Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force											Date: May 2017	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603216F / *Aerospace Propulsion and Power Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	168.542	94.594	104.499	0.000	104.499	112.332	116.482	118.570	116.573	Continuing	Continuing
632480: *Aerospace Fuels*	-	2.194	2.262	2.302	0.000	2.302	2.358	2.404	2.452	2.501	Continuing	Continuing
633035: *Aerospace Power Technology*	-	18.992	11.010	13.934	0.000	13.934	20.135	22.337	22.544	18.626	Continuing	Continuing
634921: *Aircraft Propulsion Subsystems Int*	-	74.654	19.757	17.902	0.000	17.902	18.194	18.539	18.909	19.287	Continuing	Continuing
634922: *Space & Missile Rocket Propulsion*	-	29.714	24.314	28.799	0.000	28.799	29.484	30.072	30.673	31.287	Continuing	Continuing
635098: *Advanced Aerospace Propulsion*	-	22.599	25.013	28.797	0.000	28.797	20.346	20.751	21.167	21.590	Continuing	Continuing
63681B: *Advanced Turbine Engine Gas Generator*	-	20.389	12.238	12.765	0.000	12.765	21.815	22.379	22.825	23.282	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to achieve enabling and revolutionary advances in turbine, advanced cycle, rocket, and space propulsion as well as electrical power, thermal management and fuels. The program has six projects, each focusing on technologies with a high potential to enhance the performance of existing and future Air Force weapons systems. The Aerospace Fuels project develops and demonstrates improved hydrocarbon fuels and advanced propulsion systems, including those for air-breathing high-speed/hypersonic flight. The Aerospace Power Technology project develops and demonstrates adaptive power and thermal management components, controls, and systems for high-power payloads and aircraft as part of energy-optimized aircraft development. The Aircraft Propulsion Subsystems Integration project integrates the engine cores demonstrated in the Advanced Turbine Engine Gas Generator project with low-pressure components into demonstrator engines. The Space and Missile Rocket Propulsion project develops and demonstrates innovative rocket propulsion technologies, propellants, and manufacturing techniques. The Advanced Aerospace Propulsion project develops the scramjet propulsion cycle to a technology readiness level appropriate for in-flight demonstration and for full integration with other engine cycles (including turbine and rocket based). The Advanced Turbine Engine Gas Generator project develops and demonstrates core turbine engine technologies for current and future aircraft propulsion systems. Portions of the Aerospace Fuels, Advanced Turbine Engine Gas Generator, and Aerospace Propulsion Subsystems Integration projects support adaptive cycle technology demonstrations, which develop component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs. 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 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	178.594	94.594	104.499	0.000	104.499
Current President's Budget	168.542	94.594	104.499	0.000	104.499
Total Adjustments	-10.052	0.000	0.000	0.000	0.000
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-4.557	0.000			
• SBIR/STTR Transfer	-5.495	0.000			
• Other Adjustments	0.000	0.000	0.000	0.000	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2016	FY 2017
Project: 633035: *Aerospace Power Technology*		
Congressional Add: *Silicon Carbide Research*	10.000	-
Congressional Add Subtotals for Project: 633035	10.000	-
Congressional Add Totals for all Projects	10.000	-

Change Summary Explanation

Decreases in FY 2016 reflects reprogramming to support Research and Development Projects, 10 U.S.C. Section 2358.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / *Aerospace Propulsion and Power Technology*	Project (Number/Name) 632480 / *Aerospace Fuels*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
632480: *Aerospace Fuels*	-	2.194	2.262	2.302	0.000	2.302	2.358	2.404	2.452	2.501	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates and demonstrates improved hydrocarbon fuels, unique special application fuels, alternate fuels and advanced, novel aerospace propulsion technologies for Air Force applications, including high-speed and hypersonic flight and technologies to increase turbine engine operational reliability, durability, mission flexibility, and performance, while reducing weight, fuel consumption, and cost of ownership. The advanced fuel emphasis is on demonstrating new thermally stable, high-heat sink, and controlled chemically reacting fuels for a conventional turbine engine, turbine-based combined cycle engines, and other advanced propulsion systems. The project also evaluates and demonstrates fuel system components that minimize cost, reduce maintenance, and improve performance of future aerospace systems. The advanced propulsion emphasis is on demonstrating concepts for combined cycle, ramjet, and scramjet engines. A portion of this project supports the demonstration of adaptive cycle technologies. This project develops component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Fuel-Related Thermal Management	0.607	0.662	0.674
Description: Demonstrate thermally stable fuels and fuel system hardware concepts to enhance cooling capacity (performance), minimize fuel coking, and reduce fuel system maintenance.			
FY 2016 Accomplishments: Demonstrated nano-catalysts/nano-additives for enhancing heat sink and reducing coking.			
FY 2017 Plans: Investigate adaptable heat sink alternatives for advanced thermal management.			
FY 2018 Plans: Continue investigation of fuel heat sink approaches for thermal management of adaptive engines, including on-board fuel deoxygenation.			
Title: Gas Turbine Combustion, Emissions, and Performance	0.608	0.600	0.611
Description: Develop and demonstrate efficacy of low-cost, environmentally friendly fuel approaches to assess and reduce soot/ particulate emissions from gas turbine engines.			
FY 2016 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	**Project (Number/Name)** 632480 / *Aerospace Fuels*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Assessed operability in referee combustor of reference jet fuels representing range of conventional jet fuels being used by Air Force. ***FY 2017 Plans:*** Support industry combustor model development by supplying referee combustor validation data. ***FY 2018 Plans:*** Initiate development of augmentor combustor/simulator to determine fuel effects on augmentor operability under realistic conditions.			
Title: Fuel Logistics ***Description:*** Identify, develop, and demonstrate low-cost approaches to reducing the fuel logistics footprint for the Air Force. ***FY 2016 Accomplishments:*** Continued bio-contamination, mitigation and risk assessment of aviation fuels. Demonstrated anti-microbial peptides and biological active control for mitigating biological growth in aviation fuels. ***FY 2017 Plans:*** Continue analysis of the benefits of additives in commercial aviation jet fuel for military use and potential for additive removal. ***FY 2018 Plans:*** Complete evaluation of advanced additives for water sequestration and mitigation of biological growth.	0.785	0.800	0.813
Title: Alternative Jet Fuels ***Description:*** Characterize and demonstrate the use of alternative hydrocarbon jet fuel to comply with Air Force certifications and standards for jet fuels. ***FY 2016 Accomplishments:*** Continued analysis of approaches for evaluating and approving alternative jet fuels added to commercial jet aviation fuel specifications. ***FY 2017 Plans:*** Continue analysis of new approaches for evaluating and approving alternative jet fuels added to commercial jet aviation fuel specifications. ***FY 2018 Plans:*** Complete development of generic alternative fuel specification annexes for commercial jet fuels used by Air Force.	0.194	0.200	0.204
Accomplishments/Planned Programs Subtotals	2.194	2.262	2.302

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	**Project (Number/Name)** 632480 / *Aerospace Fuels*

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: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / *Aerospace Propulsion and Power Technology*	Project (Number/Name) 633035 / *Aerospace Power Technology*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
633035: *Aerospace Power Technology*	-	18.992	11.010	13.934	0.000	13.934	20.135	22.337	22.544	18.626	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates electrical power, thermal management, and distribution for aerospace applications. This project develops and demonstrates the components, controls and systems required to satisfy the operational needs of current and future aircraft as well as to enable the use of future high-power payloads. This technology enhances reliability and survivability, and reduces vulnerability, weight, and life cycle costs of air platforms. The electrical power system components developed are projected to provide a two-fold to five-fold improvement in aircraft reliability and maintainability, and a reduction in power system weight. This project is integrated into energy optimized aircraft efforts and power and thermal programs.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: High Power Aircraft Subsystem Technologies	8.992	11.010	13.934
Description: Develop and demonstrate integrated architecture, controls and components for power generation, conditioning, and distribution; energy storage components; and thermal management and subsystem technologies for integration into high power aircraft.			
FY 2016 Accomplishments: Continued development and demonstration of system and component electrical power, electro-mechanical, and thermal technologies for high-power aircraft. Continued development of actuation technology for applications with power, volume, and thermal limitations. Initiated the development of hybrid-cycle power and thermal management system. Completed demonstration of platform-level hardware-in-the-loop integrated power and thermal management. Initiated development of advanced power generation and distribution system. Initiated development and demonstration of integrated, adaptive megawatt-class tactical aircraft power and thermal capability.			
FY 2017 Plans: Continue development and demonstration of system and component electrical power, electro-mechanical, and thermal technologies for high-power aircraft. Continue development of actuation technology for applications with power, volume, and thermal limitations. Continue the development of hybrid-cycle power and thermal management system. Continue development of advanced power generation and distribution system. Continue development and demonstration of integrated, adaptive megawatt-class tactical aircraft power and thermal capability.			
FY 2018 Plans: Continue development and demonstration of system and component electrical power, electro-mechanical, and thermal technologies for high-power aircraft. Continue development of actuation technology for applications with power, volume, and			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	**Project (Number/Name)** 633035 / *Aerospace Power Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
thermal limitations. Continue the development of hybrid-cycle power and thermal management system. Continue development of advanced power generation and distribution system. Continue development and demonstration of integrated, adaptive megawatt-class tactical aircraft power and thermal capability.			
Accomplishments/Planned Programs Subtotals	8.992	11.010	13.934

	FY 2016	FY 2017
Congressional Add: Silicon Carbide Research	10.000	-
FY 2016 Accomplishments: Conduct Congressionally directed efforts		
Congressional Adds Subtotals	10.000	-

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: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / *Aerospace Propulsion and Power Technology*	Project (Number/Name) 634921 / *Aircraft Propulsion Subsystems Int*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
634921: *Aircraft Propulsion Subsystems Int*	-	74.654	19.757	17.902	0.000	17.902	18.194	18.539	18.909	19.287	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates technology to increase turbine engine operational reliability, durability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. The Aerospace Propulsion Subsystems Integration (APSI) project includes demonstrator engines for manned systems and efficient small-scale propulsion for remotely piloted aircraft and cruise missile applications. The demonstrator engines integrate the core (high- pressure spool) technology developed under the Advanced Turbine Engine Gas Generator (ATEGG) project with the engine (low-pressure spool) technology such as fans, turbines, engine controls, mechanical systems, exhaust nozzles, and augmentors. Additionally, this project includes activities to improve propulsion safety and readiness. This project also focuses on integration of inlets, nozzles, engine-to-airframe compatibility, and power and thermal management subsystems technologies. The APSI project provides aircraft with potential for longer range and higher cruise speeds with lower specific fuel consumption, surge power for successful engagements, high sortie rates with reduced maintenance, reduced life cycle cost, and improved survivability, resulting in increased mission effectiveness. Technologies developed are applicable to sustained high-speed vehicles and responsive space launch. The APSI project is focused on improving propulsion capabilities while at the same time reducing the cost of ownership. Anticipated technology advances include turbine engine improvements providing approximately twice the range for a sustained supersonic combat aircraft, doubling the time on station with ten times the power output for surveillance aircraft and propulsion for a high speed supersonic missile with double the range for time sensitive targets. A portion of this project supports the demonstration of adaptive cycle technologies, which develop component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, high power extraction, integrated thermal management, and durability for widely varying mission needs.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Missile/Remotely Piloted Aircraft Engine Performance	19.853	11.757	10.653
Description: Design, fabricate, and test component technologies for limited-life engines to improve the performance, durability, and affordability of missile and remotely piloted aircraft engines.			
FY 2016 Accomplishments: Assembled final ground test demonstrators for supersonic, long endurance turbine engines at simulated altitude conditions. Completed fabrication and instrumentation of a subsonic small turbine engine technology experimental test. Completed detailed design of subsonic mid-sized turbine engine technology for remotely piloted aircraft. Completed final ground testing of demonstration for supersonic, long endurance turbine engines at simulated altitude conditions.			
FY 2017 Plans: Initiate follow-on conceptual design and fabrication effort for improved capability supersonic, long endurance turbine engines at simulated altitude conditions. Conduct ground test of subsonic small turbine engine for missile application. Increase effort in			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	**Project (Number/Name)** 634921 / *Aircraft Propulsion Subsystems Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
efficient limited-life medium scale propulsion development for future Intelligence, Surveillance, and Reconnaissance (ISR) and strike capability. ***FY 2018 Plans:*** Conduct design and initiate fabrication of efficient limited-life medium scale propulsion concepts for future ISR and strike capability. Continue conceptual design and initiate long lead procurement for follow-on improved capability supersonic, long endurance turbine engines at simulated altitude conditions.			
Title: Adaptive Turbine Engine Technologies ***Description:*** Design, fabricate, and demonstrate performance, durability, and operability technologies to mature adaptive turbine engine technologies. ***FY 2016 Accomplishments:*** Continued fabrication, instrumentation and assembly of core experimental adaptive turbine engines. ***FY 2017 Plans:*** Support successful technology transition to Adaptive Engine Transition Program. This work includes completing fabrication, instrumentation and assembly of core experimental adaptive turbine engine. Initiating and completing ground testing of first core experimental adaptive turbine engine. Completing the assessment of the acquired and processed data from the ground testing of core experimental adaptive turbine engines and comparison to analytical prediction tools to validate reduced specific fuel consumption, improved thrust-to-weight, and reduced cost. ***FY 2018 Plans:*** Initiate and complete final ground testing of core experimental adaptive turbine engine. Complete the assessment of the acquired and processed data from the ground testing of core experimental adaptive turbine engines and comparison to analytical prediction tools to validate reduced specific fuel consumption, improved thrust-to-weight, and reduced cost. Provide subject matter expert support to Adaptive Engine Transition Program. Initiate and complete design for integrated power and thermal management engine demonstrator. Initiate hardware fabrication for integrated power and thermal management engine demonstrator.	54.801	8.000	7.249
Accomplishments/Planned Programs Subtotals	74.654	19.757	17.902

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	**Project (Number/Name)** 634921 / *Aircraft Propulsion Subsystems Int*

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: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / *Aerospace Propulsion and Power Technology*	Project (Number/Name) 634922 / *Space & Missile Rocket Propulsion*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
634922: *Space & Missile Rocket Propulsion*	-	29.714	24.314	28.799	0.000	28.799	29.484	30.072	30.673	31.287	Continuing	Continuing

A. Mission Description and Budget Item Justification

Mission Description not provided.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Liquid Rocket Propulsion Technologies	21.937	18.330	20.923
Description: Develop liquid rocket propulsion technology for current and future space launch vehicles. ***FY 2016 Accomplishments:*** Completed sub-scale preburner risk reduction testing. Continued development of hydrocarbon engine components for integration and demonstration of advanced technologies applicable to future expendable and reusable launch vehicles. Continued fabrication of full-scale preburner. Initiated full-scale fuel kick pump testing. ***FY 2017 Plans:*** Complete fabrication of the full-scale preburner and initiate testing. Complete critical design review (CDR) for the full-scale Turbopump and begin fabrication. Continue development of hydrocarbon engine components for integration and demonstration in an advanced hydrocarbon engine concept applicable to future expendable and reusable launch vehicles. ***FY 2018 Plans:*** Complete development of hydrocarbon engine components and begin preparation for integrated testing. Complete testing of the full-scale preburner. Continue fabrication of the Turbopump. Initiate study for next generation liquid propulsion technology demonstration effort focused on modularity and cost reduction.			
Title: On-Orbit Propulsion Technologies	0.000	0.429	1.649
Description: Develop solar electric, electric, and monopropellant propulsion technologies for existing and future satellites, upper stages, orbit transfer vehicles, and satellite maneuvering. ***FY 2016 Accomplishments:*** N/A ***FY 2017 Plans:*** Initiate maturation of advanced thruster technologies with emphasis on longer lifetime and improved quantification of thrust profiles through experimental, theoretical and modeling and simulation approaches. Initiate development of experimental			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	**Project (Number/Name)** 634922 / *Space & Missile Rocket Propulsion*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
capability for longer-lifetime thruster testing, non-invasive diagnostic techniques to study plume composition, and improved fidelity thrust stands for thruster characterization. Initiate integration of system level and detailed modeling and simulation tools to improve selection of new candidate propellants and possible multimode propulsion alternatives. Initiate effort to extend and refine theoretical models for advanced propellant chemistry to assist with advanced chemical thruster design. ***FY 2018 Plans:*** Continue to develop and transition experimental, modeling and simulation, and theoretical efforts geared towards advanced thruster development with additional emphasis on understanding thrust scale-up. Extend capability to study next generation of hypergolic fuels, including propellant characterization, drop-in testing, and lab-scale thruster demonstration. Continue analysis and development of multimode propulsion opportunities to combine high efficiency and high thrust capabilities on a common propellant.			
Title: Ballistic Missile Technologies ***Description:*** Develop and demonstrate missile propulsion and post-boost control systems technologies for ballistic missiles. ***FY 2016 Accomplishments:*** Continued to develop advanced missile case, insulation, and nozzle technologies. Continued validation of modeling and simulation tools through upcoming demonstration. Initiated technology demonstration effort on advanced missile case, insulation, and nozzle technologies and validation of physics-based modeling, simulation, and analysis tools. ***FY 2017 Plans:*** Continue technology demonstration effort on advanced missile case, insulation, and nozzle technologies and validation of physics-based modeling, simulation, and analysis tools. Initiate technology demonstration effort of post-boost technologies. ***FY 2018 Plans:*** Continue technology demonstration effort on advanced missile case, insulation, and nozzle technologies and validation of physics-based modeling, simulation, and analysis tools for ballistic and tactical missile solid rocket motors. Continue technology maturation and demonstration efforts for post-boost technologies and tactical missile technologies.	5.760	4.428	2.664
Title: Strategic System Motor Surveillance ***Description:*** Develop and demonstrate aging and surveillance technologies for strategic systems to reduce lifetime prediction uncertainty for individual motors, enabling motor replacement for cause. ***FY 2016 Accomplishments:*** Applied 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 data acquisition and	2.017	1.127	3.563

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	**Project (Number/Name)** 634922 / *Space & Missile Rocket Propulsion*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
reduce uncertainty in ballistic missile life predictions. Improved the fidelity and precision of non-destructive evaluation tools to increase capability to determine flaw size, orientation, and location. Supported transition of previous tools, models, data management system to user. Started long-term validation of tools through long-term aging of sub-scale motors. Continued sub-scale motors dissection 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, and non-destructive analysis tools. Continue advanced sensor analysis development efforts to further improve data acquisition and reduce uncertainty in ballistic missile life predictions. Continue to improve the fidelity and precision of non-destructive evaluation tools to increase the capability to determine flaw size, orientation, and location. Support transition of previous tools, models, data management system to user. Continue long-term validation of tools through long-term aging of sub-scale motors. Continue sub-scale motors dissection to validate the sensor and analytical analysis of each motor. ***FY 2018 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 analysis development efforts to further improve data acquisition and reduce uncertainty in ballistic missile life predictions. Continue to improve the fidelity and precision of non-destructive evaluation tools to increase the capability to determine flaw size, orientation, and location. Support transition of previous tools, models, data management system to user. Continue long-term validation of tools through long-term aging of sub-scale motors. Continue sub-scale motors dissection to validate the sensor and analytical analysis of each motor. Initiate maturation and demonstration of advanced sensor, non-destructive evaluation, modeling and supporting technology development efforts to detect and explain phenomena to further improve data acquisition and reduce uncertainty in ballistic and tactical missile solid rocket motor life predictions.			
Accomplishments/Planned Programs Subtotals	29.714	24.314	28.799

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	**Project (Number/Name)** 634922 / *Space & Missile Rocket Propulsion*

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: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / *Aerospace Propulsion and Power Technology*	Project (Number/Name) 635098 / *Advanced Aerospace Propulsion*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
635098: *Advanced Aerospace Propulsion*	-	22.599	25.013	28.797	0.000	28.797	20.346	20.751	21.167	21.590	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates, via ground and flight tests, the scramjet propulsion cycle to a technology readiness level appropriate for full integration with other engine cycles (including turbine and rocket-based) to provide the Air Force with transformational military capabilities. The primary focus is on the hydrocarbon-fueled, scramjet engine. Multi-cycle engines will provide the propulsion systems for possible application to support aircraft and weapon platforms operating up to Mach 7. Efforts include: scramjet flow-path optimization to enable operation over the widest possible range of Mach numbers; active combustion control to assure continuous positive thrust (even during mode transition); robust flame-holding to maintain stability through flow distortions; and maximized volume-to-surface area to minimize the thermal load imposed by the high-speed engine. Thermal management plays a vital role in scramjet and combined cycle engines, including considerations for protecting low speed propulsion systems (e.g., turbine engines) during hypersonic flight.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Scramjet Technologies	22.599	25.013	28.797
Description: Develop and demonstrate technologies for a hydrocarbon-fueled scramjet with robust operation up to Mach 7.			
FY 2016 Accomplishments: Completed the assessment of cold-start systems and progressed in the design of flight weight, insensitive munition (IM) compliant systems for testing. Completed additional component development and testing for insensitive munition compliant scramjet cold start system in both X-51 heritage, two-dimensional, engine lines and axisymmetric, three-dimensional, scramjet flow lines. Designed flight weight cold start system for demonstration in direct-connect test hardware. Developed scramjet technologies to enhance operability including robust operation during maneuvers. Continued accelerated development and demonstration of tactically compliant subsystems, including scramjet engine start system, fuel system, and engine controls. Continued to accelerate development and demonstration of tactically-relevant long range high speed strike scramjet engine technologies including ground and flight demonstrations needed for potential follow-on acquisition program. Initiated detailed design of scramjet engine for air breathing weapon concept.			
FY 2017 Plans: Continue development and demonstration of tactically compliant subsystems, including scramjet engine start system, fuel system, and engine controls. Complete additional component development and testing for insensitive munition compliant scramjet cold start system in both X-51 heritage, two-dimensional, engine lines and axisymmetric, three-dimensional, scramjet flow lines. Initiate direct-connect test of tactically compliant cold start system in flight weight hardware. Continue development of scramjet technologies to enhance operability including robust operation during maneuvers. Continue accelerated development			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	**Project (Number/Name)** 635098 / *Advanced Aerospace Propulsion*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
and demonstration of tactically-relevant long range high speed strike scramjet engine technologies including ground and flight demonstrations needed for potential follow-on acquisition program. Initiate fabrication of scramjet engine for air breathing weapon concept. ***FY 2018 Plans:*** Design and analyze flight weight, medium scale high-speed propulsion systems in preparation for future ground test. Continue development and demonstration of tactically compliant subsystems, including scramjet engine start system, fuel system, and engine controls. Complete additional component development and testing for insensitive munition compliant scramjet cold start system in both X-51 heritage, two-dimensional, engine lines and axisymmetric, three-dimensional, scramjet flow lines. Initiate direct-connect test of tactically compliant cold start system in flight weight hardware. Continue development of scramjet technologies to enhance operability including robust operation during maneuvers.			
Accomplishments/Planned Programs Subtotals	22.599	25.013	28.797

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: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / *Aerospace Propulsion and Power Technology*	Project (Number/Name) 63681B / *Advanced Turbine Engine Gas Generator*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
63681B: *Advanced Turbine Engine Gas Generator*	-	20.389	12.238	12.765	0.000	12.765	21.815	22.379	22.825	23.282	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates technology to increase turbine engine operational reliability, durability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. The objective is to provide continuous evolution of technologies into an advanced gas generator in which the performance, cost, durability, repairability, and maintainability can be assessed in a realistic engine environment. The gas generator, or core, is the basic building block of the engine and nominally consists of a compressor, a combustor, a high-pressure turbine, mechanical systems, and core subsystems. Experimental core engine demonstration validates engineering design tools and enhances rapid, low-risk transition of key engine technologies into engineering development, where they can be applied to derivative and/or new systems. These technologies are applicable to a wide range of military and commercial systems including aircraft, missiles, land combat vehicles, ships, and responsive space launch. Component technologies are demonstrated in a core (sub-engine). This project also assesses the impact of low spool components such as; inlet systems, fans, low pressure turbines, exhaust systems, and system level technologies such as; integrated power generators and thermal management systems on core engine performance, and durability in ground demonstrations of engine cores. The core performances of this project are validated on demonstrator engines in the APSI Project of this program. A portion of this project supports the demonstration of adaptive cycle technologies, which develop component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Core Engine Technologies	6.961	5.238	5.463
Description: Design, fabricate, and demonstrate performance predictions in core engines, using innovative engine cycles and advanced materials for turbofan and for turbojet engines. ***FY 2016 Accomplishments:*** Continued instrumentation and assembly of component hardware for rig demonstration and validation of increased reliability, maintainability, and affordability. Completed design and fabrication of remaining components for core demonstration for potential acquisition program for transition to fielded systems. ***FY 2017 Plans:*** Finish assembly, instrumentation and test of core engine. Begin design of medium-scale efficient core demonstrator. ***FY 2018 Plans:*** Conduct post test assessment of core engine. Complete design and initiate fabrication of medium-scale efficient core demonstrator.			
Title: High Pressure Ratio Core Engine Technologies	0.757	1.900	1.982

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	**Project (Number/Name)** 63681B / *Advanced Turbine Engine Gas Generator*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Description: Design, fabricate, and demonstrate high overall pressure ratio engine cores to provide increased durability and affordability with lower fuel consumption for turbofan and for turboshaft engines. ***FY 2016 Accomplishments:*** Completed risk reduction rig testing of components for small efficient engine core concepts with advanced technologies such as high pressure ratio/high temperature capability compressors, high heat release combustors, high cooling effectiveness turbine with an integrated thermal management system, and advanced mechanical systems. ***FY 2017 Plans:*** Complete data reduction of test data for potential follow-on transition to ground engine demonstration or for fielded systems. Initiate design and fabrication of components for small efficient engine core concept with advanced technologies such as high pressure ratio/high temperature capability compressors, high heat release combustors, high cooling effectiveness turbine. ***FY 2018 Plans:*** Complete design, fabrication, and initiate assembly of components for small efficient engine core concept with advanced technologies such as high pressure ratio/high temperature capability compressors, high heat release combustors, high cooling effectiveness turbine.			
Title: Adaptive Turbine Engine Core Technologies ***Description:*** Design, fabricate, and demonstrate adaptive turbine engine cores to provide increased durability and affordability with lower fuel consumption for turbofan and for turboshaft engines. ***FY 2016 Accomplishments:*** Continued fabrication, instrumentation, and assembly of components for experimental engine core demonstration of an adaptive turbine engine with reduced specific fuel consumption, improved thrust-to-weight, and reduced cost. ***FY 2017 Plans:*** Complete testing of first adaptive core demonstrator. Finish manufacturing and begin assembly of final core demonstrator. Begin preliminary design for advanced air dominance adaptive core demonstrator. ***FY 2018 Plans:*** Complete final ground testing of final core demonstrator. Continue design and initiate long lead procurement for advanced air dominance adaptive core demonstrator.	12.671	5.100	5.320
Accomplishments/Planned Programs Subtotals	20.389	12.238	12.765

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603216F / *Aerospace Propulsion and Power Technology*	**Project (Number/Name)** 63681B / *Advanced Turbine Engine Gas Generator*

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.