Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force											Date: March 2023	
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 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	-	173.665	212.361	184.867	0.000	184.867	178.396	182.572	186.365	202.449	Continuing	Continuing
623012: *Advanced Propulsion Technology*	-	9.633	17.358	18.638	0.000	18.638	18.212	18.640	19.026	20.552	Continuing	Continuing
623048: *Combustion and Mechanical Systems*	-	6.097	4.659	4.845	0.000	4.845	4.360	4.453	4.546	5.312	Continuing	Continuing
623066: *Turbine Engine Technology*	-	88.585	76.146	73.533	0.000	73.533	71.733	73.398	74.929	80.928	Continuing	Continuing
623145: *Aerospace Power Technology*	-	44.971	69.699	39.602	0.000	39.602	38.033	38.908	39.717	43.571	Continuing	Continuing
625171: *Missile Rocket Propulsion*	-	19.154	36.039	39.233	0.000	39.233	37.161	38.064	38.851	42.146	Continuing	Continuing
625330: *Aerospace Fuel Technology*	-	5.225	8.460	9.016	0.000	9.016	8.897	9.109	9.296	9.940	Continuing	Continuing

A. Mission Description and Budget Item Justification

This effort develops propulsion and power technologies to achieve enabling and revolutionary aerospace technology capabilities. The effort has six current projects, each focusing on a technology area critical to the Department of the Air Force. The Advanced Propulsion Technology project develops high-speed air breathing propulsion engines to include combined cycle, ramjet, and hypersonic scramjet technologies. The Combustion and Mechanical Systems project develops engine mechanical system technologies: bearings, seals, drives, and lubricants as well as combustion components, concepts, and technologies for legacy and advanced turbine engines. The Turbine Engine Technology project develops enabling capabilities to enhance performance and affordability of existing weapon systems and develops component technologies for ultra-high pressure ratio, substantially improved durability, and adaptive cycle engine architecture to provide optimized performance, fuel efficiency, and life for widely varying mission needs. The Aerospace Power Technology project develops electrical power and thermal control technologies for military applications that remove operational limitations and enable advanced vehicle designs and high-power mission systems. The Missile Rocket Propulsion project develops advances in rocket propulsion technologies for tactical missiles and the sustainment of strategic systems. The Aerospace Fuel Technology project evaluates fuels and related technologies for legacy and advanced turbine engines, scramjets, rotating detonation engines and combined-cycle engines. 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.

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Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*

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 air, space and/or cyber domains.

All transfers detailed below are administrative realignments due to the stand up of the United States Space Force, and not new starts. This work will continue to be executed by the Air Force Research Laboratory Aerospace Systems Technology Directorate located in Wright Patterson Air Force Base, OH, Edwards Air Force Base, CA, or Arnold Air Force Base, TN.

In FY 2022, the work and funding associated with space technology research in Program 0602203F, Aerospace Propulsion, Project 624847, Rocket Propulsion Technology, are transferred to Appropriation 3620, Research, Development, Test & Evaluation, Space Force, Program 1206601SF, Project 624847, Rocket Propulsion Technology, due to the creation of a new Appropriation for Space Force.

In FY 2022, the work and funding associated with missile rocket propulsion technologies in Program 0602203F, Aerospace Propulsion are transferred from Project 624847, Rocket Propulsion Technology to Project 625171, Missile Rocket Propulsion Technology due to the creation of a new Appropriation for Space Force.

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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	190.683	172.861	174.787	0.000	174.787
Current President's Budget	173.665	212.361	184.867	0.000	184.867
Total Adjustments	-17.018	39.500	10.080	0.000	10.080
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	39.500			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-5.000	0.000			
• SBIR/STTR Transfer	-12.018	0.000			
• Other Adjustments	0.000	0.000	10.080	0.000	10.080

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: 623066: *Turbine Engine Technology*		

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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 2022	FY 2023
Congressional Add: *Program Increase - Modular open system architecture for turbine engine technology*	5.837	8.000
Congressional Add Subtotals for Project: 623066	5.837	8.000
Project: 623145: *Aerospace Power Technology*		
Congressional Add: *Emergency power and cooling thermal management growth*	4.864	9.500
Congressional Add: *Modular cooling capacity for tactical aircraft*	-	5.000
Congressional Add: *Program Increase - high mach turbine engine*	-	10.000
Congressional Add: *High voltage aircraft power*	-	2.000
Congressional Add: *Improving reliability of electrical systems for future aircraft*	-	5.000
Congressional Add Subtotals for Project: 623145	4.864	31.500
Project: 625171: *Missile Rocket Propulsion*		
Congressional Add: *Program increase - Small business research for rocket technology*	4.860	0.000
Congressional Add Subtotals for Project: 625171	4.860	0.000
Congressional Add Totals for all Projects	15.561	39.500

Change Summary Explanation

FY 2022 funding shows a reprogramming degrease of $5.000 million. The reprogram was performed to support the Research and Development project, MAYHEM.

FY 2024 funding increased in the FY 2024PB compared to the FY 2023PB by $10.080 million. The increase is due to increased AF emphasis in aerospace propulsion technology.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
623012: *Advanced Propulsion Technology*	-	9.633	17.358	18.638	0.000	18.638	18.212	18.640	19.026	20.552	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 2022	FY 2023	FY 2024
Title: Hypersonic Scramjet Technologies	9.633	17.358	18.638

Description: Develop robust hydrocarbon fueled scramjet engine components and technologies to improve performance, operability, durability, and scalability for future platforms.

FY 2023 Plans:

Continue development and demonstration of advanced, high speed engine components to improve operating margin, operating time and scaling laws for expendable and reusable applications. Continue development of low internal drag flame stabilization devices, instrumentation, endothermic fuels, and flight test engine components. Initiate 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 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 2023 to FY 2024 Increase/Decrease Statement:

FY 2024 increased compared to FY 2023 by $1.280 million. Funding increased to accelerate the development

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
of innovative engine control technology.			
Accomplishments/Planned Programs Subtotals	9.633	17.358	18.638

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
623048: *Combustion and Mechanical Systems*	-	6.097	4.659	4.845	0.000	4.845	4.360	4.453	4.546	5.312	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates lubricants, mechanical systems, and combustion concepts for advanced turbine engines, rotating detonation engines, and combined cycle engines. This project also develops technologies to increase turbine engine operational reliability, durability, mission flexibility, maintainability, and performance while reducing weight, fuel consumption, and cost of ownership. Applications include: missiles, aircraft, and re-usable high-speed vehicles. Analytical and experimental areas of emphasis include: lubricants, bearings, mechanical systems diagnostics, mechanical systems prognostics, rotor dynamics, oil-less engine technology, optical diagnostics, fundamental combustion, detonations, combustors, and afterburners. Lubricants for these engines must be thermally stable, cost-effective, and operate over a broad range of conditions. Advanced combustion concepts must be cost-effective, durable, and reduce pollutant emissions. A portion of this project supports evaluation of technologies for future conceptual cycles. This project develops component technologies for future conceptual engine cycles and architectures that provide both optimized performance and fuel efficiency for widely varying mission needs.

In FY2023, Combustion Technologies, Diagnostic Technologies, and Bearing Technologies efforts 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 2022	FY 2023	FY 2024
Title: Combustion Technologies	2.519	0.000	0.000
Description: Develop, test, and evaluate revolutionary combustion and propulsion concepts for gas turbine, pulse detonation, and combined cycle engines for missiles, manned and unmanned systems. ***FY 2023 Plans:*** In FY 2023, this effort 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 Plans:*** Not Applicable ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Not Applicable			
Title: Diagnostic Technologies	0.433	0.000	0.000
Description: Develop and demonstrate optical, electromechanical, and laser diagnostic tools and sensors for application to revolutionary propulsion technologies.			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623048 / *Combustion and Mechanical Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
FY 2023 Plans: In FY 2023, this effort 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 Plans:*** Not Applicable ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Not Applicable			
Title: Lubricant Technologies ***Description:*** Develop, test, and model advanced turbine engine lubricants and applied lubrication technologies. ***FY 2023 Plans:*** Continue 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. Continue 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. Complete the generation of the fatigue life database & assess fatigue growth characteristics of state of the art baseline, emerging, & advanced engine rolling element bearing materials thru sub-scale experimental investigations Initiate development of applied rotor dynamics models for design. ***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 2023 to FY 2024 Increase/Decrease Statement:***	1.497	4.659	4.845

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623048 / *Combustion and Mechanical Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by $0.186 million. Funding increased due to increased costs to complete planned activities.			
Title: Bearing Technologies ***Description:*** Develop and test advanced bearing material technology and bearing concepts for small, intermediate, and large-scale turbine engine applications. ***FY 2023 Plans:*** In FY 2023, this effort 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 Plans:*** Not Applicable ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Not Applicable	1.648	0.000	0.000
Accomplishments/Planned Programs Subtotals	6.097	4.659	4.845

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
623066: *Turbine Engine Technology*	-	88.585	76.146	73.533	0.000	73.533	71.733	73.398	74.929	80.928	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops technology to increase turbine engine operational reliability, durability, mission flexibility, and performance, while reducing weight, fuel consumption, and cost of ownership. Analytical and experimental areas of emphasis are fans and compressors, high temperature combustors, turbines, internal flow systems, controls, augmentor and exhaust systems, integrated power and thermal management systems, engine inlet integration, mechanical systems, conceptual cycle technologies, and structural design. This project develops component technology for an adaptive cycle engine architecture that provides both optimized performance and fuel efficiency for widely varying mission needs. This project supports joint Department of Defense, agency, and industry efforts to focus turbine propulsion technology on national needs. The project plan is relevant across capability areas for global responsive strike, tactical and global mobility, responsive space lift, and persistent intelligence, surveillance, and reconnaissance (ISR).

In FY2023, Combustion Technologies, Diagnostic Technologies, and Bearing Technologies efforts will transfer from PE 0602203F, Aerospace Propulsion, Project 623048, Combustion and Mechanical Systems, to this 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 2022	FY 2023	FY 2024
Title: Turbofan/Turbojet Engine Core Technologies	36.445	23.761	26.339
Description: Develop core turbofan/turbojet engine components (i.e., compressors, and turbines) for strike and air superiority capabilities. ***FY 2023 Plans:*** Continue development of improved aerodynamic design tools and analysis methods to extend engine operability and efficiency. Initiate transonic fan distortion tolerance and transfer study to enable design-for-integration and reliable assessment for embedded engines. Initiate high lift /high work turbine study to reduce turbine stage /blade count. ***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 2023 to FY 2024 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
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 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by $2.578 million. Funding increase due to increased emphasis in studies of compressors and turbines for limited life and affordability.			
Title: Turboshaft/Turboprop and Small Turbofan Engine Technologies	6.361	4.896	4.896
Description: Develop components for turboshaft/turboprop and small turbofan engines for trainers, special operations aircraft, and long range strike. ***FY 2023 Plans:*** Complete current demonstration phase of advanced component designs in rig testing. Complete validation of data to develop improved test protocol for small engine augmentor designs. Complete development and validation phase of modeling and simulation tools for the design and analysis of turbine components with mission-tailored aero-performance and highly efficient cooling geometries. Complete application evaluation in new innovative architectures, critical technologies, exploration of targeted life applications for small missile and remotely piloted aircraft applications; evaluate critical technologies that will increase range, performance, durability, electrical power and thermal capacity of these systems. Continue the exploration of new small engine technologies that can operate in high speed applications; evaluate risk reduction technologies to increase usage time of systems. Complete demonstrating advanced component designs and modeling tools in rig and engine testing. Continue to utilize validation data to develop improved test protocol for small engine designs. Complete development and validation of modeling and simulation tools for the design and analysis of engine components with new manufacturing processes. Complete the exploration of advanced integrated engine controls with potential for synergistic airframe system level benefits. 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 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 2023 to FY 2024 Increase/Decrease Statement:*** Not Applicable			
Title: Revolutionary Propulsion Technology	22.377	17.225	18.587

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
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 2022	FY 2023	FY 2024
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 2023 Plans:*** Continue identification of control technology elements applicable to integrated propulsion/power/thermal solutions. Complete evaluation of power and thermal modeling of advanced architectures into aircraft system level multidisciplinary analysis and optimization tools. 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. Complete exploration and evaluation of innovative architectures for affordable & efficient airlaunched propulsion capability from Mach 3 to Mach 5+, and turbine based combined cycle propulsion capability to Mach 5+. ***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 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $1.362 million. Funding increase due to increased initiating studies in hypersonic combined cycles.			
Title: Missile and Unmanned Aerial Systems (UAS) Engine Technologies	17.565	13.521	14.590
Description: Develop limited life engine components for missile and Unmanned Aerial System (UAS) applications, including long-range subsonic, and supersonic vehicles. ***FY 2023 Plans:*** Complete identification of control technology elements applicable to integrated propulsion/power/thermal solutions. 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; Complete evaluation of integration of advanced augmentors and ramburners; continue exploration of new expendable and attritable architectures. Complete the development and evaluation of advanced, integrated propulsion technologies for supersonic expendable, attritable,			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
and reusable strike and Intelligence, Surveillance, and Reconnaissance (ISR) systems. Continue exploration of new engine concepts for missile and unmanned systems. Initiate lifetime demonstration of limited life engine components. ***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 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $1.069 million. Funding increase due to increased emphasis to develop predictive analysis tools to enable reliable and durable component designs.			
Title: Combustion Technologies	0.000	4.788	5.166
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 2023 Plans:*** Continue exploring interactions and effects of compressor and turbine components on the combustor and combustor materials to increase efficiency and improve altitude ignition & operability. Complete use of advanced diagnostics tools to develop high-quality datasets for use by academia and industry for model development and verification. Complete research in the determination of necessary reference performance and operability combustion systems and metrics to decrease the cost of certifying new and alternative fuels in weapon systems. Complete support of development of advanced computational fluid dynamics (CFD) models to reduce combustor and augmentor design costs. Continue development of computations, modeling and simulation, and research experimentation of advanced combustion concepts including pressure gain combustion components and system level architectures. Complete planned exploration of advanced combustion and flameholding concepts working towards improved understanding at relevant operating conditions such as sub-atmospheric (less than 1 atmosphere) and high pressure (greater than 10 atmospheres); this includes fundamental combustion modeling and fluid-dynamic phenomena on high speed systems and rocket propulsion and advanced turbine engine applications, identifying modeling and simulation concepts/approaches to address combustion chemistry and physics and light/matter interactions, for high speed systems exploring turbulent combustion modeling in advanced configurations, exploring advanced combustion including pressure gain propulsion as it relates to new applications and 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			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
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 2022	FY 2023	FY 2024
improved understanding at relevant operating conditions. Initiate exploration of applied high speed combustion and combustor design. Initiate exploration of rotating detonation engines for next generation combustion systems. Initiate the development of improved numerical methods and combustion models to guide design and applied development of combustion components and 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 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $0.378 million. Funding increase described in plans above.			
Title: Diagnostic Technologies ***Description:*** Develop and demonstrate optical, electromechanical, and laser diagnostic tools and sensors for application to revolutionary propulsion technologies. ***FY 2023 Plans:*** Complete support to current phase in computational fluid dynamics combustion modeling by providing insights for interpreting experimental results using existing Modeling & Simulation methodologies and applying recently developed high-speed, spatially resolved laser diagnostics to our representative, single- element combustion experiments in order to demonstrate and deliver measurements of key combustion species and flow properties under high pressure conditions. Continue 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. Initiate the application of optical diagnostic to challenging engine environments including detonations, high pressures, and multiphase. Complete the development of improved numerical methods and turbulent combustion models to guide design and development of experimental components and systems utilizing existing Modeling & Simulation methodologies. ***FY 2024 Plans:***	0.000	0.822	0.822

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
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 2022	FY 2023	FY 2024
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 2023 to FY 2024 Increase/Decrease Statement:*** Not applicable			
Title: Bearing Technologies ***Description:*** Develop and test advanced bearing material technology and bearing concepts for small, intermediate, and large-scale turbine engine applications. ***FY 2023 Plans:*** Continue developing physics-based bearing life model based on bearing alloy fatigue and microstructural investigations, including bearing life factors for advanced bearing materials. Continue 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. ***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 2023 to FY 2024 Increase/Decrease Statement:*** Not applicable	0.000	3.133	3.133
Accomplishments/Planned Programs Subtotals	82.748	68.146	73.533

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623066 / *Turbine Engine Technology*

	FY 2022	FY 2023
Congressional Add: Program Increase - Modular open system architecture for turbine engine technology ***FY 2022 Accomplishments:*** Conduct Congressionally directed efforts. ***FY 2023 Plans:*** Conduct Congressionally directed efforts.	5.837	8.000
Congressional Adds Subtotals	5.837	8.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
623145: *Aerospace Power Technology*	-	44.971	69.699	39.602	0.000	39.602	38.033	38.908	39.717	43.571	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 2022	FY 2023	FY 2024
Title: High Power System Technologies	40.107	38.199	39.602
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 2023 Plans:*** Continue 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. Complete development of advanced, safe energy storage, power distribution, and management systems to include Silicon Carbide applications and batteries and fan tip generator development. Complete analysis and development of adaptive power and thermal control systems for high-power aircraft to include open system integration and test. Complete weapon system contractor support for platform integration of advanced power and thermal system architectures. Continue medium-scale propulsion, power and thermal system studies and development to include innovative, integrated hybrid architectures. Initiate development of advanced power and thermal capabilities for future hypersonic aircraft. Initiate development of adaptive, affordable power and thermal technologies for emerging medium-scale platforms and mission capabilities. ***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			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
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 2022	FY 2023	FY 2024
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 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $1.403 million. Funding increase due to increased emphasis in higher power aircraft system technologies to enable hypersonics and autonomous collaborative capabilities.			
Accomplishments/Planned Programs Subtotals	40.107	38.199	39.602

	FY 2022	FY 2023
Congressional Add: Emergency power and cooling thermal management growth ***FY 2022 Accomplishments:*** Conduct Congressionally directed efforts. ***FY 2023 Plans:*** Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	4.864	9.500
Congressional Add: Modular cooling capacity for tactical aircraft ***FY 2023 Plans:*** Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	-	5.000
Congressional Add: Program Increase - high mach turbine engine ***FY 2023 Plans:*** Conduct Congressionally directed efforts.	-	10.000
Congressional Add: High voltage aircraft power ***FY 2023 Plans:*** Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	-	2.000
Congressional Add: Improving reliability of electrical systems for future aircraft ***FY 2023 Plans:*** Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	-	5.000
Congressional Adds Subtotals	4.864	31.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623145 / *Aerospace Power Technology*

D. Acquisition Strategy

Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
625171: *Missile Rocket Propulsion*	-	19.154	36.039	39.233	0.000	39.233	37.161	38.064	38.851	42.146	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops rocket propulsion technologies for the sustainment of strategic systems (including solid boost/missile propulsion, post boost control, aging and surveillance efforts), and tactical missiles. Analytical and experimental areas of emphasis are propellants, propellant management, combustion, rocket material applications, and technology for sustainment of strategic systems. Technologies of interest will improve reliability, performance, survivability, affordability, and environmental compatibility of these systems. Develop technologies to reduce the weight and cost of components using new materials and improved designs and manufacturing techniques. 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). Tasks include: modeling and simulation; proof of concept tests of critical components; advanced component development; and ground-based tests. Aging and surveillance tasks could reduce lifetime prediction uncertainties for individual motors by 50%, enabling motor replacement for cause. All efforts are reviewed by a DoD level steering committee yearly for relevance to DoD missions.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Fuel Technologies	4.678	10.565	11.501
Description: Develop, characterize, and test advanced hydrocarbons, energetics, solid propellants, and monopropellants to increase space launch payload capability and refine new synthesis methods. Development of propellant management devices in support of fabrication and fuel delivery.			
FY 2023 Plans: Continue to devise, synthesize, scale-up, and characterize novel energetic ingredients for monopropellants, fuels, and oxidizers, for use across the span of space 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 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			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
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 2022	FY 2023	FY 2024
production arrangements. Continue research in high- temperature resins, insulators, and composite case fabrication techniques to enable high performance rocket motor cases. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $0.936 million. Funding increase due to one time increase upgrade to laboratory equipment.			
Title: Ballistic and Tactical Propulsion Technologies ***Description:*** Develop missile propulsion technologies and aging and surveillance technologies for ballistic and tactical missiles. ***FY 2023 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 (MS&A) 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 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 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $2.258 million. Funding increase due to major hardware purchases and integration for upcoming motor tests.	9.616	25.474	27.732
Accomplishments/Planned Programs Subtotals	14.294	36.039	39.233

	FY 2022	FY 2023
Congressional Add: Program increase - Small business research for rocket technology	4.860	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 625171 / *Missile Rocket Propulsion*

	FY 2022	FY 2023
FY 2022 Accomplishments: Conduct Congressionally directed efforts. ***FY 2023 Plans:*** Not Applicable		
Congressional Adds Subtotals	4.860	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force			Date: March 2023
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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
625330: *Aerospace Fuel Technology*	-	5.225	8.460	9.016	0.000	9.016	8.897	9.109	9.296	9.940	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates fuels for legacy and 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 missiles, aircraft, sustained high-speed vehicles, hypersonic, and responsive space launch. Analytical and experimental areas of emphasis include evaluations of fuel properties and characteristics of traditional fuels and alternative fuels developed from unconventional sources, specialty fuels, and components development used in integrated thermal and energy management systems including high heat sink fuel capability, fuels logistics and associated vulnerabilities, and combustion diagnostics and engine emissions measurements.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Alternative Fuels	0.385	0.652	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 2023 Plans: Continue investigation and development of novel sustainable and alternative aviation fuels and technologies for potential propulsion performance and logistical enhancements.			
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 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by $0.042 million. Funding increase described in plans above.			
Title: Integrated Thermal and Energy Management	1.650	2.796	2.980
Description: Develop advanced and specialty fuels, components, associated technologies, and conduct performance assessments of advanced integrated thermal and energy management systems for engines, missiles, aircraft, sustained high-speed vehicles, and hypersonic. Evaluate stability and performance of advanced and specialty fuels.			
FY 2023 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
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 2022	FY 2023	FY 2024
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. Continue 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. Continue prototype sensors to monitor the fuel chemistry that produces coke deposits and characterization of system-level impacts from thermally-stressed fuel. Continue 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 of advanced engines and other systems that evaluate integrated power and thermal management approaches to include heat exchangers. 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. Complete characterization system-level impacts of emerging aviation technologies. Complete studies using fuel as a thermal management fluid to meet Air Force requirements. Complete investigation of fuel heat exchangers as an independent investigation including additive manufactured units and their reaction to fuels. Continue developing integrated test rigs to tests these approaches and assess their efficiency. ***FY 2024 Plans:*** 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 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $0.184 million. Funding increase described in plans above.			
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.	1.650	2.796	2.980

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
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 2022	FY 2023	FY 2024
FY 2023 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 the government. Continue 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. Continue 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. Complete study of fuels and models for next generation vehicles. ***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 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 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $0.184 million. Funding increase due to increased costs of raw materials.			
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 2023 Plans:*** Complete development of augmentor combustor/simulator to determine fuel effects on augmentor operability under realistic conditions. Continue studies of impact on combustor performance and emissions based on fuel chemistry (traditional, specialty,	1.540	2.216	2.362

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
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 2022	FY 2023	FY 2024
and sustainable aviation fuels), and fuel entrance temperature well above historic use levels, and other operational impacts, such as high altitude. Continue development of low temperature catalyst augmented combustion technologies. ***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 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $0.146 million. Funding increase due to increased costs to complete planned activities.			
Accomplishments/Planned Programs Subtotals	5.225	8.460	9.016

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.