Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Air Force											Date: February 2016	
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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	168.628	185.926	185.671	0.000	185.671	196.053	199.133	204.116	202.690	Continuing	Continuing
623012: *Advanced Propulsion Technology*	-	17.250	19.670	27.095	0.000	27.095	29.673	29.612	30.686	28.566	Continuing	Continuing
623048: *Combustion and Mechanical Systems*	-	11.753	11.652	10.574	0.000	10.574	10.872	11.073	11.287	11.471	Continuing	Continuing
623066: *Turbine Engine Technology*	-	55.773	63.712	52.519	0.000	52.519	56.151	56.785	57.572	58.584	Continuing	Continuing
623145: *Aerospace Power Technology*	-	28.769	28.213	34.703	0.000	34.703	34.943	36.590	38.090	36.636	Continuing	Continuing
624847: *Rocket Propulsion Technology*	-	50.277	57.832	56.278	0.000	56.278	59.781	60.357	61.671	62.544	Continuing	Continuing
625330: *Aerospace Fuel Technology*	-	4.806	4.847	4.502	0.000	4.502	4.633	4.716	4.810	4.889	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops propulsion and power technologies to achieve enabling and revolutionary aerospace technology capabilities. The program has six projects, each focusing on a technology area critical to 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 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 management 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.

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Air Force	Date: February 2016
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	172.550	182.326	174.471	0.000	174.471
Current President's Budget	168.628	185.926	185.671	0.000	185.671
Total Adjustments	-3.922	3.600	11.200	0.000	11.200
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	3.600			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-0.147	0.000			
• SBIR/STTR Transfer	-3.775	0.000			
• Other Adjustments	0.000	0.000	11.200	0.000	11.200

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2015	FY 2016
Project: 624847: *Rocket Propulsion Technology*		
Congressional Add: *Program Increase*	-	3.600
Congressional Add Subtotals for Project: 624847	-	3.600
Congressional Add Totals for all Projects	-	3.600

Change Summary Explanation

Decrease in FY 2015 reflects reprogramming to support Research and Development Projects

Increase in FY 2017 Other Adjustments is due to higher DoD priorities for increased emphasis in hypersonics.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
623012: *Advanced Propulsion Technology*	-	17.250	19.670	27.095	0.000	27.095	29.673	29.612	30.686	28.566	Continuing	Continuing

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)	FY 2015	FY 2016	FY 2017
Title: Hypersonic Scramjet Technologies	17.250	19.670	27.095

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

FY 2015 Accomplishments:
Continued to develop advanced engine components to improve scramjet operating margin and to refine scramjet scaling laws for reusable applications. Continued to develop techniques to decrease scramjet take-over from Mach 4.5 to Mach 3.5 to provide robust options for combined cycle engines (CCEs). Completed assessment of distortion impact on isolator operability. Continued to develop low internal drag flame stabilization devices and flight test engine components. Continued fabrication of heavyweight direct connect scramjet combustors in medium scale (ten times). Initiated direct connect testing of first performing contractor medium scale (ten times) scramjet combustors from Mach 3.5 to Mach 7. Continue fabrication of second performing contractor medium scale scramjet combustor.

FY 2016 Plans:
Continue to develop advanced engine components to improve scramjet operating margin and to refine scramjet scaling laws for reusable applications. Continue to develop techniques to decrease scramjet take-over from Mach 4.5 to Mach 3.5 to provide robust options for CCEs. Continue to develop low internal drag flame stabilization devices and flight test engine components. Test advanced materials for application to scramjet engines. Continue to fabricate heavyweight direct connect scramjet combustors in medium scale (ten times). Complete direct connect testing of first performing contractor medium scale (ten times) scramjet combustor from Mach 3.5 to Mach 7. Complete fabrication of second performing contractor medium scale scramjet combustor.

FY 2017 Plans:
Continue to develop advanced engine components to improve scramjet operating margin and to refine scramjet scaling laws for reusable applications. Continue to develop techniques to decrease scramjet take-over from Mach 4.5 to Mach 3.5 to provide robust options for CCEs. Continue to develop low internal drag flame stabilization devices and flight test engine components.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force		Date: February 2016
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623012 / *Advanced Propulsion Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Continue testing advanced materials for application to scramjet engines. Complete direct connect testing of second performing contractor medium scale (ten times) scramjet combustor from Mach 3.5 to Mach 7.			
Accomplishments/Planned Programs Subtotals	17.250	19.670	27.095

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
623048: *Combustion and Mechanical Systems*	-	11.753	11.652	10.574	0.000	10.574	10.872	11.073	11.287	11.471	Continuing	Continuing

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. This effort 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)	FY 2015	FY 2016	FY 2017
Title: Combustion Technologies	4.559	4.520	4.402
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 2015 Accomplishments: Developed combustor, augmentor and constant volume combustion or pressure gain combustion technologies such as rotational detonation engines (RDEs) to enable the next generation of gas turbine engines, new engine cycles, and combined-cycles. Explored the interactions and effects of compressor and turbine components on the combustor and combustor materials, to reduce engine weight and increase efficiency. Continued using advanced diagnostics to obtain high-quality datasets that can be made available to and used by academia and industry for model development. Maintained efforts to determine necessary reference performance and operability combustion systems and metrics to decrease the cost of certifying new and alternative fuels in weapon systems. Transitioned ultra-compact combustor technology to performing contractor. Designed full annular High G Ultra Compact Combustor. Demonstrated RDE and turbine integration. Demonstrated gaseous heavy fuel detonation in RDE.			
FY 2016 Plans: Continue development of combustor, augmentor, constant volume combustion and pressure gain combustion technologies such as RDEs, Inner-turbine burners (ITBs), and ultra-compact combustors (UCCs) to enable the next generation of gas turbine engines, new engine cycles, and combined-cycles. Continue using advanced diagnostics to obtain high-quality datasets that can be made available to and used by academia and industry for model development. Maintain efforts to determine necessary			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force		Date: February 2016
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 2015	FY 2016	FY 2017
reference performance and operability combustion systems and metrics to decrease the cost of certifying new and alternative fuels in weapon systems. ***FY 2017 Plans:*** Continue to explore 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 to obtain high-quality datasets that can be made available to and used by academia and industry for model development. Maintain efforts to determine necessary reference performance and operability combustion systems and metrics to decrease the cost of certifying new and alternative fuels in weapon systems. Support development of advanced computational fluid dynamics (CFD) models to reduce combustor and augmentor design costs. Maintain efforts to determine necessary reference performance and operability combustion systems and metrics to decrease the cost of certifying new and alternative fuels in weapon systems.			
Title: Diagnostic Technologies ***Description:*** Develop and demonstrate optical, electromechanical, and laser diagnostic tools and sensors for application to revolutionary propulsion technologies. ***FY 2015 Accomplishments:*** Continued development and demonstration of diagnostic systems for high-bandwidth kilo-hertz to mega-hertz (kHz-MHz) measurements of combustion chemistry and physics based on 1) time-division-multiplexed hyperspectral absorption spectroscopy, 2) pulse-burst lasers, and 3) ultrashort-pulse (picosecond, femtosecond) lasers. Applied to laboratory flame test rigs, engine test cells, and fielded systems. ***FY 2016 Plans:*** Continue development and demonstration of diagnostic systems for high-bandwidth kHZ-MHz measurements of combustion chemistry and physics based on 1) time-division-multiplexed hyperspectral absorption spectroscopy, 2) pulse-burst lasers, and 3) ultrashort-pulse (picosecond, femtosecond) lasers. Continue application to engine test cells, and fielded systems. Initiate providing sufficient data to support CFD combustion model development. ***FY 2017 Plans:*** Continue development and demonstration of diagnostic systems for high-bandwidth kHz-MHz measurements of combustion chemistry and physics based on 1) time-division-multiplexed hyperspectral absorption spectroscopy, 2) pulse-burst lasers, and 3) ultrashort-pulse (picosecond, femtosecond) lasers. Continue application to engine test cells and fielded systems. Continue to provide sufficient data to support CFD combustion model development.	0.865	0.900	0.700
Title: Lubricant Technologies	3.057	3.030	2.701

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force		Date: February 2016
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 2015	FY 2016	FY 2017
Description: Develop, test, and qualify advanced turbine engine lubricants. Generate and maintain military specifications for aviation engine lubricants. ***FY 2015 Accomplishments:*** Executed plan for transitioning Enhanced Ester (EE) oils into the fleet. Developed transition plans for mechanical system health monitoring system technologies. Continued investigating advanced lube system thermal management technologies for fuel efficient and hi-mach engine applications. ***FY 2016 Plans:*** Demonstrate EE oils in F119 and F135 Component Improvement Program (CIP) Accelerated Maturation Testing (AMT) engines in preparation for transition to F-22 & F-35. Begin developing Grade 4 oil Phase-out plan (F-22 & F-35). Plan for F-22 & F-35 flight tests of EE oils. Initiate Research and Development (R&D) investigation of novel ionic fluids as potential lubricants for extreme environments (i.e., hi-Mach). ***FY 2017 Plans:*** Continue investigating advanced thermal management technologies for fuel efficient engines & beyond. Continue developing Grade 4 oil Phase-out plan (F-22 & F-35). Continue developing on-line lube system health monitoring technologies. Continue supporting warfighter on field-related mechanical system issues.			
Title: Bearing Technologies ***Description:*** Develop and test advanced bearing material technology and bearing concepts for small, intermediate, and large-scale turbine engine applications. ***FY 2015 Accomplishments:*** Continued full-scale bearing rig testing in support of adaptive, fuel efficient engines. Continued oil-free, foil bearing R&D in support of supersonic expendable engines and remotely piloted aircraft. Continued developing improved bearing material life model. Continued maturing active bearing thrust control system and fuse with engine prognostics health monitoring system for future fuel efficient engines. ***FY 2016 Plans:*** Complete full-scale bearing rig testing in support of adaptive, fuel efficient engines. Complete oil-free, foil bearing R&D in support of supersonic expendable engines and remotely piloted aircraft. Experimentally validate improved bearing material life model. Investigate failure mechanisms of advanced bearing alloys. Continue maturing active bearing thrust control system and fuse with	3.272	3.202	2.771

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force		Date: February 2016
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 2015	FY 2016	FY 2017
engine prognostics health monitoring system for future efficient engines. Initiate development of active thrust-balance/prognostic health management (PHM) system for large man-rated and medium-scale propulsion. ***FY 2017 Plans:*** Continue developing physics-based bearing life model based on bearing alloy fatigue & microstructural investigations, including bearing life factors for advanced bearing materials. Initiate in-house investigation of small magnetic bearings & oil-free bearings for small & medium scale unmanned aerial systems (UAS). Continue development of active thrust-balance/prognostic health management (PHM) system for large man-rated and medium-scale propulsion.			
Accomplishments/Planned Programs Subtotals	11.753	11.652	10.574

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
623066: *Turbine Engine Technology*	-	55.773	63.712	52.519	0.000	52.519	56.151	56.785	57.572	58.584	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, 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 DoD, agency, and industry efforts to focus turbine propulsion technology on national needs. The program 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)	FY 2015	FY 2016	FY 2017
Title: Turbofan/Turbojet Engine Core Technologies	27.187	31.057	23.523
Description: Develop core turbofan/turbojet engine components (i.e., compressors, combustors, and turbines) for fighters, bombers, sustained supersonic/hypersonic cruise vehicles, and transports.			
FY 2015 Accomplishments: Continued developing modeling and simulation tools for advanced components including coupled aerothermal models; highly loaded, low emissions combustion systems; and turbine durability designs. Performed structural assessment research of combustor and turbine components operating in a realistic engine environment. Continued to develop improved compressor aerodynamic design tools to extend engine operability and efficiency. Completed conceptual design, and initiated detailed design of efficient, very high pressure ratio core component technologies			
FY 2016 Plans: Complete development of modeling and simulation tools for advanced components including coupled aerothermal models; highly loaded, low emissions combustion systems; and turbine durability designs. Perform structural assessment research of mechanical and turbine components operating in a realistic engine environment. Continue development of improved compressor aerodynamic design tools to extend engine operability and efficiency. Complete detailed design of efficient, very high pressure ratio core component technologies.			
FY 2017 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force		Date: February 2016
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 2015	FY 2016	FY 2017
Develop and validate modeling and simulation tools for the design and analysis of advanced turbine components with improved durability for adaptive cycle engines. Continue development of improved compressor aerodynamic design tools and analysis methods to extend engine operability and efficiency.			
Title: Turbofan/Turbojet Engine Fan, Low Pressure Turbine, and Integration Technologies ***Description:*** 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. ***FY 2015 Accomplishments:*** Initiated adaptive engine conceptual designs to reduce specific fuel consumption reduction by up to 35% for embedded high bypass turbofans, and for sustained supersonic strike applications. Continued to develop modeling and simulation tools, including methods to predict behavior of serpentine inlets and nozzles. Conducted bench and rig tests to validate modeling and simulation tools to predict fan/inlet interaction for both podded and embedded propulsion systems. Conducted bench and rig tests to validate probabilistic ignition prediction tool for advanced augmentor design system. Developed models to validate function and durability of high temperature electronics for engine control. ***FY 2016 Plans:*** Complete preliminary designs of an adaptive engine to reduce specific fuel consumption reduction by up to 35% for embedded high bypass turbofans, and for sustained supersonic strike applications. Continue development of modeling and simulation tools, including methods to predict behavior of serpentine inlets and nozzles. Initiate rig tests to validate modeling and simulation tools to predict fan/inlet interaction for both podded and embedded propulsion systems. Complete rig tests to validate probabilistic ignition prediction tool for advanced augmentor design system. Validate models for function and durability of high temperature electronics for engine control. ***FY 2017 Plans:*** Continue development of modeling and simulation tools, including methods to predict behavior of serpentine inlets and nozzles. Develop and validate modeling and simulation tools for the design and analysis of advanced low pressure turbine components to enable lower cost/weight systems with improved aero-performance for increased range and endurance at altitude. Continue rig tests to validate modeling and simulation tools to predict fan/inlet interaction for both podded and embedded propulsion systems.	23.128	26.283	23.589
Title: Missile and Remotely Piloted Aircraft Engine Technologies ***Description:*** Develop limited life engine components for missile and remotely piloted aircraft (RPA) applications, including long-range supersonic and hypersonic vehicles. ***FY 2015 Accomplishments:***	4.424	5.054	4.424

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force		Date: February 2016
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 2015	FY 2016	FY 2017
Continued to develop and apply advanced modeling and simulation tools for variable cycle component design, advanced cooling concepts, compact augmentors, and composite structures. Continued to demonstrate advanced designs in rig testing. Utilized validation data to develop improved test protocol for small engine augmentor designs. ***FY 2016 Plans:*** Complete development of advanced modeling and simulation tools for variable cycle component design, advanced cooling concepts, compact augmentors, and composite structures. Continue to demonstrate advanced component designs in rig testing. Utilize validation data to develop improved test protocol for small engine augmentor designs. ***FY 2017 Plans:*** Continue to demonstrate advanced component designs in rig testing. Continue to utilize validation data to develop improved test protocol for small engine augmentor designs. Initiate 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.			
Title: Turboshaft/Turboprop and Small Turbofan Engine Technologies ***Description:*** Develop components for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, and theater transports. ***FY 2015 Accomplishments:*** Continued to refine and develop and apply advanced modeling and simulation tools for advanced cooling concepts, high efficiency gearboxes, and high performance airfoils. Continued to develop advanced vibration and temperature sensors for use in demonstration of engine durability requirements. ***FY 2016 Plans:*** Continue to refine and apply advanced modeling and simulation tools for advanced cooling concepts, high efficiency gearboxes, and high performance airfoils. Demonstrate advanced vibration and temperature sensors for use in engine durability testing. ***FY 2017 Plans:*** Develop and validate modeling and simulation tools to achieve very high levels of loading for advanced low pressure turbine components.	1.034	1.318	0.983
Accomplishments/Planned Programs Subtotals	55.773	63.712	52.519

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force		Date: February 2016
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602203F / *Aerospace Propulsion*	**Project (Number/Name)** 623066 / *Turbine Engine Technology*

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
623145: *Aerospace Power Technology*	-	28.769	28.213	34.703	0.000	34.703	34.943	36.590	38.090	36.636	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops electrical and thermal management technologies 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. 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 2015	FY 2016	FY 2017
Title: High Power System Technologies	28.769	28.213	34.703

Description: Develop integrated system architecture 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 2015 Accomplishments:

Continued development of system and component electrical power, electro-mechanical, and thermal technologies for high-power applications. Continued development of hybrid approaches to power generation, storage, and application as well as thermal management. Continued testing of subsystems hardware in conjunction with continued platform level tip-to-tail modeling and simulation energy optimization. Initiated integrated ground demonstration of adaptive power and thermal management system for next generation air platforms. Initiated development of advanced, safe energy storage, power distribution, and management systems to include Silicon Carbide applications and batteries.

FY 2016 Plans:

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. Complete integrated ground demonstration of adaptive power and thermal management system for next generation air platforms. Complete power, thermal and propulsion architecture study for future air platforms. Continue development of advanced, safe energy storage, power distribution, and management systems to include Silicon Carbide applications and batteries. Initiate power and thermal development toward demonstration of tactical aircraft high-power payload capability, e.g. laser weapon system.

FY 2017 Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force		Date: February 2016
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 2015	FY 2016	FY 2017
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 power and thermal development toward demonstration of tactical aircraft high-power payload capability, e.g. laser weapon system. Complete design of laser weapon system demonstration architecture.			
Accomplishments/Planned Programs Subtotals	28.769	28.213	34.703

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force			Date: February 2016
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / *Aerospace Propulsion*	Project (Number/Name) 624847 / *Rocket Propulsion Technology*	

COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
624847: *Rocket Propulsion Technology*	-	50.277	57.832	56.278	0.000	56.278	59.781	60.357	61.671	62.544	Continuing	Continuing

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 DoD. Technologies under this program enable capabilities of interest to both DoD and National Aeronautics and Space Administration (NASA). Efforts include: modeling and simulation; proof of concept tests of critical components; advanced component development; and ground-based tests. Aging and surveillance efforts could reduce lifetime prediction uncertainties for individual motors by 50%, enabling motor replacement for cause. All efforts are part of the Rocket Propulsion 21 (RP21) program and reviewed by a DoD level steering committee yearly for relevance to DoD missions and achieve RP21 Goals.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Fuel Technologies	6.414	6.427	6.854
Description: Develop, characterize, and test advanced hydrocarbons, energetics, solid propellants, and monopropellants to increase space launch payload capability and refine new synthesis methods.			
FY 2015 Accomplishments: Scaled up methods for removing components from fuels that adversely affect fuel coking in rocket engine environments. Evaluated scaled-up propellants in advanced combustion devices to determine materials compatibility and performance to include supporting large-scale motor tests. Developed advanced binder systems to enable use of advance solid propellant ingredients with significant improvements over state of the art. Acquired 60-liter pilot plant and “large-scale” continuous flow micro reactor for the on-demand and on-site production of common and new propellant ingredients. Continued development and characterization of next generation ionic liquid propellants for use in spacecraft and missile defense applications.			
FY 2016 Plans: Complete scale up methods for removing components from fuels that adversely affect fuel coking in rocket engine environments. Continue to evaluate scaled-up propellants in advanced combustion devices to determine materials compatibility and performance to include supporting large-scale motor tests. Continue to develop advanced binder systems to enable use of advance solid propellant ingredients with significant improvements over state-of-the-art. Continue to utilize 60-liter batch reactor to supplement micro continuous flow technology for the production of propellant ingredients. Continue development and characterization of			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
next generation ionic liquid propellants for use in spacecraft and missile defense applications. Evaluate the effects of ingredient variability on solid propellant properties and ageing characteristics. ***FY 2017 Plans:*** Complete scale-up methods for removing components from fuels that cause fuel coking in rocket engines. Develop robust binder systems compatible with advanced energetic materials to significantly improve the performance of state-of-the-art solid propellants. Produce modular micro plant, which will allow for the production of desired chemicals on-demand. Promote acoustic resonant mixing in order to improve the homogeneity and reproducibility of solid propellant formulations. Develop scaled-up propellants for use in large-scale motor tests. Continue development of next generation ionic liquid propellants for use in spacecraft and missile defense applications. Support NASA's Green Propellant Infusion mission to demonstrate a non-toxic ionic liquid based propulsion system in space.			
Title: Liquid Engine Combustion Technologies ***Description:*** Develop advanced liquid engine combustion technology for improved performance, while preserving chamber lifetime and reliability needs for engine uses in heavy lift space vehicles. ***FY 2015 Accomplishments:*** Continued evaluation of injector concepts in hot fire conditions. Continued efforts looking at multi-injector designs and control effectors. Continued transition of candidate injector technologies to performing contractor for use in Hydrocarbon Boost (HCB), a rocket engine ground demonstration. Continued hot fire tests in combustion stability rig and fed data to HCB to influence supporting design efforts. Continued combustion stability modeling critical to supporting HCB Demonstration and all future hydrocarbon fueled liquid rocket engines. Released beta version of analysis/design code to rocket community. Completed characterization of novel cooling channels and transfer info to HCB to influence rocket engine thrust chamber design. Acquired first available fuel lubricity and wear data in support of high performance engine turbomachinery lifetime and operability goals. Continued developing understanding of hydrocarbon fuel production, what components affect fuel coking and should be removed from the fuel (or added) during the production process, and how fuels can be engineered with a purpose. Designed advanced high heat flux rig to test fuels using orders of magnitude less fuel and time to determine feasibility of fuel for further use/consideration. Continued to evaluate and develop advanced material solutions for high temperature components in rocket engines. Continued to develop and demonstrate in-house, moderate scale liquid rocket component testing capability; began testing a sub-scale preburner in the facility to provide additional risk reduction for future engine designs. Continued to develop high performance compact liquid rocket engine technologies. Completed modeling and simulation of fuel film cooling flow under conditions relevant to liquid rocket engines and demonstrated the significance of unsteadiness on the film cooling effectiveness. ***FY 2016 Plans:*** Continue evaluation of injector concepts in hot fire conditions. Continue efforts looking at multi-injector designs and control effectors. Continue transition of candidate injector technologies to performing contractor for use in HCB, a rocket engine	5.344	6.319	6.837

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
ground demonstration. Continue hot fire tests in combustion stability rig and feed data to HCB to influence supporting design efforts. Continue combustion stability modeling critical to supporting HCB Demonstration and all future hydrocarbon fueled liquid rocket engines. Develop reduced chemical kinetic mechanism for fuel combustion implementable in CFD simulations (first & second phase: 1 to 80 atmospheres of pressure). Experimentally evaluate novel cooling channel designs developed via additive manufacturing. Extend modeling and simulation of fuel film cooling to include additional physical effects in order to close gaps with experimental data. Continue developing understanding of hydrocarbon fuel production, what components affect fuel coking and should be removed from the fuel (or added) during the production process, and how fuels can be engineered with a purpose. Complete a test article that will enable heat transfer tests at conditions relevant to full scale boost engines in a laboratory environment, and conduct testing. Continue to evaluate and develop advanced material solutions for high temperature components in rocket engines. Continue to develop and demonstrate in-house, moderate scale liquid rocket component testing capability; continue testing a sub-scale preburner in the facility to provide additional risk reduction for future engine designs. Continue to develop high performance compact liquid rocket engine technologies. ***FY 2017 Plans:*** Continue evaluation of injector concepts in hot-fire conditions. Continue examination of multi-injector designs and control effectors. Provide direct customer support to evaluate and troubleshoot injector designs and issues for HCB. Deliver high-fidelity injector simulations that compliment experimental data. Continue hot fire tests in combustion stability rig and feed data to HCB to influence supporting design efforts. Continue combustion stability modeling critical to supporting HCB Demonstration and all future hydrocarbon fueled liquid rocket engines. Deliver combustion stability codes to rocket community, enabling more robust and stable engine designs. Develop fundamental physics of fuel film cooling. Deliver validated and verified film fuel cooling modeling and simulation codes. Employ new fuel and material operating limitations, manufacturing processes, and launch goals in cycle analysis to identify trade space for future engines. Continue to evaluate and develop advanced material solutions for high temperature components in rocket engines. Develop refractory metallic film deposition techniques for application in catalytic thrusters. Test survivability and effectiveness of thermal barrier coatings for advanced hydrocarbon boost engine thrust chambers.			
Title: Advanced Liquid Engine Technologies ***Description:*** Develop advanced liquid engine technologies for improved performance, while increasing life and reliability needs for engine uses in expendable and reusable launch vehicles. ***FY 2015 Accomplishments:*** Continued to develop enabling hydrocarbon boost technology for future spacelift concepts and continue risk reduction activities for the development of HCB technologies such as subscale turbopump assembly and thrust chamber assembly. Completed Preliminary Design Reviews for the Preburner and Turbopump. ***FY 2016 Plans:***	15.917	17.517	17.906

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Continue to develop enabling HCB technology for future spacelift concepts and continue risk reduction activities for the development of HCB technologies (turbopump assembly, thrust chamber assembly). Complete Critical Design Review for the full-scale Preburner. Complete Preliminary and Critical Design Review for the full-scale Preburner and Thrust Chamber. Complete fabrication of the Preburner and begin testing. Begin fabrication of the Thrust Chamber. Begin exploring engine concepts for next generation, beyond 2035, launch vehicles and concepts to effect cost reductions. Also explore changing facility needs and requirements to support characterization of components and research demonstrators. ***FY 2017 Plans:*** Continue to develop enabling HCB technology for future spacelift concepts and continue risk reduction activities for the development of HCB technologies. Continue exploring engine concepts for next generation, beyond 2035, launch vehicles and concepts to effect cost reductions. Continue exploring changing facility needs and requirements to support characterization of components and research demonstrators.			
Title: On-Orbit Propulsion Technologies	13.895	12.317	13.190
Description: Develop solar electric, solar thermal, chemical, and advanced propulsion technologies for station-keeping, repositioning, and orbit transfer for satellites and satellite constellations. ***FY 2015 Accomplishments:*** Conducted scale-up of advanced monopropellants and evaluated advanced ignition schemes and chamber concepts. Continued development of next generation high power electric spacecraft propulsion. Continued advanced modeling and simulation tool developments to improve design and analysis tools for a wide range of spacecraft propulsion concepts/technologies, incorporating concepts/technologies and accurately model the physics. Continued transition of new thruster modeling framework to spacecraft industry for use in future designs. Explored and developed new generation of chemical spacecraft thruster technologies. Continued support of future NASA flight of Air Force Research Lab's (AFRL) non-toxic monopropellant. ***FY 2016 Plans:*** Conduct scale-up of advanced monopropellants and evaluate advanced ignition schemes and chamber concepts, including integration of advanced plume diagnostic capabilities. Continue development of next generation high power electric spacecraft propulsion for increased efficiency, operability, and flexibility. Continue advanced modeling and simulation tool developments to improve design and analysis tools for a wide range of spacecraft propulsion concepts/technologies, incorporating concepts/technologies and accurately model the physics. Transition new thruster/plume modeling framework to spacecraft industry for use in future designs. Release initial version of code to industry partners. Explore and develop new generation of chemical spacecraft thruster technologies. Complete support of NASA flight of AFRL non-toxic monopropellant (replaces toxic monopropellant currently used in spacecraft). ***FY 2017 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Complete scale-up research of the advanced monopropellant AF-M315E and continue supporting demonstrations of advanced ignition schemes and chamber concepts. Improve upon baseline plume diagnostic capabilities. Continue development of next generation high power electric spacecraft propulsion, with efforts focused on two competing technology paths. Continue advanced modeling and simulation tool developments to improve design and analysis tools for a wide range of spacecraft propulsion concepts/technologies, incorporating concepts/technologies and accurately model the physics. Continue transition of new thruster/ plume modeling framework to spacecraft industry for use in future designs. Release version 2 beta code to industry partners and provide user support. Explore and develop new generation of chemical spacecraft thruster technologies.			
Title: Space Access and Strike Applications ***Description:*** Develop missile propulsion and boost technologies for space access and strike applications. ***FY 2015 Accomplishments:*** Continued development of advanced tactical propulsion. Continued development and evaluation of next generation of updated, physics- based modeling, simulation, and analysis tools for missile propulsion components and applications. Continued to develop advanced component technologies for missile propulsion applications for strategic and strike systems helping to ensure their long-term sustainment. Continued propellant development efforts including long-life propellants. ***FY 2016 Plans:*** Continue to develop advanced tactical propulsion. Continue development and evaluation of next generation of updated, physics-based modeling, simulation, and analysis tools for missile propulsion components and applications. Continue to develop advanced component technologies for missile propulsion applications for strategic and strike systems helping to ensure their long-term sustainment. Continue propellant development efforts including long-life propellants. ***FY 2017 Plans:*** Continue to develop advanced tactical propulsion. Continue development and evaluation of next generation of updated, physics-based modeling, simulation, and analysis tools for missile propulsion components and applications. Use tools in upcoming missile propulsion demonstration. Continue to develop advanced component technologies for missile propulsion applications for strategic and strike systems helping to ensure their long-term sustainment. Develop technology options for post-boost systems exploring cost reductions, performance improvements, and potential for commonality between Air Force, Navy, and Missile Defense Agency needs for this technology. Continue propellant development efforts including long-life propellants.	5.171	7.094	7.146
Title: Ballistic Missile Technologies ***Description:*** Develop missile propulsion technologies and aging and surveillance technologies for ballistic missiles. ***FY 2015 Accomplishments:*** Continued application of next generation of chemical and aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, and non-destructive analysis tools. Continued advanced sensor development efforts to further improve	3.536	4.558	4.345

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
data acquisition and reduced uncertainty in ballistic missile life predictions. Supported transition of previous tools, models, data management system to user. ***FY 2016 Plans:*** Continue to apply next generation of chemical and aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, and non-destructive analysis tools. Continue advanced sensor development efforts to further improve data acquisition and reduce uncertainty in ballistic missile life predictions. Support transition of previous tools, models, data management system to user. Improve the fidelity and precision of non-destructive evaluation tools, improving capability to determine flaw size, orientation, and location. Begin long-term validation of tools through long-term aging of sub-scale motors. Sub-scale motors will be periodically dissected to validate the sensor and analytical analysis of each motor. ***FY 2017 Plans:*** Continue to apply next generation of chemical and aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, to user. Continue advanced sensor development efforts to further improve data acquisition and reduce uncertainty in ballistic missile life predictions. Continue long-term validation of tools through long-term aging of sub-scale motors. Sub-scale motors will be periodically dissected to validate the sensor and analytical analysis of each motor.			
Accomplishments/Planned Programs Subtotals	50.277	54.232	56.278

	FY 2015	FY 2016
Congressional Add: Program Increase ***FY 2016 Plans:*** Conduct Congressionally directed efforts	-	3.600
Congressional Adds Subtotals	-	3.600

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force			Date: February 2016
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COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
625330: *Aerospace Fuel Technology*	-	4.806	4.847	4.502	0.000	4.502	4.633	4.716	4.810	4.889	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates hydrocarbon-based fuels for legacy and advanced turbine engines, scramjets, pulse 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, and responsive space launch. Analytical and experimental areas of emphasis include evaluations of fuel properties and characteristics of alternative fuels developed from unconventional sources (such as coal, natural gas, biomass, and combinations thereof), unique/alternate fuels and components 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 2015	FY 2016	FY 2017
Title: Alternative Fuels	0.193	0.194	0.100
Description: Conduct evaluations and perform technical assessments of alternative hydrocarbon fuels derived from coal, natural gas, and biomass for use in legacy and advanced aerospace systems. ***FY 2015 Accomplishments:*** Evaluated alternative fuels being considered for addition to commercial aviation jet fuel, which Air Force will use due to conversion to new fuel standards. ***FY 2016 Plans:*** Continue to evaluate advanced cellulosic alternative fuels being considered for addition to commercial aviation jet fuel, which Air Force will use due to conversion to new fuel standards. ***FY 2017 Plans:*** Continue to evaluate advanced alternative fuels being considered for addition to commercial aviation jet fuel, which Air Force will use due to conversion to new fuel standards.			
Title: Integrated Thermal and Energy Management	1.450	1.463	1.401
Description: Develop and demonstrate advanced components and conduct performance assessments of advanced aircraft integrated thermal and energy management systems for engines and aircraft. ***FY 2015 Accomplishments:*** Developed and evaluated nano-catalysts/nano-additives for enhancing heat sink and reducing coking. ***FY 2016 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Air Force		Date: February 2016
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Evaluate fuel-based closed-loop liquid precooler systems for tactical air platforms. Optimize the composition of next generation endothermic fuel for use with catalysts for maximum heat sink and reduced coking. ***FY 2017 Plans:*** Continue to develop fuel and catalyst approaches to improve endothermic fuel heat sink and minimize coking.			
Title: Fuel Logistics ***Description:*** Study and evaluate low-cost approaches to reduce fuel logistics footprint to reduce cost. Study fuel logistics vulnerabilities and develop detection and mitigation technologies. ***FY 2015 Accomplishments:*** Evaluated anti-microbial peptides and biological active control for mitigating biological growth an aviation fuels. ***FY 2016 Plans:*** Evaluate AF capability to reduce/eliminate additives from F-24 (commercial Jet A + additives). ***FY 2017 Plans:*** Continue to develop tools to link changes in F-24/Jet A fuel composition over time with fuel properties and performance including infrastructure.	1.450	1.463	1.401
Title: Combustion Emissions and Performance ***Description:*** Develop and test advanced emissions diagnostic techniques for airbreathing propulsion systems. Conduct evaluations of the combustion and emissions characteristics of aviation fuels. ***FY 2015 Accomplishments:*** Evaluated advanced diagnostics to assess combustor engine emissions and combustion characteristics. ***FY 2016 Plans:*** Initiate combustor/hot section materials durability study as a function of fuel composition. ***FY 2017 Plans:*** Evaluate fuel composition effects on operability and emissions of advanced developmental combustors and engines.	1.713	1.727	1.600
Accomplishments/Planned Programs Subtotals	4.806	4.847	4.502

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

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D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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