Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Air Force										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*				R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	129.925	120.924	151.152	-	151.152	153.221	151.998	167.798	157.799	Continuing	Continuing
632480: *Aerospace Fuels*	9.091	6.768	3.581	-	3.581	2.452	4.550	4.573	4.560	Continuing	Continuing
633035: *Aerospace Power Technology*	5.021	5.746	3.067	-	3.067	7.520	9.892	8.944	9.601	Continuing	Continuing
634921: *Aircraft Propulsion Subsystems Int*	40.066	17.709	77.716	-	77.716	68.076	52.129	68.848	68.821	Continuing	Continuing
634922: *Space & Missile Rocket Propulsion*	29.357	27.596	22.446	-	22.446	24.061	24.388	27.598	26.631	Continuing	Continuing
635098: *Advanced Aerospace Propulsion*	12.744	30.117	9.553	-	9.553	18.811	42.427	39.140	29.523	Continuing	Continuing
63681B: *Advanced Turbine Engine Gas Generator*	33.646	32.988	34.789	-	34.789	32.301	18.612	18.695	18.663	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, and rocket 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 for 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 Aerospace 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, 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 Reliance 21 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 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	

B. Program Change Summary ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Previous President's Budget	136.135	120.953	113.398	-	113.398
Current President's Budget	129.925	120.924	151.152	-	151.152
Total Adjustments	-6.210	-0.029	37.754	-	37.754
• Congressional General Reductions	-	-0.029			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.494	-			
• Other Adjustments	-2.716	-	37.754	-	37.754

Change Summary Explanation

FY11: Other Adjustments include -0.716 Congressional General Reductions and -2.000 Congressional Directed Transfers

FY13: Increase due to higher Air Force priorities for adaptive turbine engine technologies

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 632480: *Aerospace Fuels*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
632480: *Aerospace Fuels*	9.091	6.768	3.581	-	3.581	2.452	4.550	4.573	4.560	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates and demonstrates improved hydrocarbon fuels, unique/alternate fuels and advanced, novel aerospace propulsion technologies for Air Force applications; including high-speed/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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Title: Major Thrust 1. ***Description:*** Demonstrate thermally stable fuels and fuel system hardware concepts to enhance cooling capacity (performance), minimize fuel coking, and reduce fuel system maintenance. ***FY 2011 Accomplishments:*** Demonstrated adaptive engine cycles for high efficiency and ultra efficient turbine engine technologies integrated power/thermal management systems that included cooled cooling air systems, as well as approaches to deoxygenate fuel to improve thermal stability. ***FY 2012 Plans:*** Demonstrate advanced fuel-based turbine engine cooling approaches. Note: In FY 2012, efforts in this thrust are decreased due to higher Air Force (AF) priorities. ***FY 2013 Base Plans:*** Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:*** N/A	2.866	1.000	-	-	-
Title: Major Thrust 2.	1.196	1.000	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 632480: *Aerospace Fuels*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Description: Develop and demonstrate efficacy of low-cost, environmentally friendly fuel approaches to assess and reduce soot/particulate emissions from gas turbine engines. ***FY 2011 Accomplishments:*** Assessed fuel structure/combustion performance relationship in high pressure combustor. Assessed effectiveness of chemical kinetic models for jet fuels to match high pressure combustor flame data. ***FY 2012 Plans:*** Demonstrate state-of-the-art soot/particulate diagnostics in full scale engine testing. ***FY 2013 Base Plans:*** Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:*** N/A					
Title: Major Thrust 3. ***Description:*** Develop and demonstrate enhancements to fuel system technology. ***FY 2011 Accomplishments:*** Developed advanced fuel catalyst and composition approaches to achieve 2nd generation endothermic fuel heat sink goals. ***FY 2012 Plans:*** Demonstrate effective structural cooling of 2nd generation endothermic fuels for hypersonic vehicles. ***FY 2013 Base Plans:*** Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:*** N/A	1.043	1.000	-	-	-
Title: Major Thrust 4. ***Description:*** Identify, develop, and demonstrate low-cost approaches to reducing the fuel logistics footprint for the Expeditionary Air Force. ***FY 2011 Accomplishments:***	1.097	0.770	3.581	-	3.581

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 632480: *Aerospace Fuels*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Modeled spread of biological materials (fungus, bacteria, etc.) through fuel handling systems. Demonstrated advanced additives for mitigation of biological growth. ***FY 2012 Plans:*** Evaluate fuel compositional relationship to biological growth. ***FY 2013 Base Plans:*** Demonstrate mitigation of biological growth in alternative fuels and commercial jet fuels in base-level fuel distribution systems. ***FY 2013 OCO Plans:*** N/A					
Title: Major Thrust 5. ***Description:*** Characterize and demonstrate the use of alternative hydrocarbon jet fuel to comply with Air Force certifications and standards for jet fuels. ***FY 2011 Accomplishments:*** Demonstrated biomass-derived fuel and specification requirements, focusing on yield potential from varying feedstocks. Studied greenhouse gas footprint assessment for alternative aviation fuels. ***FY 2012 Plans:*** Demonstrate improved alternative fuel combustion evaluation process to enable more rapid certification. Evaluate fully-synthetic biofuels in "fit-for-purpose" and rig testing to demonstrate durability. ***FY 2013 Base Plans:*** Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:*** N/A	2.889	2.998	-	-	-
Accomplishments/Planned Programs Subtotals	9.091	6.768	3.581	-	3.581

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
• N/A: *N/A*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 632480: *Aerospace Fuels*

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 2013 Air Force			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 633035: *Aerospace Power Technology*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
633035: *Aerospace Power Technology*	5.021	5.746	3.067	-	3.067	7.520	9.892	8.944	9.601	Continuing	Continuing

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 for manned and remotely piloted aircraft. The electrical power system components developed are projected to provide a two- 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 for directed energy weapons.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Title: Major Thrust 1. ***Description:*** Develop electrical power and thermal management component subsystem technologies for integration with directed energy weapons (DEW) to deliver high power for DEW operation. ***FY 2011 Accomplishments:*** Supported development of energy storage, power conditioning, and thermal management subsystems to support flight demonstration of a high energy laser. ***FY 2012 Plans:*** Support integration of power and thermal management subsystems for flight demonstration of a high energy laser. ***FY 2013 Base Plans:*** Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:*** N/A	0.250	0.200	-	-	-
Title: Major Thrust 2. ***Description:*** Develop power generation/conditioning/distribution component, energy storage, and thermal management components and subsystem technologies for integration into high power aircraft. ***FY 2011 Accomplishments:***	4.287	5.055	3.067	-	3.067

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 633035: *Aerospace Power Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Integrated, fabricated, and modified high temperature, energy optimized power and thermal management components. Integrated subsystems (including rugged/robust power electronics, motor controls, high performance electric actuators, and adaptive power and thermal management technologies) and performed integrated system level evaluation testing. Performed system modifications as necessary to demonstrate that integrated subsystems meet design criteria and performance objectives. ***FY 2012 Plans:*** Demonstrate robust, high power, high temperature power and thermal management subsystems as part of hardware in the loop validation and verification of system level energy optimized air platform models. ***FY 2013 Base Plans:*** Demonstrate adaptive power and thermal management subsystems for next generation air platforms based on system level energy optimized air platform models. ***FY 2013 OCO Plans:*** N/A					
Title: Major Thrust 3. ***Description:*** Develop hybrid electrical power and thermal management components and subsystem technologies for special purpose applications, enabling long endurance small remotely piloted aircraft (RPA). ***FY 2011 Accomplishments:*** Developed and fabricated energy optimized, lightweight, hybrid electrical power and thermal management subsystems for increased endurance RPA and ground based special purpose applications. ***FY 2012 Plans:*** Demonstrate ruggedized high endurance small RPA hybrid power and thermal management subsystems. ***FY 2013 Base Plans:*** Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:*** N/A	0.484	0.491	-	-	-
Accomplishments/Planned Programs Subtotals	5.021	5.746	3.067	-	3.067

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 633035: *Aerospace Power Technology*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
• N/A: *N/A*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

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 2013 Air Force			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 634921: *Aircraft Propulsion Subsystems Int*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
634921: *Aircraft Propulsion Subsystems Int*	40.066	17.709	77.716	-	77.716	68.076	52.129	68.848	68.821	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 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 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/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 10 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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Title: Major Thrust 1.	7.267	1.800	0.500	-	0.500
Description: Design, fabricate, and demonstrate durability and integration technologies for turbofan/turbojet engines to improve durability, supportability, and affordability of AF aircraft.					
FY 2011 Accomplishments: Completed detailed design and began fabricate hardware for advanced features for durable fans, turbines, mechanical systems, interactions between the inlet and fan, and controls/accessories, to include advanced cooling design for low pressure turbine blades, health monitoring, light weight externals, and repair validation.					
FY 2012 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 634921: *Aircraft Propulsion Subsystems Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Continue fabrication of low spool engine components. Investigate inlet and exhaust interactions. Continue to develop controls and accessories, health monitoring technologies, and light weight external components. Continue to assess and validate repair techniques. ***FY 2013 Base Plans:*** Investigate inlet and exhaust interactions. Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:*** N/A					
Title: Major Thrust 2. ***Description:*** Design, fabricate, and test advanced component technologies for improved performance and fuel consumption of turbofan/turbojet engines. ***FY 2011 Accomplishments:*** Continued fabrication and began assembly 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. Continued preliminary design for a high bypass/high overall pressure ratio engine technologies for improved fuel consumption. ***FY 2012 Plans:*** Complete 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. Conduct experimental testing of engine technologies. Continue preliminary design of high bypass/high overall pressure ratio engine technologies for improved fuel consumption. Note: In FY 2012, efforts in this thrust are decreased due to higher AF priorities. ***FY 2013 Base Plans:*** Finish 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. Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:*** N/A	24.805	14.709	9.167	-	9.167
Title: Major Thrust 3.	7.994	1.200	15.916	-	15.916

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 634921: *Aircraft Propulsion Subsystems Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
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 2011 Accomplishments:*** Conducted detailed design of a higher specific thrust, low-cost expendable turbine engine for improved fuel efficiency to significantly improve range. Conducted detailed design of advanced fan, advanced low spool turbine spool, and advanced engine components for fuel efficient subsonic unmanned turbofan engines. ***FY 2012 Plans:*** Complete detailed design and initiate fabrication of components of a higher specific thrust, low-cost expendable turbine engine for improved fuel efficiency to significantly improve range. Continue detailed design of advanced fan, advanced low spool turbine spool, and advanced engine components for fuel efficient subsonic unmanned turbofan engines. Note: In FY 2012, efforts in this thrust are decreased due to higher AF priorities. ***FY 2013 Base Plans:*** Complete assembly and instrumentation of supersonic, long endurance turbine engines. Complete critical technology rig testing and begin sea level testing of supersonic, long endurance turbine engines accelerate engine activity to meet follow on activity need date).					
Title: Major Thrust 4. ***Description:*** Design, fabricate, and demonstrate performance, durability, and operability technologies to mature adaptive turbine engine technologies. ***FY 2011 Accomplishments:*** N/A ***FY 2012 Plans:*** N/A ***FY 2013 Base Plans:*** Complete preliminary designs for an adaptive turbine engine with reduced specific fuel consumption, improved thrust-to-weight, and reduced cost. Perform augmentor/exhaust nozzle cold flow testing. Perform preliminary design of an advanced adaptive fan.	-	-	52.133	-	52.133
Accomplishments/Planned Programs Subtotals	40.066	17.709	77.716	-	77.716

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 634921: *Aircraft Propulsion Subsystems Int*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
• N/A: *N/A*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

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 2013 Air Force			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 634922: *Space & Missile Rocket Propulsion*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
634922: *Space & Missile Rocket Propulsion*	29.357	27.596	22.446	-	22.446	24.061	24.388	27.598	26.631	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced and innovative low-cost rocket turbo-machinery and components, low-cost space launch propulsion technologies, and advanced propellants for launch and orbit transfer propulsion. Additionally, this project develops technologies for the sustainment of strategic systems (including solid boost/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. This project also develops chemical, electrical, and solar rocket propulsion technologies for station-keeping and on-orbit maneuvering applications. 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 20-50 percent and reduce launch, operations, and support costs by approximately 30 percent. Responsiveness and operability of propulsion systems will be enhanced for reusable launch systems. Technology advances could also lead to seven-year increase in satellite on-orbit time, a 50 percent increase in satellite maneuvering capability, a 25 percent reduction in orbit transfer operational costs, and a 15 percent increase in satellite payload. Aging and surveillance efforts for solid rocket motors could reduce lifetime prediction uncertainties for individual motors by 50 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 often NASA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Title: Major Thrust 1.	22.210	20.860	19.680	-	19.680
Description: Develop liquid rocket propulsion technology for current and future space launch vehicles. ***FY 2011 Accomplishments:*** Continued, through hot fire testing, the validation and verification of modeling and simulation tools developed for advanced cryogenic upper stage technologies. Continued development of hydrocarbon engine components for integration and demonstration in an advanced hydrocarbon engine concept for future reusable launch vehicles. Continued sub-scale component testing to demonstrate hydrocarbon boost technologies. Continued material manufacturing scale-up effort to support hydrocarbon boost demonstration program. ***FY 2012 Plans:*** Complete the validation and verification of modeling and simulation tools developed for advanced cryogenic upper stage technologies. Continue development of hydrocarbon engine components for integration and					

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 634922: *Space & Missile Rocket Propulsion*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
demonstration in an advanced hydrocarbon engine concept for future reusable launch vehicles. Continue sub-scale preburner and turbine component testing to demonstrate hydrocarbon boost technologies. Continue ox-rich material manufacturing scale-up effort to support hydrocarbon boost demonstration program. Conduct component scale-up and characterization for advanced hydrocarbon engine technologies using fuels other than kerosene. Note: In FY 2012, funding is decreased due to higher Air Force priorities. ***FY 2013 Base Plans:*** Continue development of hydrocarbon engine components for integration and demonstration in an advanced hydrocarbon engine concept for future reusable launch vehicles. Continue sub-scale preburner and turbine component testing to demonstrate hydrocarbon boost technologies. Complete ox-rich material manufacturing scale-up effort to support hydrocarbon boost demonstration program. ***FY 2013 OCO Plans:*** N/A					
Title: Major Thrust 2. ***Description:*** Develop solar electric, electric, and monopropellant propulsion technologies for existing and future satellites, upper stages, orbit transfer vehicles, and satellite maneuvering. ***FY 2011 Accomplishments:*** Initiated scale-up of micro propulsion technologies for spacecraft with the need for high mobility on orbit. Continued hardware scale-up and prepared to conduct testing of hardware for an advanced multi-mode (high thrust or high efficiency) propulsion system for satellites. Scaled-up next generation of chemical thrusters for spacecraft propulsion systems. ***FY 2012 Plans:*** Conduct scale-up of propulsion technologies for spacecraft with the need for high mobility on orbit. Complete hardware scale-up and conduct testing of hardware for an advanced multi-mode (high thrust or high efficiency) propulsion system for satellites. Build components for integration and demonstration of next generation of chemical thrusters for spacecraft propulsion systems. ***FY 2013 Base Plans:*** Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:***	3.696	3.748	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 634922: *Space & Missile Rocket Propulsion*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
N/A					
Title: Major Thrust 3. ***Description:*** Develop and demonstrate missile propulsion and Post Boost Control Systems technologies for ballistic missiles. ***FY 2011 Accomplishments:*** Continued development of advanced missile propulsion technologies. Continued sub-scale component developments providing sub-scale validation of modeling and simulation tools. ***FY 2012 Plans:*** Continue development of advanced missile case, insulation, and nozzle technologies. Continue sub-scale component developments providing sub-scale validation of modeling and simulation tools. Complete propellant component development and transition into next generation integrated motor demonstration. ***FY 2013 Base Plans:*** Continue development of advanced missile case, insulation, and nozzle technologies. continue subscale component developments providing sub-scale validation of modeling and simulation tools. Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:*** N/A	2.409	2.017	1.587	-	1.587
Title: Major Thrust 4. ***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 2011 Accomplishments:*** Continued integration and full-scale demonstration of advanced aging and surveillance tools for solid rocket motors to validate and verify modeling and simulation tools and component technologies. Completed assessment of effort modeling critical defects in solid rocket motors. ***FY 2012 Plans:***	1.042	0.971	1.179	-	1.179

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 634922: *Space & Missile Rocket Propulsion*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Continue integration and full-scale demonstration of advanced aging and surveillance tools for solid rocket motors to validate and verify modeling and simulation tools and component technologies. ***FY 2013 Base Plans:*** Continue integration and full-scale demonstration of advanced aging and surveillance tools for solid rocket motors to validate and verify modeling and simulation tools and component technologies. ***FY 2013 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	29.357	27.596	22.446	-	22.446

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
• N/A: *N/A*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

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 2013 Air Force			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 635098: *Advanced Aerospace Propulsion*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
635098: *Advanced Aerospace Propulsion*	12.744	30.117	9.553	-	9.553	18.811	42.427	39.140	29.523	Continuing	Continuing

Note

Note: In FY 2012, funding in this project is increased to complete scramjet engine flight demonstrations.

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 over the range of Mach 0 to 8+. 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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Title: Major Thrust 1.	12.744	30.117	9.553	-	9.553
Description: Develop and demonstrate technologies for a hydrocarbon-fueled scramjet with robust operation over a range of Mach 4 to 8. ***FY 2011 Accomplishments:*** Continued flight testing of a scramjet engine demonstrator. Analyzed flight test data and began preparing a final report. Demonstrated small- scale scramjet engine to Technology Readiness Level 6. ***FY 2012 Plans:*** Complete flight testing of a scramjet engine demonstrator. Analyze flight test data and complete a final report. Develop and demonstrate tactically compliant subsystems, including scramjet engine start system, fuel system, and engine controls. Note: In FY 2012, efforts in this thrust are increased to complete scramjet engine flight demonstrations. ***FY 2013 Base Plans:*** Continue development and demonstration of tactically compliant subsystems, including scramjet engine start system, fuel system, and engine controls. Complete component demonstration of tactically compliant cold start					

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 635098: *Advanced Aerospace Propulsion*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
system. Initiate design of flight weight scramjet engine cold start system, fuel system components, and advanced engine control system. Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	12.744	30.117	9.553	-	9.553

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
• N/A: *N/A*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

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 2013 Air Force			DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 63681B: *Advanced Turbine Engine Gas Generator*	

COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
63681B: *Advanced Turbine Engine Gas Generator*	33.646	32.988	34.789	-	34.789	32.301	18.612	18.695	18.663	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 the continued evolution of technologies into an advanced gas generator in which the performance, cost, durability, reparability, 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 Project 4921 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 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Title: Major Thrust 1.	20.290	19.790	15.322	-	15.322
Description: Design, fabricate, and demonstrate performance predictions in core engines, using innovative engine cycles and advanced materials for turbofan/turbojet engines. ***FY 2011 Accomplishments:*** Continued hardware fabrication and initiate assembly of high temperature capable, durable compressor, combustor, and turbine for adaptive core engine. Completed detailed design and initiate fabrication of component technologies for a core-centric durability engine demonstration. Conducted fabrication of component technologies for increased reliability, maintainability, and affordability for potential transition to fielded systems. Conducted preliminary design and initiate detailed design of system-level technologies and weapon systems integration on core engine performance. ***FY 2012 Plans:*** Complete hardware fabrication, assembly and experimental demonstration of high temperature capable, durable compressor, combustor, and turbine for adaptive core engine. Continue fabrication of component					

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 63681B: *Advanced Turbine Engine Gas Generator*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
technologies and initiate assembly for a core-centric durability engine demonstration. Continue fabrication of component technologies for increased reliability, maintainability, and affordability for potential transition to fielded systems. Conduct detailed design of system-level technologies and weapon systems integration on core engine performance. ***FY 2013 Base Plans:*** Evaluate and conduct post demonstration assessment of high temperature capable, durable compressor, combustor, and turbine for adaptive core engine. ***FY 2013 OCO Plans:*** N/A					
Title: Major Thrust 2. ***Description:*** Design, fabricate, and demonstrate high overall pressure ratio cores to provide increased durability and affordability with lower fuel consumption for turbofan/turboshaft engines. ***FY 2011 Accomplishments:*** Completed preliminary design of core for efficient core engine concept with advanced core 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. Continued selective risk reduction experimental demonstrations of RPA small versatile affordable advanced core engine. Continued detailed design and initiate fabrication of efficient small engine component technologies including high efficiency, high pressure ratio, high temperature capability compressor, high efficiency, high heat release combustor, and high work, high cooling effectiveness or uncooled turbine for use in RPA applications. ***FY 2012 Plans:*** Initiate detailed design, fabrication and begin assembly and instrumentation of core for efficient core engine concept with advanced core 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. Continue selective risk reduction experimental demonstrations of RPA small versatile affordable advanced core engine. Continue fabrication of efficient small engine component technologies including high efficiency, high pressure ratio, high temperature capability compressor, high efficiency, high heat release combustor, and high work, high cooling	13.356	13.198	3.500	-	3.500

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 63681B: *Advanced Turbine Engine Gas Generator*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
effectiveness or uncooled turbine for use in RPA applications. Initiate conceptual design for advanced very efficient and very high pressure ratio core engine. ***FY 2013 Base Plans:*** Continue detailed design, fabrication and begin assembly and instrumentation of core for efficient core engine concept with advanced core 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. Decrease in FY 2013 due to higher Department of Defense priorities. ***FY 2013 OCO Plans:*** N/A					
Title: Major Thrust 3. ***Description:*** Design, fabricate, and demonstrate performance, durability, and operability technologies to mature adaptive turbine engine core technologies. ***FY 2011 Accomplishments:*** N/A ***FY 2012 Plans:*** N/A ***FY 2013 Base Plans:*** Conduct design of core technologies for application to adaptive turbine engine with reduced specific fuel consumption, improved thrust-to-weight, and reduced cost. Perform power and thermal management system analysis and assessment. ***FY 2013 OCO Plans:*** N/A	-	-	15.967	-	15.967
Accomplishments/Planned Programs Subtotals	33.646	32.988	34.789	-	34.789

Exhibit R-2A, RDT&E Project Justification: PB 2013 Air Force		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603216F: *Aerospace Propulsion and Power Technology*	PROJECT 63681B: *Advanced Turbine Engine Gas Generator*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
• N/A: *N/A*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

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.