. - Initiate studies in reducing the overall time required for engine development and design cycle. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	13.521	14.590	20.789

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623066 / *Turbine Engine Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2025 increased compared to FY 2024 by $6.199 million. Funding increased due to increased emphasis in Engine Technologies for Autonomous Vehicles and Munitions needed for component failure mode investigations and reducing engine development and design cycle.			
Title: Combustion Technologies ***Description:*** Develop, test, and evaluate revolutionary combustion and propulsion concepts for gas turbine, pulse detonation, and combined cycle engines for missiles, limited life systems. ***FY 2024 Plans:*** Complete exploring interactions and effects of compressor and turbine components on the combustor and combustor materials to increase efficiency and improve altitude ignition & operability. Complete development of computations, modeling and simulation, and research experimentation of advanced combustion concepts including pressure gain combustion components and system level architectures. Continue the development and demonstration of new design, modeling and simulation and testing methods to improve efficiency and operability. Continue investigation to identify and assess disruptive propulsion/power concepts and evaluate concepts. Continue development of new technologies for unmanned aircraft system propulsion/power systems for improved understanding at relevant operating conditions. Continue exploration of applied high speed combustion and combustor design. Continue exploration of rotating detonation engines for next generation combustion systems. Continue the development of improved numerical methods and combustion models to guide design and applied development of combustion components and systems. ***FY 2025 Plans:*** - Complete the development and demonstration of new design, modeling and simulation and testing methods to improve efficiency and operability. - Complete investigation to identify and assess disruptive propulsion/power concepts and evaluate concepts. - Complete development of new technologies for unmanned aircraft system propulsion/power systems for improved understanding at relevant operating conditions. - Complete exploration of applied high speed combustion and combustor design. - Complete exploration of rotating detonation engines for next generation combustion systems. - Complete the development of improved numerical methods and combustion models to guide design and applied development of combustion components and systems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 decreased compared to FY 2024 by $3.081 million. Funding decreased due to decreased emphasis in combustion component technologies and increased emphasis in Engine Technologies for Autonomous Vehicles and Munitions.	4.788	5.166	2.085
Title: Diagnostic Technologies	0.822	0.822	0.215

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623066 / *Turbine Engine Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: Develop and demonstrate optical, electromechanical, and laser diagnostic tools and sensors for application to revolutionary propulsion technologies. ***FY 2024 Plans:*** Complete development of diagnostic tools/ methods for robust measurement capability in engine test cells and full annular ground test environments including reacting and nonreacting spray experiments for liquid fuel spray model development and employment of nonintrusive optical diagnostics that will be used to obtain accurate, spatially/temporally resolved data. Continue the application of optical diagnostic to challenging engine environments including detonations, high pressures, and multiphase. ***FY 2025 Plans:*** Complete the application of optical diagnostic to challenging engine environments including detonations, high pressures, and multiphase. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 decreased compared to FY 2024 by $0.607 million. Funding decreased due to decreased emphasis in diagnostic technologies and increased emphasis Engine Technologies for Autonomous Vehicles and Munitions.			
Title: Bearing Technologies ***Description:*** Develop and test advanced bearing material technology and bearing concepts for small, intermediate, and large-scale turbine engine applications. ***FY 2024 Plans:*** Complete developing physics-based bearing life model based on bearing alloy fatigue and microstructural investigations, including bearing life factors for advanced bearing materials. Complete incorporating fatigue life, fault evolution, and parametric heat generation of advanced material systems into the models. Continue development of oil-free bearing technology for Unmanned Air Systems. Continue the development and demonstration of propulsion technologies for subsonic expendable and attritable air platforms, small and medium scale propulsion technologies, and evaluate lubricants, mechanical systems, bearing technology and combustion concepts for advanced turbine engines. Continue the development of fundamental knowledge of bearing material rolling contact fatigue failure mechanisms and lubricant interactions through microstructural investigations and failure analysis. Initiate macro failure mode investigations as a function of underlying microstructure and material fatigue life. ***FY 2025 Plans:*** - Complete development of oil-free bearing technology for Unmanned Air Systems. - Complete the development and demonstration of propulsion technologies for subsonic expendable and attritable air platforms, small and medium scale propulsion technologies, and evaluate lubricants, mechanical systems, bearing technology and combustion concepts for advanced turbine engines.	3.133	3.133	3.133

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623066 / *Turbine Engine Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Complete the development of fundamental knowledge of bearing material rolling contact fatigue failure mechanisms and lubricant interactions through microstructural investigations and failure analysis ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Not Applicable			
Title: Lubricant Technologies ***Description:*** This project evaluates lubricants, for advanced turbine engines, and combined cycle engines with emphasis on low cost and high speed applications. ***FY 2024 Plans:*** For FY 2024 and prior years, this work is performed under PE 0602203F, Aerospace Propulsion, Project 623048, Combustion and Mechanical Systems, Lubricant Technologies ***FY 2025 Plans:*** - Complete the development of lubricant modeling through characterization of heat generation, lubrication system cooling effectiveness, failure progression of bearing materials under relevant engine conditions, and overall system performance of advanced bearing concepts for model validation. - Complete performance validation study of lubricant & lubrication system components via full-scale high-fidelity laboratory parametric testing at representative engine operating conditions. - Complete development of applied rotor dynamics models for design. - Continue studies on bearings nonoil lubrication technologies for limited life systems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $4.845 million. Funding increased due to transfer of Lubricant Technologies effort from PE 0602203F, Aerospace Propulsion, Project 623048, Combustion and Mechanical Systems, Lubricant Technologies effort.	0.000	0.000	4.845
Accomplishments/Planned Programs Subtotals	68.242	73.533	76.546

	FY 2023	FY 2024
Congressional Add: Program Increase - Modular open system architecture for turbine engine technology ***FY 2023 Accomplishments:*** Conduct Congressionally directed efforts.	7.803	-
Congressional Adds Subtotals	7.803	-

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623066 / *Turbine Engine Technology*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force			Date: March 2024
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / *Aerospace Propulsion*	Project (Number/Name) 623145 / *Aerospace Power Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
623145: *Aerospace Power Technology*	-	59.325	39.602	38.640	0.000	38.640	39.461	40.271	44.090	44.963	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops integrated electrical and thermal management components, controls and systems for military aerospace applications. Power component technologies are developed to increase reliability, maintainability, commonality, affordability, and supportability of aircraft and flight line equipment. Research is conducted in energy storage and hybrid power system technologies to enable special purpose applications. Electrical power and thermal management technologies enable future military power and thermal needs. Controls and system integration technologies ensure the interoperability of aircraft, power, thermal, engine and other systems and subsystems. This project supports development of electrical power and thermal management components, controls and systems suitable for applications to legacy and future aircraft platforms including strike and mobility concepts. Lightweight power systems suitable for other aerospace applications are also developed.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: High Power System Technologies	31.000	39.602	38.640
Description: Develop integrated system architecture, controls, and component technologies to provide for the large amounts of electrical power needed, and concurrent thermal mitigation required, by current and future manned and unmanned systems. ***FY 2024 Plans:*** Complete development of system and component electrical power, electro-mechanical, and thermal technologies for high-power applications. Continue testing of subsystems hardware in conjunction with continued platform level tip-to-tail modeling and simulation for energy optimization. Continue medium-scale propulsion, power and thermal system studies and development to include innovative, integrated hybrid architectures. Continue development of advanced power and thermal capabilities for future hypersonic aircraft. Continue development of adaptive, affordable power and thermal technologies for emerging medium-scale platforms and mission capabilities. Initiate development of advanced vehicle energy management capabilities. ***FY 2025 Plans:*** - Continue testing of subsystems hardware in conjunction with continued platform level tip-to-tail modeling and simulation for energy optimization including update of Digital System Model for government subsystem architecture for autonomous collaborative platforms to provide sharable power and thermal model baseline for industry and government use. - Continue medium-scale propulsion, power and thermal system studies and development to include innovative, integrated hybrid architectures including medium scale vapor cycle systems to provide greater thermal capacity to autonomous collaborative platforms. - Continue development of advanced power and thermal capabilities for future hypersonic aircraft including power generation prototypes for high-temperature long-endurance missions to enable new platform capabilities.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623145 / *Aerospace Power Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Continue development of adaptive, affordable power and thermal technologies for emerging medium-scale platforms and mission capabilities including hardware-in-the-loop evaluation of electric flight control actuators to provide cost effective electric architectures and validated digital models. - Continue development of advanced vehicle energy management capabilities including modeling and analysis of path planning for energy management on autonomous collaborative platforms to provide benefits assessment, such as for extended range. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 decreased compared to FY 2024 by $0.962 million. Funding decreased due to decreased emphasis in high power system technologies.			
Accomplishments/Planned Programs Subtotals	31.000	39.602	38.640

	FY 2023	FY 2024
Congressional Add: Emergency power and cooling thermal management growth ***FY 2023 Accomplishments:*** Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	8.267	-
Congressional Add: Modular cooling capacity for tactical aircraft ***FY 2023 Accomplishments:*** Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	3.477	-
Congressional Add: Program Increase - high mach turbine engine ***FY 2023 Accomplishments:*** Conduct Congressionally directed efforts.	9.754	-
Congressional Add: High voltage aircraft power ***FY 2023 Accomplishments:*** Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	1.950	-
Congressional Add: Improving reliability of electrical systems for future aircraft ***FY 2023 Accomplishments:*** Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	4.877	-
Congressional Adds Subtotals	28.325	-

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623145 / *Aerospace Power Technology*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force											Date: March 2024	
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602203F / *Aerospace Propulsion*				Project (Number/Name) 625171 / *Missile Rocket Propulsion*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
625171: *Missile Rocket Propulsion*	-	35.991	39.233	36.945	0.000	36.945	37.788	38.558	41.808	42.646	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops rocket propulsion technologies for the design, development, and fabrication of strategic systems (including solid boost/missile motors, post boost control, aging and surveillance efforts), and tactical missiles. Analytical and experimental areas of emphasis are propellants, propellant management, combustion, rocket material applications, model-based system engineering, digital design of manufacture and test, test stand life-fire testing, and technology for sustainment of strategic systems. This project develops the next generation of physics-based modeling, simulation, and analysis (MS&A) tools for rapid and agile missile propulsion design, analysis, and production, as well as the digital engineering concepts to manage the entire process of design, test, and validation of solid rocket motors through live-fire tests. All efforts in this project contribute to the sustainment of the rocket propulsion industry, providing rocket propulsion technology for the entire Department of Defense (DoD). All efforts are reviewed by a DoD level steering committee yearly for relevance to DoD missions.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Missile Propellant Research	10.565	11.501	10.852
Description: Develop, characterize, and test advanced fuels, energetics, solid propellants, formulations, and their ingredients to increase missile launch vehicles and refine new synthesis methodologies. Development of propellant management devices in support of fabrication and fuel delivery.			
FY 2024 Plans: Continue to devise, synthesize, scale-up, and characterize novel energetic ingredients for monopropellants, fuels, and oxidizers, for use in DAF and missile applications including tactical, strategic, and in-space thrust and attitude control. Continue to formulate, scale-up, and evaluate formulations of solid and liquid rocket propellants, including green monopropellants. Continue to identify, evaluate, and adapt 21st century automated formulation and production techniques to enable more rapid and agile munitions production arrangements. Continue research in high- temperature resins, insulators, and composite case fabrication techniques to enable high performance rocket motor cases.			
FY 2025 Plans: - Continue to devise, synthesize, scale-up, test, and characterize novel energetic ingredients for monopropellants, fuels, and oxidizers, for use in DAF and missile applications including tactical and strategic applications. - Continue to formulate, scale-up, test, and evaluate formulations of solid and liquid rocket propellants, including green monopropellants. - Continue to identify, evaluate, and adapt 21st century automated formulation and production techniques to enable more rapid and agile munitions.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 625171 / *Missile Rocket Propulsion*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Continue research in high- temperature resins, insulators, and composite case fabrication techniques to enable high performance rocket motor cases. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 decreased compared to FY 2024 by $0.649 million. Funding decreased due to decreased emphasis in missile propellant research.			
Title: Ballistic and Tactical Propulsion Technologies ***Description:*** Develop and demonstrate missile propulsion technologies for ballistic and tactical missile applications. Research develops digital design and test with novel manufacturing processes to support national defense needs for performance, effectiveness, and industrial manufacturing capability for missile propulsion ***FY 2024 Plans:*** Continue to apply next generation of chemical and mechanical aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, to user needs and unique challenges. Continue to develop advanced tactical propulsion hardware and concepts. Continue development, evaluation, verification, and validation of next generation of physics-based modeling, simulation, and analysis tools for rapid and agile missile propulsion design, analysis, and production to include designs for 21st century material processing techniques and hardware. Continue to support advanced component technologies for missile propulsion applications for strategic and strike systems helping to ensure their long-term sustainment. Continue automated solid rocket motor production techniques and components to enable more rapid and agile munitions production and logistic support. ***FY 2025 Plans:*** - Continue to apply next generation of chemical and mechanical aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, to user needs and unique challenges. - Continue to develop advanced tactical propulsion hardware and concepts. - Continue development, evaluation, verification, and validation of next generation of physics-based modeling, simulation, and analysis tools for rapid and agile missile propulsion design, analysis, and production to include designs for 21st century material processing techniques and hardware. - Continue to support advanced component technologies for missile propulsion applications for strategic and strike systems helping to ensure their long-term sustainment. - Continue automated solid rocket motor production techniques and components to enable more rapid and agile munitions production and logistic support. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	25.426	27.732	26.093

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 625171 / *Missile Rocket Propulsion*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2025 decreased compared to FY 2024 by $1.639 million. Funding decreased due to decreased emphasis in ballistic and tactical propulsion technologies.			
Accomplishments/Planned Programs Subtotals	35.991	39.233	36.945

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force			Date: March 2024
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / *Aerospace Propulsion*	Project (Number/Name) 625330 / *Aerospace Fuel Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
625330: *Aerospace Fuel Technology*	-	8.449	9.016	8.985	0.000	8.985	9.189	9.376	10.015	10.218	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates fuels for advanced turbine engines, scramjets, detonation, and combined cycle engines. This project also considers fuel related concepts that can increase turbine engine operational reliability, durability, mission flexibility, energy efficiency, and performance while reducing weight, fuel consumption, and cost of ownership. Applications include autonomous collaborative platforms, munitions, and high-speed systems (to include hypersonics). Research areas of emphasis include evaluations of fuel properties and characteristics of traditional, specialty, and alternative fuels developed from unconventional sources.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Alternative Fuels	0.652	0.694	0.694
Description: Investigate novel sustainable aviation fuels for engines, missiles, aircraft, sustained high-speed vehicles, hypersonic, and responsive space launch applications. Conduct evaluations and perform technical assessments of alternative fuels developed from unconventional sources for use in legacy and advanced aerospace systems. Support development of alternative fuel specification for commercial jet fuels with Federal Aviation Agency. ***FY 2024 Plans:*** Complete development and continue investigation of novel sustainable and alternative aviation fuels and technologies for potential propulsion performance and logistical enhancements. ***FY 2025 Plans:*** - Complete investigation of novel sustainable and alternative aviation fuels and technologies for potential propulsion performance and logistical enhancements. - Initiate research in developing tools to understand fuel composition, focusing on non-drop-in fuels. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Not Applicable			
Title: Integrated Thermal and Energy Management	2.785	2.980	6.641
Description: Investigate and evaluate stability and performance of advanced and specialty fuels for air breathing propulsion systems. ***FY 2024 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 625330 / *Aerospace Fuel Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Continue the development and evaluation of novel fuel additives, catalysts, compositions, and system approaches enabling new hypersonic applications and expanding into other advance concepts and system-level impacts of emerging aviation technologies. Complete development of fuel related integrated thermal and energy management technologies including models for designs and evaluation of vehicle fuel systems, methods to monitor the fuel coking and other chemistry, and characterization methods for system-level impacts from thermally-stressed fuel, as well as expanding use as a thermal management fluid. Complete sensors to monitor the fuel chemistry that produces coke deposits and characterization of system-level impacts from thermally- stressed fuel. Complete evaluation of fuel reaction models that enable high temperature systems for evaluating advanced fuels including endothermic fuels. Continue investigation of fuel heat sink approaches for thermal management; Complete thermal management investigations of advanced engines and other systems that evaluate integrated power and thermal management approaches to include heat exchanger. Continue development of fuel models for system design and evaluation of fuel system. Continue development of sensors and analysis techniques for monitoring fuel chemistry that causes deposits. Continue developing integrated test rigs to tests these approaches and assess their efficiency. ***FY 2025 Plans:*** - Complete the development and evaluation of novel fuel additives, catalysts, compositions, and system approaches enabling new hypersonic applications and expanding into other advance concepts and system-level impacts of emerging aviation technologies. - Continue investigation of fuel heat sink approaches for thermal management; model fuel molecular interactions - Complete development of fuel models for system design and evaluation of fuel system. - Continue development of sensors and analysis techniques for monitoring fuel chemistry that causes deposits. - Complete development of integrated test rigs to tests these approaches and assess their efficiency. - Initiate development of fuel formulations for high-speed applications ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $3.661 million. Funding increased due to increased emphasis in fuel used for thermal management needed in high-speed applications.			
Title: Fuel Logistics and Sustainment ***Description:*** Study and evaluate low-cost approaches to reduce fuel logistics footprint to reduce cost. Study fuel logistics vulnerabilities and develop detection and mitigation technologies. ***FY 2024 Plans:*** Continue support of fuel sustainment issues as needed, to understand current needs and problems as well as work to find solutions. Continue development of fuel compositional analyses methods that are verifiable across services and leverages a database of specification and extended compositional information to advance data visualization and analytics. Continue method developments to capture fuel stability limiters to minimize logistics vulnerabilities; develop detection and mitigations for fuel biocontamination to support logistics readiness; and develop fuel-sensing technologies with coordination and collaboration across	2.796	2.980	1.580

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 625330 / *Aerospace Fuel Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
the government. Complete thermal stability studies (such as chemistry, fuel system, and hybrid developments), and technologies (such as additives, deoxygenation, and platform thermal stability sensors); and models and technologies developments for traditional, specialty, and sustainable aviation fuels under simulated current and future operational domain conditions to ensure Air Force's readiness. Complete to analyze and develop fuels, fuel blends, catalyst formulations, accessories, and models for operational requirement of hypersonic application and extending into other next generation applications and vehicles. ***FY 2025 Plans:*** - Complete support of fuel sustainment issues as needed, to understand current needs and problems as well as work to find solutions. - Complete development of fuel compositional analyses methods that are verifiable across services and leverages a database of specification and extended compositional information to advance data visualization and analytics. - Complete method developments to capture fuel stability limiters to minimize logistics vulnerabilities; develop detection and mitigations for fuel biocontamination to support logistics readiness; and develop fuel-sensing technologies with coordination and collaboration across the government. - Initiate research in converting military waste such as hydraulic fluids and engine oil to fuel or fuel components. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 decreased compared to FY 2024 by $1.400 million. Funding decreased due to decreased emphasis in fuel logistics and sustainment for existing aerospace systems.			
Title: Combustion Emissions and Performance ***Description:*** Develop and test applied emissions diagnostic techniques for air breathing propulsion systems. Evaluate aviation fuel for combustion and emissions characteristics and fuel composition performance impacts. Identify and develop approaches to improve system performance and emissions across different fuels and types. ***FY 2024 Plans:*** Complete studies of impact on combustor performance and emissions based on fuel chemistry (traditional, specialty, and sustainable aviation fuels), and fuel entrance temperature well above historic use levels, and other operational impacts, such as high altitude. Complete development of low temperature catalyst augmented combustion technologies. Initiate studies of impact on combustor performance and emissions based on fuel chemistry of sustainable aviation fuels. ***FY 2025 Plans:*** - Complete studies of impact on combustor performance and emissions based on fuel chemistry of sustainable aviation fuels. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	2.216	2.362	0.070

Exhibit R-2A, RDT&E Project Justification: PB 2025 Air Force		Date: March 2024
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 625330 / *Aerospace Fuel Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2025 decreased compared to FY 2024 by $2.292 million. Funding decreased due to decreased emphasis in combustion emissions and performance for existing aerospace systems.			
Accomplishments/Planned Programs Subtotals	8.449	9.016	8.985

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.