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

<b>Appropriation/Budget Activity</b> 3600: Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research	<b>R-1 Program Element (Number/Name)</b> PE 0602203F I Aerospace Propulsion
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	-	214.814	201.048	174.683	0.000	174.683	-	-	-	-	-	-
623012: <i>Advanced Propulsion Technology</i>	-	29.802	0.000	17.679	0.000	17.679	-	-	-	-	-	-
623048: <i>Combustion and Mechanical Systems</i>	-	11.134	0.000	11.345	0.000	11.345	-	-	-	-	-	-
623066: <i>Turbine Engine Technology</i>	-	50.601	73.887	62.350	0.000	62.350	-	-	-	-	-	-
623145: <i>Aerospace Power Technology</i>	-	44.213	57.121	37.557	0.000	37.557	-	-	-	-	-	-
624847: <i>Rocket Propulsion Technology</i>	-	74.322	62.488	0.000	0.000	0.000	-	-	-	-	-	-
625171: <i>Missile Rocket Propulsion</i>	-	0.000	0.000	37.114	0.000	37.114	-	-	-	-	-	-
625330: <i>Aerospace Fuel Technology</i>	-	4.742	7.552	8.638	0.000	8.638	-	-	-	-	-	-

**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 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 to enable revolutionary propulsion capability for the Department of the Air Force. 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 Rocket Propulsion Technology project develops advances in rocket propulsion technologies for space access, space maneuver, missiles, the sustainment of strategic systems, and tactical rockets. The Aerospace Fuel Technology project evaluates hydrocarbon-based fuels for legacy and advanced turbine engines, scramjets, pulse detonation, 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.

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<b>Appropriation/Budget Activity</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force I BA 2: Applied Research</i>	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>
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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 PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

Funds in this PE 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 PE 0602203F, Aerospace Propulsion, Project 624847, Rocket Propulsion Technology, are transferred to Appropriation 3620F, Research, Development, Test & Evaluation, Space Force, PE 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 PE 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>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022 Base</b>	<b>FY 2022 OCO</b>	<b>FY 2022 Total</b>
Previous President's Budget	226.775	0.000	0.000	0.000	0.000
Current President's Budget	214.814	201.048	174.683	0.000	174.683
Total Adjustments	-11.961	201.048	174.683	0.000	174.683
• Congressional General Reductions	0.000	-0.367			
• Congressional Directed Reductions	0.000	-2.450			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	28.000	0.000			
• Congressional Directed Transfers	0.000	203.865			
• Reprogrammings	0.467	0.000			
• SBIR/STTR Transfer	-5.478	0.000			
• Other Adjustments	-34.950	0.000	174.683	0.000	174.683

**Congressional Add Details (\$ in Millions, and Includes General Reductions)**

**Project:** 623066: *Turbine Engine Technology*

	<b>FY 2020</b>	<b>FY 2021</b>

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<b>Appropriation/Budget Activity</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force I BA 2: Applied Research</i>	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>
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<b>Congressional Add Details (\$ in Millions, and Includes General Reductions)</b>	<b>FY 2020</b>	<b>FY 2021</b>
Congressional Add: <i>Program increase - advanced turbine technologies</i>	2.000	0.000
Congressional Add Subtotals for Project: 623066	2.000	0.000
<b>Project: 623145: <i>Aerospace Power Technology</i></b>		
Congressional Add: <i>Program increase - thermal management technologies</i>	7.000	0.000
Congressional Add Subtotals for Project: 623145	7.000	0.000
<b>Project: 624847: <i>Rocket Propulsion Technology</i></b>		
Congressional Add: <i>Program increase - next generation hall thrusters</i>	14.000	0.000
Congressional Add: <i>Program increase - next generation liquid propulsion</i>	5.000	0.000
Congressional Add Subtotals for Project: 624847	19.000	0.000
Congressional Add Totals for all Projects	28.000	0.000

**Change Summary Explanation**

Increase in FY 2022 of 174.683 million is due to Congressional reversal of program element restructure, higher Department of the Air Force priorities, and transformational activities.

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

<b>Appropriation/Budget Activity</b> 3600 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602203F / Aerospace Propulsion				<b>Project (Number/Name)</b> 623012 / Advanced Propulsion Technology			
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
623012: <i>Advanced Propulsion Technology</i>	-	29.802	0.000	17.679	0.000	17.679	-	-	-	-	-	-

**A. Mission Description and Budget Item Justification**

This project develops combined/advanced cycle air breathing high-speed (up to Mach 5) and hypersonic (Mach 5 to 7) 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)**

<b>Title:</b> Hypersonic Scramjet Technologies	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p><b>Description:</b> Develop robust hydrocarbon fueled scramjet engine components and technologies to improve performance, operability, durability, and scalability for future platforms.</p> <p><b>FY 2021 Plans:</b> Continue to develop and demonstrate advanced engine components to improve scramjet operating margin, operating time, and to refine scramjet scaling laws for expendable and reusable applications. Continue to develop low internal drag flame stabilization devices and flight test engine components. 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.</p> <p><b>FY 2022 Plans:</b> Continue development and demonstration of advanced engine components to improve scramjet operating margin, operating time, and to refine scramjet scaling laws for expendable and reusable applications. Continue development of low internal drag flame stabilization devices, instrumentation, endothermic fuels, and flight test engine components. 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.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 increased compared to FY 2021 by \$17.679 million. Funding increase due to increased emphasis on hypersonic scramjet technologies.</p>	29.802	0.000	17.679
<b>Accomplishments/Planned Programs Subtotals</b>	29.802	0.000	17.679

**C. Other Program Funding Summary (\$ in Millions)**

N/A

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<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 623012 / <i>Advanced Propulsion Technology</i>
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**C. Other Program Funding Summary (\$ in Millions)**

**Remarks**

**D. Acquisition Strategy**

Not applicable.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force										<b>Date:</b> May 2021		
<b>Appropriation/Budget Activity</b> 3600 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>				<b>Project (Number/Name)</b> 623048 / <i>Combustion and Mechanical Systems</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022 Base</b>	<b>FY 2022 OCO</b>	<b>FY 2022 Total</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>FY 2026</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
623048: <i>Combustion and Mechanical Systems</i>	-	11.134	0.000	11.345	0.000	11.345	-	-	-	-	-	-

**A. Mission Description and Budget Item Justification**

This project evaluates lubricants, mechanical systems, and combustion concepts for advanced turbine engines, pulse 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 adaptive cycle technologies. Adaptive cycle technologies develops component technology for an adaptive cycle engine architecture that provides both optimized performance and fuel efficiency for widely varying mission needs.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<b>Title:</b> Combustion Technologies	4.600	0.000	4.687
<b>Description:</b> Develop, test, and evaluate revolutionary combustion and propulsion concepts for gas turbine, pulse detonation, and combined cycle engines for missiles, manned and unmanned systems.			
<b>FY 2021 Plans:</b> Continue exploring interactions and effects of compressor and turbine components on the combustor and combustor materials to reduce engine weight and increase efficiency. Continue using advanced diagnostics tools to develop high-quality datasets for use by academia and industry for model development and verification. Continue 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. Continue to support 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. Continue to explore 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 initiating 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. Initiate the development and demonstration of new tools and use of new designs and materials to improve			

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p>efficiency, power under quiet operations. Initiate investigation to identify and assess disruptive propulsion/power concepts and evaluate concepts. Initiate development of new technologies for unmanned aircraft system propulsion/power systems for improved understanding at relevant operating conditions.</p> <p><b>FY 2022 Plans:</b> Continue exploring interactions and effects of compressor and turbine components on the combustor and combustor materials to reduce engine weight and increase efficiency. Continue using advanced diagnostics tools to develop high-quality datasets for use by academia and industry for model development and verification. Continue 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. Continue to support 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. Continue to explore 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 tools and use of new designs and materials to improve efficiency, power under quiet operations. 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</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 increased compared to FY 2021 by \$4.687 million. Funding increase is due to increased emphasis on combustion technologies.</p>				
<p><b>Title:</b> Diagnostic Technologies</p> <p><b>Description:</b> Develop and demonstrate optical, electromechanical, and laser diagnostic tools and sensors for application to revolutionary propulsion technologies.</p> <p><b>FY 2021 Plans:</b> Complete the development and demonstration of diagnostic systems for high-bandwidth kilohertz to megahertz measurement of combustion chemistry and physics. Complete the development of diagnostic techniques to include 1) time-division-multiplexed hyperspectral absorption spectroscopy, 2) pulse-burst lasers, and 3) ultrashort-pulse (picosecond, femtosecond) lasers.</p>		0.790	0.000	0.805

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<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 623048 / <i>Combustion and Mechanical Systems</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p>Complete the application of the insights gained to engine test cells and fielded systems including development and deployment of fiber-coupled sensor systems based on hyperspectral absorption spectroscopy. Continue supporting computational fluid dynamics combustion modeling by providing, insights for interpreting experimental results using existing Modeling &amp; 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 non-reacting spray experiments for liquid fuel spray model development, employing Nonintrusive optical diagnostics will be used to obtain accurate, spatially/temporally resolved data. This provides the local flow field data required for comparisons to results of numerical simulations. Complete the development of portable measurement capability for engine testing. Complete the advancement of algorithms for tomographic reconstruction and spatiotemporal nonlinear data analysis to assess the rich data sets generated in the fundamental experiments and system testing described above. Initiate the development of improved numerical methods and turbulent combustion models to guide design and development of experimental components and systems utilizing existing Modeling &amp; Simulation methodologies.</p> <p><b>FY 2022 Plans:</b> Continue supporting computational fluid dynamics combustion modeling by providing, insights for interpreting experimental results using existing Modeling &amp; 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. This provides the local flow field data required for comparisons to results of numerical simulations. Continue the development of improved numerical methods and turbulent combustion models to guide design and development of experimental components and systems utilizing existing Modeling &amp; Simulation methodologies.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 increased compared to FY 2021 by \$0.805 million. Funding increased due to increased emphasis on diagnostic technologies.</p>			
<p><b>Title:</b> Lubricant Technologies</p> <p><b>Description:</b> Develop, test, and qualify advanced turbine engine lubricants. Generate and maintain military specifications for aviation engine lubricants.</p> <p><b>FY 2021 Plans:</b></p>	2.734	0.000	2.786

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p>Continue developing innovative fluids by; defining target requirements for new polyol ester oils, conducts Research &amp; Development for new/enhanced turbine engine oils for legacy &amp; emerging engines, qualifies new &amp; updated engine oil products for legacy &amp; emerging engines. Complete identification and development on in-line mechanical system health monitoring sensor technology. 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. Initiate performance validation study of advanced bearing designs/materials, lubricant &amp; lubrication system components via fullscale high-fidelity laboratory parametric testing at representative engine operating conditions. Initiate the generation of the fatigue life database &amp; assess fatigue growth characteristics of state of the art baseline, emerging, &amp; advanced engine rolling element bearing materials thru sub-scale experimental investigations.</p> <p><b>FY 2022 Plans:</b> Continue developing innovative fluids by; defining target requirements for new polyol ester oils, conducts Research &amp; Development for new/enhanced turbine engine oils for legacy &amp; emerging engines, qualifies new &amp; updated engine oil products for legacy &amp; 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 advanced bearing designs/materials, lubricant &amp; lubrication system components via full-scale high-fidelity laboratory parametric testing at representative engine operating conditions. Continue the generation of the fatigue life database &amp; assess fatigue growth characteristics of state of the art baseline, emerging, &amp; advanced engine rolling element bearing materials thru sub-scale experimental investigations</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 increased compared to FY 2021 by \$2.786 million. Funding increased due to increased emphasis on lubricant technologies.</p>			
<p><b>Title:</b> Bearing Technologies</p> <p><b>Description:</b> Develop and test advanced bearing material technology and bearing concepts for small, intermediate, and large-scale turbine engine applications.</p> <p><b>FY 2021 Plans:</b> Continue developing physics-based bearing life model based on bearing alloy fatigue &amp; 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. Complete development of active thrust-balance/prognostic health management system for large man-rated and</p>	3.010	0.000	3.067

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p>medium-scale propulsion. Initiate 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. Initiate the development of fundamental knowledge of bearing material rolling contact fatigue failure mechanisms and lubricant interactions through microstructural investigations and failure analysis.</p> <p><b><i>FY 2022 Plans:</i></b> 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.</p> <p><b><i>FY 2021 to FY 2022 Increase/Decrease Statement:</i></b> FY 2022 increased compared to FY 2021 by \$3.067 million. Funding increased due to increased emphasis on bearing technologies.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>	11.134	0.000	11.345

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

Not applicable.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force										<b>Date:</b> May 2021		
<b>Appropriation/Budget Activity</b> 3600 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>				<b>Project (Number/Name)</b> 623066 / <i>Turbine Engine Technology</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022 Base</b>	<b>FY 2022 OCO</b>	<b>FY 2022 Total</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>FY 2026</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
623066: <i>Turbine Engine Technology</i>	-	50.601	73.887	62.350	0.000	62.350	-	-	-	-	-	-

**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, adaptive 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).

**B. Accomplishments/Planned Programs (\$ in Millions)**

	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p><b>Title:</b> Turbofan/Turbojet Engine Core Technologies</p> <p><b>Description:</b> Develop core turbofan/turbojet engine components (i.e., compressors, combustors, and turbines) for fighters, bombers, sustained supersonic/hypersonic cruise vehicles, and transports.</p> <p><b>FY 2021 Plans:</b> Complete development and validation of modeling and simulation tools for the design and analysis of advanced turbine components with improved durability for advanced engines including: planning for a conceptual design, fabrication, and testing of component technology rigs, including bearing testing; exploring new approaches for advanced engine technologies, including use of high-temperature materials, integrated propulsion, power and thermal technologies and responsive controls; finalizing the concepts for achieving the product goals for increased fuel efficiency, power and thermal management and propulsive capability. Continue development of improved aerodynamic design tools and analysis methods to extend engine operability and efficiency.</p> <p><b>FY 2022 Plans:</b> Continue development of improved aerodynamic design tools and analysis methods to extend engine operability and efficiency.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 decreased compared to FY 2021 by \$5.141 million. Funding decrease due to reduced emphasis on turbofan and turbojet engine core technologies.</p>	20.277	32.602	27.461
<p><b>Title:</b> Turbofan/Turbojet Engine Fan, Low Pressure Turbine, and Integration Technologies</p> <p><b>Description:</b> Develop turbofan/turbojet engine components (i.e., fans, nozzles, etc.) used in engines for fighters, bombers, sustained supersonic strike and hypersonic cruise vehicles, and transports.</p>	20.423	0.000	0.000

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<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 623066 / <i>Turbine Engine Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p><b>FY 2021 Plans:</b> Starting in FY 2021, this work is performed in PE 0602203F, Aerospace Propulsion, Project 623066, Turbine Engine Technology, Revolutionary Propulsion Technology effort and Missile and Unmanned Aerial System (UAS) Engine Technology effort.</p> <p><b>FY 2022 Plans:</b> Not applicable.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> Not applicable.</p>				
<p><b>Title:</b> Missile and Remotely Piloted Aircraft Engine Technologies</p> <p><b>Description:</b> Develop limited life engine components for missile and remotely piloted aircraft (RPA) applications, including long-range supersonic and hypersonic vehicles.</p> <p><b>FY 2021 Plans:</b> Starting in FY 2021, this work is performed in PE 0602203F, Aerospace Propulsion, Project 623066, Turbine Engine Technology, Turboshaft/Turboprop and Small Turbofan Engine Technologies effort.</p> <p><b>FY 2022 Plans:</b> Not applicable.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> Not applicable.</p>		4.923	0.000	0.000
<p><b>Title:</b> Turboshaft/Turboprop and Small Turbofan Engine Technologies</p> <p><b>Description:</b> Develop components for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, and theater transports.</p> <p><b>FY 2021 Plans:</b> Continue to demonstrate advanced component designs in rig testing. Continue to utilize validation data to develop improved test protocol for small engine augmentor designs. Continue development and validation of modeling and simulation tools for the design and analysis of turbine components with mission-tailored aero-performance and highly efficient cooling geometries. Complete the development and validation of parameter, process, and performance modeling for components manufactured through additive technologies. Complete the development and validation of rules and tools to enable flexible design for targeted life applications. Continue the 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</p>		2.978	5.653	4.793

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force	<b>Date:</b> May 2021
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<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 623066 / <i>Turbine Engine Technology</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
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<p>high speed applications; Evaluate risk reduction technologies to increase usage time of systems. Complete development of computations, modeling and simulation, and research experimentation of advanced combustion concepts including pressure gain combustion components. Continue 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. Continue development and validation of modeling and simulation tools for the design and analysis of engine components with new manufacturing processes. Continue 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.</p> <p><b>FY 2022 Plans:</b> Continue to demonstrate advanced component designs in rig testing. Continue to utilize validation data to develop improved test protocol for small engine augmentor designs. Continue development and validation of modeling and simulation tools for the design and analysis of turbine components with mission-tailored aero-performance and highly efficient cooling geometries. Continue the 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. Continue 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. Continue development and validation of modeling and simulation tools for the design and analysis of engine components with new manufacturing processes. Continue 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.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 decreased compared to FY 2021 by \$0.86 million. Funding decrease due to reduced emphasis on turboshaft and turboprop and small turbofan engine technologies.</p>			
<p><b>Title:</b> Revolutionary Propulsion Technology</p> <p><b>Description:</b> Develop, test, and evaluate revolutionary propulsion concepts for gas turbine, pressure gain propulsion, and combined cycle engines for missiles, manned and unmanned systems.</p> <p><b>FY 2021 Plans:</b></p>	0.000	19.972	16.861

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force		<b>Date:</b> May 2021
<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 623066 / <i>Turbine Engine Technology</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p>Complete development of modeling and simulation tools, for advanced turbine engine concepts. Complete advanced modeling and simulation tools for the design and analysis of advanced propulsion technologies to enable lower cost/weight systems with improved aero-performance for increased range and endurance at altitude. Complete analysis of advanced propulsion engines, such as rotating detonation engines and advanced high-speed concepts. Continue 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; continue evaluation of integration of advanced augmentors and ramburners; continue exploration of new expendable and attritable architectures. Initiate the development and evaluation of advanced, integrated propulsion technologies for supersonic expendable, attritable, and reusable strike &amp; ISR systems. Initiate studies for exploration of advanced propulsion technologies. Explore and evaluate innovative architectures for affordable &amp; efficient air-launched propulsion capability from Mach 3 to Mach 5+, and turbine based combined cycle propulsion capability to Mach 5+.</p> <p><b>FY 2022 Plans:</b> Continue 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; 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. Continue exploration and evaluation of innovative architectures for affordable &amp; efficient air-launched propulsion capability from Mach 3 to Mach 5+, and turbine based combined cycle propulsion capability to Mach 5+.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 decreased compared to FY 2021 by \$3.111 million. Funding decrease due to reduced emphasis on revolutionary propulsion technology.</p>			
<p><b>Title:</b> Missile and Unmanned Aerial Systems (UAS) Engine Technologies</p> <p><b>Description:</b> Develop limited life engine components for missile and Unmanned Aerial System (UAS) applications, including longrange subsonic, supersonic and hypersonic vehicles.</p> <p><b>FY 2021 Plans:</b> Complete development of modeling and simulation tools for advanced missile and unmanned aerial system concepts. Complete advanced modeling and simulation tools for the design and analysis of new systems to enable lower cost/weight systems with improved aero-performance for increased range and endurance at altitude. Continue identification of control technology elements applicable to integrated propulsion/power/thermal solutions. Continue evaluation of power and thermal modeling of advanced</p>	0.000	15.660	13.235

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force	<b>Date:</b> May 2021
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<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 623066 / <i>Turbine Engine Technology</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	FY 2020	FY 2021	FY 2022
<p>architectures into aircraft system level multidisciplinary analysis and optimization tools: explore new control methods for integrated propulsion, power and thermal management; continue evaluation of integration of advanced augmentors and ramburners; continue exploration of new expendable and attritable architectures. Initiate the development and evaluation of advanced, integrated propulsion technologies for supersonic expendable, attritable, and reusable strike &amp; ISR systems. Explore new engine concepts for missile and unmanned systems.</p> <p><b>FY 2022 Plans:</b> Continue 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; 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 exploration of new engine concepts for missile and unmanned systems.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 decreased compared to FY 2021 by \$2.425 million. Funding decreased due to decreased emphasis on missile and Unmanned Aerial System (UAS) engine technologies.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>	48.601	73.887	62.350

	FY 2020	FY 2021
<b>Congressional Add:</b> Program increase - advanced turbine technologies	2.000	0.000
<b>FY 2020 Accomplishments:</b> Conduct Congressionally directed efforts		
<b>FY 2021 Plans:</b> Not applicable.		
<b>Congressional Adds Subtotals</b>	2.000	0.000

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

Not applicable.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force										<b>Date:</b> May 2021		
<b>Appropriation/Budget Activity</b> 3600 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>				<b>Project (Number/Name)</b> 623145 / <i>Aerospace Power Technology</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022 Base</b>	<b>FY 2022 OCO</b>	<b>FY 2022 Total</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>FY 2026</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
623145: <i>Aerospace Power Technology</i>	-	44.213	57.121	37.557	0.000	37.557	-	-	-	-	-	-

**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 megawatt level power and thermal management 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)**

	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<b>Title:</b> High Power System Technologies	37.213	57.121	37.557
<b>Description:</b> 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.			
<b>FY 2021 Plans:</b> Continue development of system and component electrical power, electro-mechanical, and thermal technologies for high-power applications. Continue development of hybrid approaches to power generation, storage, and application as well as thermal management. Continue testing of subsystems hardware in conjunction with continued platform level tip-to-tail modeling and simulation energy optimization. Continue development of advanced, safe energy storage, power distribution, and management systems to include Silicon Carbide applications and batteries. Continue power and thermal development toward demonstration of tactical aircraft high-power payload capability, e.g. laser weapon system. Continue analysis and development of adaptive power and thermal control systems for high-power aircraft. Continue weapon system contractor support for platform integration of advanced power and thermal system architectures. Initiate medium-scale propulsion, power and thermal system studies and development.			
<b>FY 2022 Plans:</b> Continue development of system and component electrical power, electro-mechanical, and thermal technologies for high-power applications. Complete development of hybrid approaches to power generation, storage, and application as well as thermal management. Continue testing of subsystems hardware in conjunction with continued platform level tip-to-tail modeling and simulation for energy optimization. Continue development of advanced, safe energy storage, power distribution, and management			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force	<b>Date:</b> May 2021
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<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 623145 / <i>Aerospace Power Technology</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	FY 2020	FY 2021	FY 2022
systems to include Silicon Carbide applications and batteries and fan tip generator development. Complete power and thermal development toward demonstration of tactical aircraft high-power payload capability to include +/-270 Volts Direct Current (VDC) power generation and storage. Continue analysis and development of adaptive power and thermal control systems for highpower aircraft to include open system integration and test. Continue 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.			
<b><i>FY 2021 to FY 2022 Increase/Decrease Statement:</i></b> FY 2022 decreased compared to FY 2021 by \$19.564 million. Funding decrease due to reduced emphasis on high power system technologies.			
<b>Accomplishments/Planned Programs Subtotals</b>	37.213	57.121	37.557

	FY 2020	FY 2021
<b><i>Congressional Add:</i></b> Program increase - thermal management technologies	7.000	0.000
<b><i>FY 2020 Accomplishments:</i></b> Conduct Congressionally directed efforts		
<b><i>FY 2021 Plans:</i></b> Not applicable.		
<b>Congressional Adds Subtotals</b>	7.000	0.000

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

Not applicable.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force										<b>Date:</b> May 2021		
<b>Appropriation/Budget Activity</b> 3600 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602203F / Aerospace Propulsion				<b>Project (Number/Name)</b> 624847 / Rocket Propulsion Technology			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022 Base</b>	<b>FY 2022 OCO</b>	<b>FY 2022 Total</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>FY 2026</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
624847: Rocket Propulsion Technology	-	74.322	62.488	0.000	0.000	0.000	-	-	-	-	-	-

**A. Mission Description and Budget Item Justification**

This project develops rocket propulsion technologies for space access, space maneuver, 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, technology for sustainment of strategic systems, and innovative space propulsion concepts. 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). Technologies under this project enable capabilities of interest to both DoD and National Aeronautics and Space Administration (NASA). 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 thrusts are part of the Rocket Propulsion 21 (RP21) collaboration and are reviewed by a DoD level steering committee yearly for relevance to DoD missions and progress towards RP21 Goals.

In FY 2022, the work and funding associated with space technology research in PE 0602203F, Aerospace Propulsion, Project 624847, Rocket Propulsion Technology, are transferred to Appropriation 3620F, Research, Development, Test & Evaluation, Space Force, PE 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 PE 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.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<b>Title:</b> Fuel Technologies	9.404	12.595	0.000
<b>Description:</b> Develop, characterize, and test advanced hydrocarbons, energetics, solid propellants, and monopropellants to increase space launch payload capability and refine new synthesis methods.			
<b>FY 2021 Plans:</b> Continue to develop solid rocket propellant binder systems for use across operationally relevant conditions. 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 knowledge transfer for making green monopropellants to United States industrial base. Continue to formulate, scale-up, and evaluate formulations of solid and liquid rocket propellants. Continue to identify, evaluate, and adapt 21st century material processing			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force		<b>Date:</b> May 2021
<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 624847 / <i>Rocket Propulsion Technology</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p>techniques and equipment to enable more rapid and agile development for more precise products. Continue research in high temperature resins, insulators, and composite case fabrication techniques to enable high performance rocket motor cases.</p> <p><b>FY 2022 Plans:</b> Complete development of solid rocket propellant binder systems for use across operationally relevant conditions. 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.</p> <p>In FY2022, work and funding associated with fuel technologies in Project 624847, Rocket Propulsion Technology, are transferred to Project 625171, Missile Rocket Technology, due to the creation of a new Appropriation for Space Force.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 decreased compared to FY 2021 by \$12.596 million. Funding decreased due to work and funding associated with fuel technologies in Project 624847, Rocket Propulsion Technology, being transferred to Project 625171, Missile Rocket Technology, due to the creation of a new Appropriation for Space Force.</p>			
<p><b>Title:</b> Liquid Engine Combustion Technologies</p> <p><b>Description:</b> Develop advanced liquid engine combustion technology for improved performance, while preserving chamber lifetime and reliability needs for engine uses in heavy lift space vehicles.</p> <p><b>FY 2021 Plans:</b> Continue evaluation of methane multi-injector designs in hot-fire conditions. Continue hot fire tests in combustion stability rig. Continue combustion stability modeling critical for future hydrocarbon fueled liquid rocket engines. Complete the delivery of combustion stability codes with nearly complete set of validation data to rocket community, enabling more robust and stable engine designs. Continue developing understanding of hydrocarbon fuel production, expanding testing into methane fuels and other cryogenic cooling. Continue the employment of new fuel and material operating limitations, manufacturing processes, and launch goals in cycle analysis to identify trade space for future engines. Continue to develop and evaluate advanced material solutions for high temperature components in rocket propulsion. Continue installation of new test facility that will fill the current capability gap and allow for fast, low-cost testing of multi-injector designs and stability strategies at conditions relevant to the demands of both Department of Defense and industry for next-generation engines (including use of liquid oxygen and higher pressures and thrust). Continue development and payoff determination of rotating detonation rocket engine technologies.</p> <p><b>FY 2022 Plans:</b></p>	7.708	11.216	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force		<b>Date:</b> May 2021		
<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 624847 / <i>Rocket Propulsion Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p>In FY2022, the work and funding associated with liquid engine combustion technologies in Project 624847, Rocket Propulsion Technology, are transferred to Appropriation 3620F, Research, Development, Test &amp; Evaluation, Space Force, PE 1206601SF, Project 624847, Rocket Propulsion Technology, due to the creation of a new Appropriation for Space Force.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 decreased compared to FY 2021 by \$11.216 million. Due to in FY2022, the work and funding associated with liquid engine combustion technologies in Project 624847, Rocket Propulsion Technology, are transferred to Appropriation 3620F, Research, Development, Test &amp; Evaluation, Space Force, PE 1206601SF, Project 624847, Rocket Propulsion Technology, due to the creation of a new Appropriation for Space Force.</p>				
<p><b>Title:</b> Advanced Liquid Engine Technologies</p> <p><b>Description:</b> Develop advanced liquid engine technologies for improved performance, while increasing life and reliability needs for engine uses in expendable and reusable launch vehicles.</p> <p><b>FY 2021 Plans:</b> Complete exploring engine concepts for next generation, beyond 2035, launch vehicles and concepts to effect cost reductions. Continue sub-scale risk mitigation and technology maturation activities to incorporate into next generation engine concepts. Continue modular component integration and interaction research activities supporting next generation engine concepts.</p> <p><b>FY 2022 Plans:</b> In FY2022, the work and funding associated with advanced liquid engine technology in Project 624847, Rocket Propulsion Technology, are transferred to Appropriation 3620F, Research, Development, Test &amp; Evaluation, Space Force, PE 1206601SF, Project 624847, Rocket Propulsion Technology, due to the creation of a new Appropriation for Space Force.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 decreased compared to FY 2021 by \$4.965 million. Due to in FY2022, the work and funding associated with advanced liquid engine technology in Project 624847, Rocket Propulsion Technology, are transferred to Appropriation 3620F, Research, Development, Test &amp; Evaluation, Space Force, PE 1206601SF, Project 624847, Rocket Propulsion Technology, due to the creation of a new Appropriation for Space Force.</p>		10.459	4.965	0.000
<p><b>Title:</b> On-Orbit Propulsion Technologies</p> <p><b>Description:</b> Develop solar electric, solar thermal, chemical, and advanced propulsion technologies for station-keeping, repositioning, and orbit transfer for satellites and satellite constellations.</p> <p><b>FY 2021 Plans:</b> Continue advanced chemical propellants scale-up research focusing on transition of numerical tools and experimental methodologies for advanced monopropellants to spacecraft industry. Continue to support the maturation of advanced diagnostics</p>		14.938	7.651	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force		<b>Date:</b> May 2021		
<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 624847 / <i>Rocket Propulsion Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p>for both chemical and electric propulsion thruster plumes with potential for integrated state-of-health application. Continue to expand the validation and verification programs (both experimental and flight) to quantify accuracy of modeling and simulation tools developed to support thruster-spacecraft integration. Continue transition and support of thruster/ plume modeling framework to spacecraft industry, with addition of advanced Electric Propulsion thruster models, to industry partners. Expanding exploration of advanced integrated electric propulsion and chemical thruster concepts and assess new spacecraft propulsion requirements.</p> <p><b>FY 2022 Plans:</b> In FY2022, the work and funding associated with on-orbit propulsion technologies in Project 624847, Rocket Propulsion Technology, are transferred to Appropriation 3620F, Research, Development, Test &amp; Evaluation, Space Force, PE 1206601SF, Project 624847, Rocket Propulsion Technology, due to the creation of a new Appropriation for Space Force.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 decreased compared to FY 2021 by D7.651 million. Due to in FY2022, the work and funding associated with on-orbit propulsion technologies in Project 624847, Rocket Propulsion Technology, are transferred to Appropriation 3620F, Research, Development, Test &amp; Evaluation, Space Force, PE 1206601SF, Project 624847, Rocket Propulsion Technology, due to the creation of a new Appropriation for Space Force.</p>				
<p><b>Title:</b> Space Access and Strike Applications</p> <p><b>Description:</b> Develop missile propulsion and boost technologies for space access and strike applications.</p> <p><b>FY 2021 Plans:</b> Starting in FY 2021, this work is performed under the Ballistic and Tactical Propulsion Technologies major thrust.</p> <p><b>FY 2022 Plans:</b> Not applicable.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> Not applicable.</p>		5.066	0.000	0.000
<p><b>Title:</b> Ballistic and Tactical Propulsion Technologies</p> <p><b>Description:</b> Develop missile propulsion technologies and aging &amp; surveillance technologies for ballistic and tactical missiles.</p> <p><b>FY 2021 Plans:</b> 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 development of advanced sensor, non-destructive evaluation, modeling and supporting technology development efforts to detect and explain phenomena further improve data acquisition and reduce uncertainty in tactical, hypersonic, and ballistic missile solid rocket motor service life predictions. Continue long-term validation of tools through long-term aging and testing of sub-scale motors. Continue to develop advanced tactical</p>		7.747	26.061	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force	<b>Date:</b> May 2021
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<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / Aerospace Propulsion	<b>Project (Number/Name)</b> 624847 / Rocket Propulsion Technology
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	FY 2020	FY 2021	FY 2022
<p>propulsion and concepts. Continue propellant development efforts including long-life and other novel propellant systems. Continue development, evaluation, verification, and validation of next generation of updated, 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 equipment. Continue to develop advanced component technologies for missile propulsion applications for strategic and strike systems helping to ensure their long-term sustainment.</p> <p><b>FY 2022 Plans:</b> In FY2022 the work and funding associated with ballistic and tactical propulsion technologies in Project 624847, Rocket Propulsion Technology, are transferred to Project 625171, Missile Rocket Technology, due to the creation of a new Appropriation for Space Force.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 decreased compared to FY 2021 by \$26.061 million. Funding decreased due to the work and funding associated with ballistic and tactical propulsion technologies in PE 0602203F, Aerospace Propulsion, Project 624847, Rocket Propulsion Technology, are transferred to Project 625171, Missile Rocket Technology, due to the creation of a new Appropriation for Space Force.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>	55.322	62.488	0.000

	FY 2020	FY 2021
<b>Congressional Add:</b> Program increase - next generation hall thrusters	14.000	0.000
<b>FY 2020 Accomplishments:</b> Not Applicable		
<b>FY 2021 Plans:</b> Not applicable.		
<b>Congressional Add:</b> Program increase - next generation liquid propulsion	5.000	0.000
<b>FY 2020 Accomplishments:</b> Conduct Congressionally directed effort		
<b>FY 2021 Plans:</b> Not applicable.		
<b>Congressional Adds Subtotals</b>	19.000	0.000

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

Not applicable.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force										<b>Date:</b> May 2021		
<b>Appropriation/Budget Activity</b> 3600 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602203F / Aerospace Propulsion				<b>Project (Number/Name)</b> 625171 / Missile Rocket Propulsion			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022 Base</b>	<b>FY 2022 OCO</b>	<b>FY 2022 Total</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>FY 2026</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
625171: <i>Missile Rocket Propulsion</i>	-	0.000	0.000	37.114	0.000	37.114	-	-	-	-	-	-

**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 thrusts are part of the Rocket Propulsion 21 (RP21) collaboration and are reviewed by a DoD level steering committee yearly for relevance to DoD missions and progress towards RP21 Goals.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<b>Title:</b> Fuel Technologies	-	0.000	12.146
<b>Description:</b> Develop, characterize, and test advanced hydrocarbons, energetics, solid propellants, and monopropellants to increase space launch payload capability and refine new synthesis methods.			
<b>FY 2021 Plans:</b> Before FY2022, this work is performed in PE 0602203F, Aerospace Vehicle Technologies, Project 624847, Rocket Propulsion Technology, Fuel Technologies effort.			
<b>FY 2022 Plans:</b> Complete development of solid rocket propellant binder systems for use across operationally relevant conditions. 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.			
<b>FY 2021 to FY 2022 Increase/Decrease Statement:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force		<b>Date:</b> May 2021		
<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 625171 / <i>Missile Rocket Propulsion</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
FY 2022 increased compared to FY 2021 by \$12.146 million. Funding increase is due to work shifting from project, 624847 / Rocket Propulsion Technology.				
<p><b>Title:</b> Ballistic and Tactical Propulsion Technologies</p> <p><b>Description:</b> Develop missile propulsion technologies and aging &amp; surveillance technologies for ballistic and tactical missiles.</p> <p><b>FY 2021 Plans:</b> Before FY2022, this work is performed in PE 0602203F, Aerospace Vehicle Technologies, Project 624847, Rocket Propulsion Technology, Ballistic and Tactical Propulsion Technologies effort at \$26.214 million.</p> <p><b>FY 2022 Plans:</b> 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. Complete development of advanced sensor, non-destructive evaluation, modeling and supporting technology development efforts to detect and explain phenomena further improve data acquisition and reduce uncertainty in tactical, hypersonic, and ballistic missile solid rocket motor service life predictions. Complete long-term validation of tools through long-term aging and testing of sub-scale motors. Continue to develop advanced tactical propulsion and concepts. Complete propellant development efforts including long-life and other novel propellant systems. Continue development, evaluation, verification, and validation of next generation of updated, 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. Initiate automated solid rocket motor production techniques and equipment to enable more rapid and agile munitions production and logistic support.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 increased compared to FY 2021 by \$24.968 million. Funding increase is due to work shifting from project, 624847 / Rocket Propulsion Technology.</p>		-	0.000	24.968
<b>Accomplishments/Planned Programs Subtotals</b>		-	0.000	37.114
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
Not applicable				

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

<b>Appropriation/Budget Activity</b> 3600 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>				<b>Project (Number/Name)</b> 625330 / <i>Aerospace Fuel Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
625330: <i>Aerospace Fuel Technology</i>	-	4.742	7.552	8.638	0.000	8.638	-	-	-	-	-	-

**A. Mission Description and Budget Item Justification**

This project evaluates hydrocarbon-based 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 (such as coal, natural gas, biomass, and combinations thereof), 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 2020	FY 2021	FY 2022
<p><b>Title:</b> Alternative Fuels</p> <p><b>Description:</b> 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.</p> <p><b>FY 2021 Plans:</b> Complete development of generic alternative fuel specification annexes for commercial jet fuels used by Air Force.</p> <p><b>FY 2022 Plans:</b> Initiate investigation and development of novel sustainable aviation fuels and technologies for potential propulsion performance enhancement.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 decreased compared to FY 2021 by \$0.082 million. Funding decrease due to reduced emphasis on alternative fuels.</p>	0.093	0.718	0.636
<p><b>Title:</b> Integrated Thermal and Energy Management</p> <p><b>Description:</b> 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, hypersonic, and responsive space launch. Evaluate stability and performance of advanced and specialty fuels.</p> <p><b>FY 2021 Plans:</b></p>	1.496	2.293	2.728

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force	<b>Date:</b> May 2021
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<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 625330 / <i>Aerospace Fuel Technology</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
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<p>Continue the evaluation of advanced additives, catalysts, and fuel composition approaches to minimize endothermic fuel coking for hypersonic applications. Continue model development for integrated thermal and energy management to include designs and evaluation of vehicle fuel systems, and 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 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. Initiate the development of fuel models for system design and evaluation. Continue development of online sensors for monitoring chemistry that causes deposits. Continue characterization system-level impacts of emerging aviation technologies. Initiate new, continue, and complete studies using fuel as a thermal management fluid to meet AF requirements to include impact on combustor performance and emissions. Continue investigation of heat exchangers including additive manufactured units and their reaction to fuels. Continue developing integrated test rigs to tests these approaches and assess efficiency of these approaches.</p>			
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**FY 2022 Plans:**

Continue the development and evaluation of novel additives, catalysts, and fuel composition and fuel system approaches enable new hypersonic applications. Continue model development for integrated thermal and energy management that include designs and evaluation of vehicle fuel systems, and 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 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. Continued the 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 characterization system-level impacts of emerging aviation technologies. Continue studies using fuel as a thermal management fluid to meet Air Force requirements. Continue investigation of fuel heat exchangers including additive manufactured units and their reaction to fuels. Continue developing integrated test rigs to tests these approaches and assess efficiency of these approaches.

**FY 2021 to FY 2022 Increase/Decrease Statement:**

FY 2022 increased compared to FY 2021 by \$0.435 million. Funding increase due to increased emphasis on integrated thermal and energy management.

<b>Title:</b> Fuel Logistics and Sustainment	1.496	2.295	2.728
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**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. Identify, develop, and demonstrate low-cost approaches to reducing the fuel logistics footprint for the Department of the Air Force.

**FY 2021 Plans:**

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force	<b>Date:</b> May 2021
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<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 625330 / <i>Aerospace Fuel Technology</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
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<p>Continue supporting fuel sustainment issues as needed, to understand problems and work to find solutions. Continue determining fuel temperature limits and other fuel technology approaches (additives, deoxygenation) for full-life fuel systems for advanced applications. Identify new approaches to be able to: capture fuel stability limiters to minimize logistics vulnerabilities, work on bio-detection and mitigations to support logistics readiness, and coordinate and collaborate with Army and Navy in identification and development of fuel sensing technologies. Continue the development of fuel composition in-situ sensors to ensure thermal stability throughout platform mission. Continue the development of fuel sensors and mitigation products to detect and mitigate fuel bio-contamination. Continue development of compositional analysis that can be verified across services and leverages a database of specification and extended compositional information to advance data visualization and analytics. Continue to analyze to develop fuels, fuel blends and catalyst formulations that provide endothermic cooling capacity for hypersonic applications. Continue study of fuels and models for next generation vehicles. Continue study of fuel temperature limitations and use data to validate models, including the development and utilization of the analytical methods and knowledge discovery tools necessary to understand fundamental fuel composition and its impact across the operational domain to ensure readiness across the operational domain for the AF.</p> <p><b>FY 2022 Plans:</b> Continue supporting fuel sustainment issues as needed, to understand problems and work to find solutions. Continue development of compositional analysis that can be verified across services and leverages a database of specification and extended compositional information to advance data visualization and analytics. Continue approaches to be able 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, models (such as chemistry, fuel system, and hybrid) developments, and technologies (such as additives, deoxygenation, and platform thermal stability sensors) developments for traditional, specialty, and sustainable aviation fuels under simulated operational domain conditions to ensure readiness across the Air Force's operational domains. Continue to analyze and develop fuels, fuel blends, and catalyst formulations that provide endothermic cooling capacity for hypersonic applications. Continue study of fuels and models for next generation vehicles.</p> <p><b>FY 2021 to FY 2022 Increase/Decrease Statement:</b> FY 2022 increased compared to FY 2021 by \$0.433 million. Funding increase due to increased emphasis on fuel logistics and sustainment.</p>			
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<p><b>Title:</b> Combustion Emissions and Performance</p> <p><b>Description:</b> 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.</p> <p><b>FY 2021 Plans:</b></p>	1.657	2.246	2.546
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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2022 Air Force	<b>Date:</b> May 2021
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<b>Appropriation/Budget Activity</b> 3600 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602203F / <i>Aerospace Propulsion</i>	<b>Project (Number/Name)</b> 625330 / <i>Aerospace Fuel Technology</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
<p>Continue development of augmentor combustor/simulator to determine fuel effects on augmentor operability under realistic conditions.</p> <p><b><i>FY 2022 Plans:</i></b> Continue development of augmentor combustor/simulator to determine fuel effects on augmentor operability under realistic conditions. Initiate 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. Initiate development of low temperature catalyst augmented combustion technologies.</p> <p><b><i>FY 2021 to FY 2022 Increase/Decrease Statement:</i></b> FY 2022 increased compared to FY 2021 by \$0.300 million. Funding increase due to increased emphasis on combustion emissions and performance.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>	4.742	7.552	8.638

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

Not applicable.