Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Air Force											Date: March 2014	
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 2013**	**FY 2014**	**FY 2015 Base**	**FY 2015 OCO #**	**FY 2015 Total**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**	**Cost To Complete**	**Total Cost**
Total Program Element	-	146.776	159.291	124.236	-	124.236	164.953	109.333	103.450	118.417	Continuing	Continuing
632480: *Aerospace Fuels*	-	3.195	2.452	2.275	-	2.275	4.110	2.280	2.321	4.109	Continuing	Continuing
633035: *Aerospace Power Technology*	-	14.649	17.520	5.417	-	5.417	6.368	11.075	10.016	10.220	Continuing	Continuing
634921: *Aircraft Propulsion Subsystems Int*	-	69.342	64.160	53.675	-	53.675	77.407	19.914	18.051	20.481	Continuing	Continuing
634922: *Space & Missile Rocket Propulsion*	-	20.028	24.061	26.552	-	26.552	34.952	31.160	31.521	37.213	Continuing	Continuing
635098: *Advanced Aerospace Propulsion*	-	8.523	18.811	27.252	-	27.252	23.877	25.212	22.986	20.519	Continuing	Continuing
63681B: *Advanced Turbine Engine Gas Generator*	-	31.039	32.287	9.065	-	9.065	18.239	19.692	18.555	25.875	Continuing	Continuing

The FY 2015 OCO Request will be submitted at a later date.

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 power and thermal management systems for weapons 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, since it enables and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Air Force		Date: March 2014
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 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	151.152	149.321	141.759	-	141.759
Current President's Budget	146.776	159.291	124.236	-	124.236
Total Adjustments	-4.376	9.970	-17.523	-	-17.523
• Congressional General Reductions	-0.217	-0.030			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	13.000	10.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.638	-			
• Other Adjustments	-13.521	-	-17.523	-	-17.523

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2013	FY 2014
Project: 633035: *Aerospace Power Technology*		
Congressional Add: *Silicon Carbide Research*	11.912	10.000
Congressional Add Subtotals for Project: 633035	11.912	10.000
Congressional Add Totals for all Projects	11.912	10.000

Change Summary Explanation

Decrease in FY13 Other Adjustments was due to Sequestration.
Increase in FY13 and FY14; Congressional Add for Silicon Carbide research.
Decrease in FY 2015 is due to higher DoD priorities.

Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force			Date: March 2014
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 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
632480: *Aerospace Fuels*	-	3.195	2.452	2.275	-	2.275	4.110	2.280	2.321	4.109	Continuing	Continuing

The FY 2015 OCO Request will be submitted at a later date.

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 2013	FY 2014	FY 2015
Title: Fuel-Related Thermal Management	0.446	0.341	0.416
Description: Demonstrate thermally stable fuels and fuel system hardware concepts to enhance cooling capacity (performance), minimize fuel coking, and reduce fuel system maintenance.			
FY 2013 Accomplishments: Evaluated fuel-related thermal management requirements of variable-cycle engines.			
FY 2014 Plans: Demonstrate fuel-cooled thermal management approaches for variable-cycle engines.			
FY 2015 Plans: Demonstrate heat sink and coking performance of advanced producible endothermic fuel.			
Title: Gas Turbine Combustion, Emissions, and Performance	0.446	0.341	0.416
Description: Develop and demonstrate efficacy of low-cost, environmentally friendly fuel approaches to assess and reduce soot/ particulate emissions from gas turbine engines.			
FY 2013 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014
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 2013	FY 2014	FY 2015
Supported development of international standard for soot (particulate) emissions from gas turbine engines. ***FY 2014 Plans:*** Demonstrate international standard methodology for measuring soot (particulates) on a variety of gas turbine engines. This measurement methodology will be transitioned through publication as a recommended international aerospace practice. ***FY 2015 Plans:*** Demonstrate advanced particulate characterization enabling the identification and quantification of particulates absorbed in volatile and non-volatile hydrocarbon fuels.			
Title: Fuel System Technologies ***Description:*** Develop and demonstrate enhancements to fuel system technology. ***FY 2013 Accomplishments:*** Demonstrated effectiveness of Jet Propellant (JP-7) replacement endothermic fuel in reduced-scale cooling simulations to support medium-scale scramjet testing. ***FY 2014 Plans:*** Demonstrate effectiveness of enhanced endothermic fuel under higher heat sink conditions in reduced scale cooling simulations. This effort will be completed in FY14. ***FY 2015 Plans:*** N/A	0.446	0.341	-
Title: Fuel Logistics ***Description:*** Identify, develop, and demonstrate low-cost approaches to reducing the fuel logistics footprint for the Air Force. ***FY 2013 Accomplishments:*** Demonstrated mitigation of biological growth in alternative fuels and commercial jet fuels in base-level fuel distribution systems. Evaluated the effect of trace biodiesel contamination, resulting from transport via pipeline, on fuel properties and stability. ***FY 2014 Plans:*** Evaluate impact of commercial aviation jet fuel conversion (including alternative fuels) on Air Force fuel infrastructure. ***FY 2015 Plans:*** Continue to demonstrate and evaluate commerical conversion impacts and fuel filtration devices with nano-size meshes to mitigate biological growth in aviation fuels.	0.714	0.545	0.607
Title: Alternative Jet Fuels	1.143	0.884	0.836

Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014
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 2013	FY 2014	FY 2015
Description: Characterize and demonstrate the use of alternative hydrocarbon jet fuel to comply with Air Force certifications and standards for jet fuels. ***FY 2013 Accomplishments:*** Evaluated storage, distribution, ignition, combustion, and other properties of cellulosic-based alternative aviation fuels produced through thermo-catalytic processes. Initiated support to interagency combustor operability testing. Began publishing research reports for industry review to facilitate development of consistent and common military and commercial fuel specifications. ***FY 2014 Plans:*** Continue to evaluate storage, distribution, ignition, combustion, and other properties of cellulosic-based alternative aviation fuels produced through fermentation processes. Continue to support interagency combustor operability testing. Continue to publish research reports for industry review to faciliate development of consistent and common military and commercial fuel specifications. Continue to support interagency combustor operability testing. ***FY 2015 Plans:*** Complete combustor operability study with low-temperature fuel-air ignition and re-light investigation for reference fuels and fuels that are 100% synthetic. Continue to evaluate cellulosic-based alternative aviation fuels produced through fermentation processes.			
Accomplishments/Planned Programs Subtotals	3.195	2.452	2.275

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 2015 Air Force			Date: March 2014
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 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
633035: *Aerospace Power Technology*	-	14.649	17.520	5.417	-	5.417	6.368	11.075	10.016	10.220	Continuing	Continuing

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project develops and demonstrates electrical power, thermal management, and distribution for aerospace applications. 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. This project also develops and demonstrates electrical power and thermal management technologies to enable solid state high power density sources.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
Title: High Power Aircraft Subsystem Technologies	2.737	7.520	5.417
Description: Develop components for power generation, conditioning, and distribution; energy storage components; and thermal management components and subsystem technologies for integration into high power aircraft. ***FY 2013 Accomplishments:*** Demonstrated adaptive power and thermal management subsystems for next generation air platforms with potential transition to fifth generation strike aircraft via system level energy optimized air platform models in support of and in preparation for hardware development and demonstration. ***FY 2014 Plans:*** Complete demonstration of adapative power and thermal management subsystems for next generation air platforms and initiate integration of power and thermal management subsystems for platform-level hardware-in-the-loop energy optimization demonstration. Facilitate technology and hardware integration for demonstration. Completing design work and initiating component subsystem testing. ***FY 2015 Plans:*** Continue demonstration of platform-level hardware-in-the-loop integrated power and thermal management subsystems. Facilitate technology and hardware development for demonstration of integrated power, thermal and propulsion systems.			
Accomplishments/Planned Programs Subtotals	2.737	7.520	5.417

Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014
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*

	FY 2013	FY 2014
Congressional Add: Silicon Carbide Research	11.912	10.000
FY 2013 Accomplishments: Conducted Congressionally directed effort.		
FY 2014 Plans: Conduct Congressionally directed efforts		
Congressional Adds Subtotals	11.912	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: PB 2015 Air Force			Date: March 2014
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 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
634921: *Aircraft Propulsion Subsystems Int*	-	69.342	64.160	53.675	-	53.675	77.407	19.914	18.051	20.481	Continuing	Continuing

The FY 2015 OCO Request will be submitted at a later date.

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 concept 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, and durability for widely varying mission needs.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
Title: Turbofan/Turbojet Durability	0.500	0.200	-
Description: Design, fabricate, and demonstrate durability and integration technologies for turbofan engines and for turbojet engines to improve durability, supportability, and affordability of Air Force aircraft. ***FY 2013 Accomplishments:*** Investigated inlet and exhaust interactions with initial study effort involving modeling and simulation. ***FY 2014 Plans:*** Complete inlet and exhaust interaction study and demonstrate health monitor technologies. ***FY 2015 Plans:*** N/A.			
Title: Turbofan/Turbojet Performance	6.167	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014
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 2013	FY 2014	FY 2015
Description: Design, fabricate, and test advanced component technologies for improved performance and fuel consumption of turbofan and turbojet engines. ***FY 2013 Accomplishments:*** Completed assembly and instrumentation of advanced adaptive cycle (third air stream) engine technologies, including an advanced fan, high work variable low turbine for long dwell time, controls, inlet integration, and advanced exhaust nozzle for subsonic to sustained supersonic flight. Completed experimental testing of engine technologies. ***FY 2014 Plans:*** N/A ***FY 2015 Plans:*** N/A			
Title: Missile/Remotely Piloted Aircraft Engine Performance ***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 2013 Accomplishments:*** Completed assembly and instrumentation of supersonic, long endurance turbine engine components. Completed critical technology rig testing and sea level testing of supersonic, long endurance turbine engines. ***FY 2014 Plans:*** Complete ground testing of demonstration supersonic, long endurance turbine engines at simulated altitude conditions. Accelerate engine activity to meet follow on need date. Continue rig testing of advanced components for engine technology applicable to subsonic missiles or unmanned vehicles. Continue detailed design of subsonic small turbine engine technology. Begin preliminary design of subsonic mid-sized turbine engine technology for remotely piloted aircraft. ***FY 2015 Plans:*** Complete rig testing of advanced components for engine technology applicable to missiles and unmanned vehicles. Complete detailed design and begin fabrication and instrumentation of a subsonic small turbine engine technology experimental test. Complete preliminary design of subsonic mid-sized turbine engine technology for remotely piloted aircraft.	15.916	18.428	14.274
Title: Adaptive Turbine Engine Technologies ***Description:*** Design, fabricate, and demonstrate performance, durability, and operability technologies to mature adaptive turbine engine technologies.	46.759	45.532	39.401

Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014
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 2013	FY 2014	FY 2015
FY 2013 Accomplishments: Initiated preliminary designs for an adaptive turbine engine with reduced specific fuel consumption, improved thrust-to-weight, and reduced cost. Accelerated engine technology development activity to meet follow on activity need date. Performed augmentor and exhaust nozzle cold flow testing. Performed preliminary design of an advanced adaptive fan. Initiated long lead hardware procurement. ***FY 2014 Plans:*** Complete prelimary designs for an adaptive turbine engine with reduced specific fuel consumption, improved thrust-to-weight, and reduced cost. Initiate manufacturing of advanced adaptive fan, augmentor, and exhaust rig test hardware. Continue engine technology development activity to support component instrumentation and integration into core engine. ***FY 2015 Plans:*** Complete preliminary design reviews and initiate detailed design of an adaptive turbine engine with reduced specific fuel consumption, improved thrust-to-weight, and reduced cost. Initiate manufacturing of advanced adaptive core engine test hardware. Continue engine technology development activity to support core engine assembly and initial ground testing.			
Accomplishments/Planned Programs Subtotals	69.342	64.160	53.675

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 2015 Air Force			Date: March 2014
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 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
634922: *Space & Missile Rocket Propulsion*	-	20.028	24.061	26.552	-	26.552	34.952	31.160	31.521	37.213	Continuing	Continuing

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced and innovative low-cost rocket turbo-machinery and components, and low-cost space launch propulsion technologies. Additionally, this project develops technologies for the sustainment of strategic systems (including solid rocket motor boosters and missile propulsion, post boost control, and aging and surveillance efforts) and tactical rockets. Characteristics such as environmental acceptability, affordability, reliability, responsiveness, reduced weight, and reduced operation and launch costs are emphasized. Increased life and performance of propulsion systems are key goals. Technology areas investigated include ground demonstrations of compact, lightweight, advanced propulsion technologies, higher efficiency energy conversion systems (derived from an improved understanding of combustion fundamentals), and high-energy propellants. Technological advances developed in this program could improve the performance of expendable payload capabilities by approximately twenty to fifty percent and reduce launch, operations, and support costs by approximately thirty percent. Responsiveness and operability of propulsion systems will be enhanced for reusable launch systems. Aging and surveillance efforts for solid rocket motors could reduce lifetime prediction uncertainties for individual motors by fifty percent, enabling motor replacement for cause. The efforts in this project contribute to the sustainment of the rocket propulsion industry, providing rocket propulsion technology for the entire Department of Defense and NASA. The project efforts are part of the Rocket Propulsion 21 (RP21) program. The project efforts are reviewed by a DoD level steering committee annually for relevance to DoD missions and achievement of technical goals defined by the RP21 program.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
Title: Liquid Rocket Propulsion Technologies	17.262	18.277	20.034
Description: Develop liquid rocket propulsion technology for current and future space launch vehicles.			
FY 2013 Accomplishments: Continued development of hydrocarbon engine components for integration and demonstration in an advanced hydrocarbon engine concept applicable to future expendable and reusable launch vehicles. Continued sub-scale preburner and sub-scale turbine component testing to demonstrate hydrocarbon boost technologies. Began thrust chamber sub-scale development. Began full-scale pre-burner component development.			
FY 2014 Plans: Continue development of hydrocarbon engine components for integration and demonstration in an advanced hydrocarbon engine concept applicable to future expendable and reusable launch vehicles. Continue sub-scale preburner and continue sub-scale			

Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014
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 2013	FY 2014	FY 2015
turbine component testing to demonstrate hydrocarbon boost technologies. Continue thrust chamber sub-scale development. Continue full-scale pre-burner component development. ***FY 2015 Plans:*** Continue development of hydrocarbon engine components for integration and demonstration in an advanced hydrocarbon engine concept applicable to future expendable and reusable launch vehicles. Complete sub-scale preburner and continue sub-scale turbine component testing to demonstrate hydrocarbon boost technologies. Continue thrust chamber sub-scale development. Continue full-scale pre-burner component development and begin fabrication of test article. Continue design of thrust chamber assembly postponed in FY13.			
Title: On-Orbit Propulsion Technologies ***Description:*** Developed solar electric, electric, and monopropellant propulsion technologies for existing and future satellites, upper stages, orbit transfer vehicles, and satellite maneuvering. ***FY 2013 Accomplishments:*** Efforts terminated in FY2013 due to higher DoD priorities. Propulsion unit for cubesats transitioned to customer for flight demonstration. High performance AF-M315E mono-propellant (non-toxic replacement for highly toxic Hydrazine) thruster technology transitioned to NASA for flight demo in FY15. ***FY 2014 Plans:*** N/A ***FY 2015 Plans:*** N/A	-	-	-
Title: Ballistic Missile Technologies ***Description:*** Develop and demonstrate missile propulsion and post-boost control systems technologies for ballistic missiles. ***FY 2013 Accomplishments:*** Developed advanced missile case, insulation, and nozzle technologies. Developed and ground tested subscale components providing validation of modeling and simulation tools. ***FY 2014 Plans:*** Continue to develop advanced missile case, insulation, and nozzle technologies. Continue validation of modeling and simulation tools. Demonstrate prototype. ***FY 2015 Plans:***	1.587	3.419	4.468

Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014
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 2013	FY 2014	FY 2015
Continue to develop advanced missile case, insulation, and nozzle technologies. Continue validation of modeling and simulation tools.			
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 2013 Accomplishments:*** Continued integration and full-scale demonstration of advanced aging and surveillance tools into solid rocket motors to validate and verify modeling and simulation tools and component technologies. Technologies will be integrated and tested in full-scale demonstration in 2014. ***FY 2014 Plans:*** Complete integration and full-scale demonstration of advanced aging and surveillance tools into solid rocket motors to validate and verify modeling and simulation tools and component technologies. Begin development of next generation of sensors used for aging and surveillance. ***FY 2015 Plans:*** Continue development of next generation of sensors used for aging and surveillance. Support transition of previous tools, models, and data management system to user.	1.179	2.365	2.050
Accomplishments/Planned Programs Subtotals	20.028	24.061	26.552

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 2015 Air Force			Date: March 2014
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 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
635098: *Advanced Aerospace Propulsion*	-	8.523	18.811	27.252	-	27.252	23.877	25.212	22.986	20.519	Continuing	Continuing

The FY 2015 OCO Request will be submitted at a later date.

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 7.0. 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 2013	FY 2014	FY 2015
Title: Scramjet Technologies	8.523	18.811	27.252
Description: Develop and demonstrate technologies for a hydrocarbon-fueled scramjet with robust operation up to Mach 7.0.			
FY 2013 Accomplishments: Completed fourth flight test of a scramjet engine demonstrator. Analyzed flight test data and completed final report. Continued development and demonstration of tactically compliant subsystems, including scramjet engine start system, fuel system, and engine controls. Completed component demonstration of tactically compliant cold start system. Initiated design of flight weight scramjet engine cold start system, fuel system components, and advanced engine control system technologies.			
FY 2014 Plans: Continue development and demonstration of tactically compliant subsystems, including scramjet engine start system, fuel system, and engine controls. Initiate fabrication of flight weight ground test engine to demonstrate tactially compliant cold start system. Design and initiate fabrication of ground test flight weight engine components for High Speed Strike Weapon demonstration.			
FY 2015 Plans: Continue development and demonstration of tactically compliant subsystems, including scramjet engine start system, fuel system, and engine controls. Initiate testing of flight weight ground test engine to demonstrate tactically compliant cold start system.			

Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014
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 2013	FY 2014	FY 2015
Complete fabrication of ground test flight weight engine components for High Speed Strike Weapon demonstration and initiate testing.			
Accomplishments/Planned Programs Subtotals	8.523	18.811	27.252

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 2015 Air Force			Date: March 2014
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 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
63681B: *Advanced Turbine Engine Gas Generator*	-	31.039	32.287	9.065	-	9.065	18.239	19.692	18.555	25.875	Continuing	Continuing

The FY 2015 OCO Request will be submitted at a later date.

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 the continued 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, and exhaust systems) and system level technologies (such as integrated power generators and thermal management systems) on core engine performance and durability in "core-centric engine" demonstration. The core performances of this project are validated on demonstrator engines in the Aerospace Propulsion Subsystems Integration Project of this Program Element. 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 2013	FY 2014	FY 2015
Title: Core Engine Technologies	12.322	11.030	3.095
Description: Design, fabricate, and demonstrate performance predictions in core engines, using innovative engine cycles and advanced materials for turbofan and for turbojet engines.			
FY 2013 Accomplishments: Evaluated and conducted post demonstration assessment of high temperature capable, durable compressor, combustor, and turbine technologies for adaptive core engines. Completed fabrication of component technologies and assembly for a core-centric durability engine demonstration. Continued fabrication of component technologies for increased reliability, maintainability, and affordability for potential transition to fielded systems.			
FY 2014 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014
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 2013	FY 2014	FY 2015
Continue testing of a core-centric durability engine technology for demonstration. Based on test data, refine development and fabrication of component technologies for increased reliability, maintainability, and affordability for potential transition to fielded systems. Initiate durability testing of component technologies. ***FY 2015 Plans:*** Complete fabrication of hardware components enabling increased reliability, maintainability, and affordability for potential follow-on ground engine demonstration or potential acquisition program for transition to fielded systems.			
Title: High Pressure Ratio Core Engine Technologies ***Description:*** Design, fabricate, and demonstrate high overall pressure ratio cores to provide increased durability and affordability with lower fuel consumption for turbofan and for turboshaft engines. ***FY 2013 Accomplishments:*** Initiated preliminary design of small efficient core engine concept with advanced technologies including high efficiency, high pressure ratio, high temperature capability compressor, high efficiency, high heat release combustor, and high work, high cooling effectiveness turbine with an integrated thermal management system and advanced mechanical systems. ***FY 2014 Plans:*** Continue detailed design of small efficient core engine concepts with advanced technologies such as high pressure ratios, high temperature capability compressors, high heat release combustors, and high cooling effectiveness turbine with an integrated thermal management system and advanced mechanical systems. ***FY 2015 Plans:*** Initiate risk reduction rig tests of components of small efficient core engine concepts with advanced technologies such as high pressure ratios, high temperature capability compressors, high heat release combustors, and high cooling effectiveness turbine with an integrated thermal management system and advanced mechanical systems.	3.500	1.200	0.337
Title: Adaptive Turbine Engine Core Technologies ***Description:*** Design, fabricate, and demonstrate performance, durability, and operability technologies to mature adaptive turbine engine core technologies. ***FY 2013 Accomplishments:*** Conducted design of core technologies for application to adaptive turbine engine with reduced specific fuel consumption, improved thrust-to-weight, and reduced cost. Performed power and thermal management system analysis and assessment. ***FY 2014 Plans:***	15.217	20.057	5.633

Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014
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 2013	FY 2014	FY 2015
Complete preliminary design of core technologies for application to adaptive turbine engine with reduced specific fuel consumption, improved thrust-to-weight, and reduced cost. Initiate long lead hardware procurement and manufacturing of components for experimental core demonstration. Increase in FY 2014 supports execution and completion of preliminary design, purchases of raw materials for components, and contracts second and third tier turbine engine suppliers of components. ***FY 2015 Plans:*** Complete detailed design of core technologies for application to adaptive turbine engine with reduced specific fuel consumption, improved thrust-to-weight, and reduced cost. Initiate hardware procurement and manufacturing of components for transition to experimental core demonstration. Initiate instrumentation and assembly of hardware for transition to experimental core demonstration.			
Accomplishments/Planned Programs Subtotals	31.039	32.287	9.065

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

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