Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force										DATE: February 2010	
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 2009 Actual**	**FY 2010 Estimate**	**FY 2011 Base Estimate**	**FY 2011 OCO Estimate**	**FY 2011 Total Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	175.292	192.241	136.135	0.000	136.135	112.786	115.313	120.264	129.044	Continuing	Continuing
6310SP: *Space Rocket Prop Demo*	22.724	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
632480: *Aerospace Fuels*	14.998	26.524	9.393	0.000	9.393	6.882	6.731	7.668	7.965	Continuing	Continuing
633035: *Aerospace Power Technology*	11.450	14.936	5.556	0.000	5.556	5.842	5.766	8.522	10.224	Continuing	Continuing
634921: *Aircraft Propulsion Subsystems Int*	44.678	39.592	41.403	0.000	41.403	18.006	18.176	17.867	19.479	Continuing	Continuing
634922: *Space & Missile Rocket Propulsion*	4.736	29.515	31.840	0.000	31.840	28.059	31.925	39.865	41.610	Continuing	Continuing
635098: *Advanced Aerospace Propulsion*	28.301	23.832	13.177	0.000	13.177	20.457	17.959	18.617	20.357	Continuing	Continuing
63681B: *Advanced Turbine Engine Gas Generator*	48.405	57.842	34.766	0.000	34.766	33.540	34.756	27.725	29.409	Continuing	Continuing

Note

Note: In FY 2010, work in PE 0603216F Project 10SP was consolidated into PE 0603216F Project 4922 within this program element to better align work.

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 seven 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 Technologies project develops and demonstrates power and thermal management systems for weapons and aircraft as part of the Integrated Vehicle Energy Technology (INVENT) program. The Advanced Turbine Engine Gas Generator (ATEGG) project develops and demonstrates core turbine engine technologies for current and future aircraft propulsion systems. The Aerospace Propulsion Subsystem Integration (APSI) project integrates the engine cores demonstrated in the ATEGG project with low-pressure components into demonstrator engines. Turbine engine

Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force	DATE: February 2010
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*

propulsion projects within this program are part of the Versatile Affordable Advanced Turbine Engine (VAATE) program. A portion of the Fuels, ATEGG, and APSI projects supports 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. 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 Space and Missile Rocket Propulsion project develops and demonstrates innovative rocket propulsion technologies, propellants, manufacturing techniques. Rocket propulsion projects within this program are part of the Integrated High Payoff Rocket Propulsion Technology (IHPRPT) program, which includes the area of Technology for the Sustainment of Strategic Systems.

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	180.554	175.676	0.000	0.000	0.000
Current President's Budget	175.292	192.241	136.135	0.000	136.135
Total Adjustments	-5.262	16.565	136.135	0.000	136.135
• Congressional General Reductions		-6.055			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.800			
• Congressional Adds		23.420			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-5.262	0.000	136.135	0.000	136.135

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2009	FY 2010
Project: 6310SP: *Space Rocket Prop Demo*		
Congressional Add: *Hybrid Sounding Rocket Propulsion.*	0.798	0.000
Congressional Add Subtotals for Project: 6310SP	0.798	0.000
Project: 632480: *Aerospace Fuels*		
Congressional Add: *Assured Aerospace Fuels Research.*	1.596	0.000
Congressional Add: *Bio-JP8 Fuel Development.*	0.798	3.983

Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force	DATE: February 2010
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*

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2009**	**FY 2010**
Congressional Add: *Renewable Hydrocarbon Fuels for Military Applications.*	1.995	1.992
Congressional Add: *Algal Biofuels for Aviation.*	0.000	2.390
Congressional Add: *Algal-Derived Jet Fuel for Air Force Applications.*	0.000	2.689
Congressional Add: *Hawaii Microalgae Biofuel Project.*	0.000	3.505
Congressional Add Subtotals for Project: 632480	4.389	14.559
Project: 633035: *Aerospace Power Technology*		
Congressional Add: *Silicon Carbide (SiC) Power Electronics for More Electric Aircraft.*	3.191	0.000
Congressional Add: *Methanol Fuel Cell Development for USAF Battlefield Renewable Integrated Tactical Energy System (BRITES).*	0.000	2.390
Congressional Add: *Silicon Carbide Power Modules for the F-35 Joint Strike Fighter.*	0.000	2.390
Congressional Add: *Texas Research Institute for Environmental Studies.*	0.000	0.797
Congressional Add Subtotals for Project: 633035	3.191	5.577
Project: 634921: *Aircraft Propulsion Subsystems Int*		
Congressional Add: *Small Adaptive Cycle Turbine Engines.*	1.596	0.000
Congressional Add: *Small Turbofan Versatile Affordable Advanced Turbine Engine (VAATE) Program.*	3.590	3.187
Congressional Add Subtotals for Project: 634921	5.186	3.187
Congressional Add Totals for all Projects	13.564	23.323

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force	DATE: February 2010
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*

In FY 2010, Congress added $2.4 million for Algal Biofuels for Aviation, $2.7 million for Algal-Derived Jet Fuel for Air Force Applications, $4.0 million for Bio-JP8 Fuel Development, $3.52 million for Hawaii Microalgae Biofuel Project, $2.4 million for Methanol Fuel Cell Development for USAF Battlefield Renewable Integrated Tactical Energy System (BRITES), $2.0 million for Renewable Hydrocarbon Fuels for Military Applications, $2.4 million for Silicon Carbide Power Modules for the F-35 Joint Strike Fighter, $3.2 million for Small Turbofan Versatile Affordable Advanced Turbine Engine Program, and $0.8 million for Texas Research Institute for Environmental Studies.

C. Performance Metrics
(U) Under Development.

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010
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 6310SP: *Space Rocket Prop Demo*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6310SP: *Space Rocket Prop Demo*	22.724	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note

Note: In FY 2010 and beyond, this work was moved to Project 4922 within this Program Element to better align efforts.

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 Technology for Sustainment of Strategic Systems Phase 1. 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 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 a 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. The efforts in this project contribute to the IHPRPT program, a joint Department of Defense, National Aeronautics and Space Administration, and industry effort to focus rocket propulsion technology on national space launch needs.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop liquid rocket propulsion technology for current and future space launch vehicles.	15.769	0.000	0.000	0.000	0.000
FY 2009 Accomplishments: In FY 2009: Completed advanced cryogenic upper stage hardware fabrication and begin testing components to validate and verify modeling and simulation tools developed. Developed hydrocarbon engine components for integration and demonstration in an advanced hydrocarbon engine concept					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 6310SP: *Space Rocket Prop Demo*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
for future reusable launch vehicles. Continued material manufacturing scale-up effort to support hydrocarbon boost demonstration program. Continued advanced hydrocarbon fuel/additive scale-up and proof efforts. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Develop solar electric propulsion technologies for satellites, upper stages, orbit transfer vehicles, and satellite formation flying, station keeping, and repositioning. *FY 2009 Accomplishments:* In FY 2009: Developed electric propulsion systems for orbit-transfer by developing high-power hall thrusters capable of low earth orbit to geosynchronous orbit transfer. Conducted and completed testing of the high-power hall thruster demonstration. Continued hardware scale-up for an advanced multi-mode (high thrust or high efficiency) propulsion system for satellites. Continued demonstration of advanced chemical propulsion system for satellites. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable.	0.220	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 6310SP: *Space Rocket Prop Demo*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 OCO Plans: In FY 2011 OCO: N/A.					
MAJOR THRUST: Develop electric and advanced chemical based monopropellant propulsion technologies for future satellite propulsion systems. Phases are referring to IHPRPT program phases. *FY 2009 Accomplishments:* In FY 2009: Continued development of advanced IHPRPT Phase III monopropellant thruster technologies. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.	5.937	0.000	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	21.926	0.000	0.000	0.000	0.000

	FY 2009	FY 2010
Congressional Add: Hybrid Sounding Rocket Propulsion. *FY 2009 Accomplishments:* In FY 2009: Matured hybrid rocket propulsion technologies.	0.798	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 6310SP: *Space Rocket Prop Demo*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010
FY 2010 Plans: In FY 2010: Not Applicable.		
Congressional Adds Subtotals	0.798	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (3423): *Activity Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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 2011 Air Force			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
632480: *Aerospace Fuels*	14.998	26.524	9.393	0.000	9.393	6.882	6.731	7.668	7.965	Continuing	Continuing

Note

Note: The funding in this project has decreases in FY 2011 and beyond due to planned taper of turbine engine technologies.

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. This project is integrated into the Versatile Affordable Advanced Turbine Engine (VAATE) program. 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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Demonstrate thermally stable fuels and fuel system hardware concepts to enhance cooling capacity (performance), minimize fuel coking, and reduce fuel system maintenance.	1.869	3.000	2.866	0.000	2.866
FY 2009 Accomplishments: In FY 2009: Demonstrated engine and airframe durability and performance benefits from the use of alternative fuels. Developed knowledge base needed for Air Force-wide certification of alternative fuels, especially biofuels. Demonstrated cooling air systems and other advanced aircraft thermal management systems. Determined fuel structure changes required to increase specific gravity to 0.775. Determined elastomer swell agents capable of increasing swell to typical JP-8 levels. Began determination of new specification requirements for biomass-derived alternative fuels. Developed key					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
thermal management technologies, including high heat sink fuels, cooled cooling air systems, and high temperature/thermally efficient fuel pumps. *FY 2010 Plans:* In FY 2010: Demonstrate adaptive engine cycles for high efficiency and ultra efficient turbine engine technologies integrated power/thermal management systems that include cooled cooling air systems, as well as approaches to deoxygenate fuel to improve thermal stability. *FY 2011 Base Plans:* In FY 2011: Demonstrate adaptive engine cycles for high efficiency and ultra efficient turbine engine technologies integrated power/thermal management systems that include cooled cooling air systems, as well as approaches to deoxygenate fuel to improve thermal stability. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Determine fuel cooling requirements and specifications for advanced aircraft sensors and directed energy weapons that will meet the needs of evolving manned and unmanned systems. *FY 2009 Accomplishments:* In FY 2009: Demonstrated an advanced UAV/ultra efficient turbine engine technologies thermal management system that includes a cooled cooling air system, as well as advanced approaches for ensuring fuel flow in wing tanks under high altitude, long endurance conditions. Note: In FY 2010, efforts in this and the next major thrust were combined to more accurately align efforts with organizational structure. *FY 2010 Plans:* In FY 2010: Not Applicable.	2.200	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 Base Plans: In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Develop and demonstrate efficacy of low-cost, environmentally friendly fuel additives to reduce soot particulate emissions from gas turbine engines. *FY 2009 Accomplishments:* In FY 2009: Continued to demonstrate advanced particulate measurement diagnostics suitable for full-scale engine testing. Continued demonstration of fuel/combustor concepts that reduce both soot and NOx. *FY 2010 Plans:* In FY 2010: Assess fuel structure/combustion performance relationship in high pressure combustor. Demonstrate advanced particulate measurement diagnostics suitable for full-scale engine testing. Assess effectiveness of chemical kinetic models for jet fuels to match high pressure combustor flame data. *FY 2011 Base Plans:* In FY 2011: Assess fuel structure/combustion performance relationship in high pressure combustor. Assess effectiveness of chemical kinetic models for jet fuels to match high pressure combustor flame data. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.	0.934	1.500	1.196	0.000	1.196
MAJOR THRUST: Develop and demonstrate enhancements to fuel system technology.	0.934	1.500	1.043	0.000	1.043

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Developed combined cycle engine cooling systems, utilizing 2nd-generation endothermic fuels and other advanced fuels. *FY 2010 Plans:* In FY 2010: Demonstrate extended duration operation of combined cycle engine regenerative cooling systems with 2nd generation endothermic fuels. Evaluate supersonic combustion of 2nd-generation endothermic fuels. *FY 2011 Base Plans:* In FY 2011: Demonstrate effective supersonic combustion of 2nd-generation endothermic fuels. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Identify, develop, and demonstrate low-cost approaches to reducing the fuel logistics footprint for the Expeditionary Air Force. *FY 2009 Accomplishments:* In FY 2009: Developed ability to model spread of biological materials through fuel handling systems. Initiated demonstration of advanced additives to mitigate biological growth in conventional and alternative aerospace fuels. *FY 2010 Plans:* In FY 2010: Model spread of biological materials (fungus, bacteria, etc.) through fuel handling systems. Demonstrate advanced additives for mitigation of biological growth.	0.934	1.019	1.097	0.000	1.097

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 Base Plans: In FY 2011: Model spread of biological materials (fungus, bacteria, etc.) through fuel handling systems. Demonstrate advanced additives for mitigation of biological growth. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Assured Fuels Initiative: Characterize and demonstrate the use of alternative hydrocarbon jet fuel to comply with Air Force certifications and standards for jet fuels. *FY 2009 Accomplishments:* In FY 2009: Determined fuel structure changes required to increase specific gravity to 0.775. Determined elastomer swell agents capable of increasing swell to typical JP-8 levels. Began determination of new specification requirements for biomass-derived alternative fuels. *FY 2010 Plans:* In FY 2010: Investigate biomass-derived fuel and specification requirements. Study elastomer swell agents for 100 percent synthetic paraffinic kerosene fuels. Initiate study of greenhouse gas footprint assessment for alternative aviation fuels. Note: Funding increase in FY 2010 due to increased emphasis on development of alternative hydrocarbon jet fuel. *FY 2011 Base Plans:* In FY 2011: Evaluate biomass-derived fuel and specification requirements, focusing on yield potential from varying feedstocks. Study greenhouse gas footprint assessment for alternative aviation fuels. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.	3.738	4.946	3.191	0.000	3.191
Accomplishments/Planned Programs Subtotals	10.609	11.965	9.393	0.000	9.393

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010
Congressional Add: Assured Aerospace Fuels Research. *FY 2009 Accomplishments:* In FY 2009: Created sufficient alternative (non-petroleum) jet fuel to enable fuel composition-versus-properties studies. The facility is also used for collaborative studies with fuel manufacturers on technology to produce suitable jet fuels for AF use. *FY 2010 Plans:* In FY 2010: Not Applicable.	1.596	0.000
Congressional Add: Bio-JP8 Fuel Development. *FY 2009 Accomplishments:* In FY 2009: Evaluated an alternative biofuel production pathway with hydrotreated fats and oils as the initial "biokerosene" jet fuels to be evaluated. *FY 2010 Plans:* In FY 2010: Conduct Congressionally directed effort in Bio-JP8 Fuel Development.	0.798	3.983
Congressional Add: Renewable Hydrocarbon Fuels for Military Applications. *FY 2009 Accomplishments:* In FY 2009: Conducted research to identify the most promising types of algae for use in military applications.	1.995	1.992

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010
FY 2010 Plans: In FY 2010: Conduct Congressionally directed effort in Renewable Hydrocarbon Fuels for Military Applications.		
Congressional Add: Algal Biofuels for Aviation. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Conduct Congressionally directed effort in Algal Biofuels for Aviation.	0.000	2.390
Congressional Add: Algal-Derived Jet Fuel for Air Force Applications. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Conduct Congressionally directed effort in Algal-Derived Jet Fuel for Air Force applications.	0.000	2.689
Congressional Add: Hawaii Microalgae Biofuel Project. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Conduct Congressionally directed effort in the Hawaii Microalgae Biofuel Project.	0.000	3.505

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010
Congressional Adds Subtotals	4.389	14.559

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602203F: *Aerospace Propulsion.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602102F: *Materials.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: *Aerospace Sensors.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603112F: *Advanced Materials for Weapons Systems.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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 2011 Air Force			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
633035: *Aerospace Power Technology*	11.450	14.936	5.556	0.000	5.556	5.842	5.766	8.522	10.224	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 unmanned aerospace vehicles. The electrical power system components developed are projected to provide a two- to five-fold improvement in aircraft reliability and maintainability, and a 20 percent reduction in power system weight. This project is integrated into the Integrated Vehicle Energy Technology (INVENT) 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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop electrical power and thermal management component subsystem technologies for integration with directed energy weapons (DEW) to deliver high power for DEW operation.	0.396	0.207	0.250	0.000	0.250
FY 2009 Accomplishments: In FY 2009: Completed analysis of high power megawatt class generator test results.					
FY 2010 Plans: In FY 2010: Initiate development of high energy laser flight demonstration power and thermal management systems.					
FY 2011 Base Plans: In FY 2011: Initiate development of energy storage, power conditioning, and thermal management subsystems to support flight demonstration of a high energy laser.					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 OCO Plans: In FY 2011 OCO: N/A.					
MAJOR THRUST: Develop power generation/conditioning/distribution component, energy storage, and thermal management components and subsystem technologies for integration into high power aircraft. *FY 2009 Accomplishments:* In FY 2009: Designed high temperature demonstrator and fabricated key components. *FY 2010 Plans:* In FY 2010: Complete detailed design of high temperature, energy optimized demonstrator and initiate fabrication of power and thermal management components. *FY 2011 Base Plans:* In FY 2011: Integrate, fabricate, and modify high temperature, energy optimized power and thermal management components. Note: In FY 2011, decrease in funding in is due to the movement of technologies to PE 0602203F, Aerospace Propulsion, to better reflect the actual technology readiness level of this effort. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.	3.191	3.992	1.939	0.000	1.939
MAJOR THRUST: Develop power and thermal management components and subsystems technologies for fielded and future high power aircraft to enable efficient power acquisition, storage, and transport. *FY 2009 Accomplishments:* In FY 2009: Investigated, designed, and developed efficient, lightweight, wide temperature range, rugged/robust power electronics, motor controls, actuators, heat exchangers, and thermal management components and subsystems.	4.672	4.814	2.883	0.000	2.883

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2010 Plans: In FY 2010: Fabricate rugged/robust power electronics, motor controls, high performance electric actuators, and adaptive power and thermal management subsystems. Develop subsystems modifications to support integrated subsystems testing. *FY 2011 Base Plans:* In FY 2011: Integrate subsystems (including rugged/robust power electronics, motor controls, high performance electric actuators, and adaptive power and thermal management technologies) and perform integrated system level evaluation testing. Perform system modifications as necessary to demonstrate that integrated subsystems meet design criteria and performance objectives. Note: In FY 2011, the efforts in this thrust are reduced due to higher AF priorities. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Develop hybrid electrical power and thermal management components and subsystem technologies for special purpose applications, enabling long endurance small unmanned aerial systems. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Investigate optimization of advanced hybrid fuel cell/battery subsystem designs to achieve minimum volume/weight, maximum power/energy density, and increased battery/fuel cell ruggedness, efficiency, and reliability. Assess hybrid energy management systems for expanded special purpose applications to address needed strike, intelligence, surveillance, and reconnaissance capabilities. Integrate hybridized energy electrical power, and thermal management components with end-user operational subsystems such as sensors and communication devices. Note: This is a continuation of the fuel cell and battery work previously applied to battlefield air operations kit in	0.000	0.346	0.484	0.000	0.484

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009. In FY 2010, efforts were broken out the clearly show application of these technologies to unmanned aerial systems (UAS). *FY 2011 Base Plans:* In FY 2011: Develop and fabricate energy optimized, lightweight, hybrid electrical power and thermal management subsystems for increased endurance UAS and ground based special purpose applications. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
Accomplishments/Planned Programs Subtotals	8.259	9.359	5.556	0.000	5.556

	FY 2009	FY 2010
Congressional Add: Silicon Carbide (SiC) Power Electronics for More Electric Aircraft. *FY 2009 Accomplishments:* In FY 2009: Developed reliable, high voltage (600-1200V), high current (50-100A/die) enhancement mode vertical junction field effect transistors and Schottky diodes, manufacturing yield limiter evaluation and enhancement, applications engineering, and reliability testing. *FY 2010 Plans:* In FY 2010: Not Applicable.	3.191	0.000
Congressional Add: Methanol Fuel Cell Development for USAF Battlefield Renewable Integrated Tactical Energy System (BRITES).	0.000	2.390

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010
FY 2009 Accomplishments: In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Conduct Congressionally directed effort in Methanol Fuel Cell Development for USAF Battlefield Integrated Tactical Energy System (BRITES).		
Congressional Add: Silicon Carbide Power Modules for the F-35 Joint Strike Fighter. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Conduct Congressionally directed effort in Silicon Carbide Power Modules for the F-35 Joint Strike Fighter.	0.000	2.390
Congressional Add: Texas Research Institute for Environmental Studies. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Conduct Congressionally directed effort at the Texas Research Institute for Environmental Studies.	0.000	0.797
Congressional Adds Subtotals	3.191	5.577

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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 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602201F: *Aerospace Flight Dynamics.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: *Aerospace Propulsion.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602605F: *Directed Energy Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: *Advanced Weapons Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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 2011 Air Force			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634921: *Aircraft Propulsion Subsystems Int*	44.678	39.592	41.403	0.000	41.403	18.006	18.176	17.867	19.479	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. This project includes the Aerospace Propulsion Subsystems Integration (APSI) program, which includes demonstrator engines such as the Joint Technology Demonstrator Engine for manned systems and the Joint Expendable Turbine Engine Concept for unmanned air vehicle 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, these efforts include activities under the national Propulsion Safety and Readiness program. This project also focuses on integration of inlets, nozzles, engine/airframe compatibility, and power and thermal management subsystems technologies. APSI 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. APSI supports the goals of the national Versatile Affordable Advanced Turbine Engine (VAATE) program, which 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. The VAATE program provides continuous technology transition for military turbine engine upgrades and derivatives and has the added dual-use benefit of enhancing the United States turbine engine industry's international competitiveness. 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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Design, fabricate, and demonstrate durability and integration technologies for turbofan/ turbojet engines to improve durability, supportability, and affordability of AF aircraft.	1.621	2.625	7.267	0.000	7.267

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Completed testing and started validation of engine life models for engine components for agile combat support technologies. Initiated design of advanced features for durable fans, turbines, mechanical systems, interactions between the inlet and fan, and controls/accessories. *FY 2010 Plans:* In FY 2010: Complete preliminary design and begin detailed design of 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 2011 Base Plans:* In FY 2011: Complete detailed design and begin 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. Note: In FY 2011, funding is increased due to shift in emphasis from preliminary design to detailed design of durable turbine engines. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Design, fabricate, and test advanced component technologies for improved performance and fuel consumption of turbofan/turbojet engines. *FY 2009 Accomplishments:* In FY 2009: Finished assembly and began testing of engine designs for a supersonic and subsonic engine using variable cycle features, an advanced fan, improved turbine using cooled metal and cooled Ceramic Matrix Composites (CMC), advanced augmentor, and lightweight CMC cases and ducts. Finished detailed design of advanced adaptive cycle (third air stream) engine technologies,	30.877	28.786	26.142	0.000	26.142

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
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. Finished procurement of long lead hardware for 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. Initiated conceptual design for a high bypass/high overall pressure ratio engine for improved fuel consumption. *FY 2010 Plans:* In FY 2010: Initiate assembly testing of engine designs for a supersonic and subsonic engine using variable cycle features, an advanced fan, improved turbine using cooled metal and cooled CMCs, advanced augmentor, and lightweight CMC cases and ducts. Begin to fabricate 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. Initiate preliminary design for a high bypass/high overall pressure ratio engine for improved fuel consumption. Note: In FY 2010 and FY 2011, the efforts in this thrust are reduced due to higher AF priorities. *FY 2011 Base Plans:* In FY 2011: Continue fabrication and begin 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. Continue preliminary design for a high bypass/high overall pressure ratio engine for improved fuel consumption. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Design, fabricate, and test component technologies for limited life engines to improve the performance, durability, and affordability of missile and unmanned aerial system engines.	6.994	4.994	7.994	0.000	7.994

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Finished testing of advanced components for technologies for engine testing to include an advanced light weight fan/compressor, turbines with new advanced cooling approaches, oil-less bearings and high through flow combustors for high mach missile applications. Initiated design of a higher specific thrust, low cost expendable turbine engine for improved fuel efficiency improving range. Initiated design of low spool components for fuel efficient subsonic unmanned turbofan engines. *FY 2010 Plans:* In FY 2010: Conduct preliminary design of a higher specific thrust, low cost expendable turbine engine for improved fuel efficiency improving range. Conduct preliminary design of advanced fan, advanced low spool turbine, and advanced engine components for improved fuel efficient subsonic unmanned turbofan engines. Note: In FY 2010, funding dips due to completion of testing of advanced components. *FY 2011 Base Plans:* In FY 2011: Conduct detailed design of a higher specific thrust, low cost expendable turbine engine for improved fuel efficiency improving range. Conduct detailed design of advanced fan, advanced low spool turbine spool, and advanced engine components for fuel efficient subsonic unmanned turbofan engines. Note: In FY 2011, funding is increased due to shift in emphasis from preliminary design to detailed design of expendable turbine engines. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
Accomplishments/Planned Programs Subtotals	39.492	36.405	41.403	0.000	41.403

FY 2009	FY 2010
1.596	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010
Congressional Add: Small Adaptive Cycle Turbine Engines. *FY 2009 Accomplishments:* In FY 2009: Performed risk reduction for an advanced cooled metal turbine and for an advanced high temperature rear bearing. *FY 2010 Plans:* In FY 2010: Not Applicable.		
Congressional Add: Small Turbofan Versatile Affordable Advanced Turbine Engine (VAATE) Program. *FY 2009 Accomplishments:* In FY 2009: Supported the on-going engine demonstrator, design and hardware, tip treatments for high pressure compressor, and thermal mechanical fatigue analysis/design for the turbine. *FY 2010 Plans:* In FY 2010: Conduct Congressionally directed effort in the Small Turbofan Versatile Affordable Advanced Turbine Engine (VAATE) Program.	3.590	3.187
Congressional Adds Subtotals	5.186	3.187

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602201F: *Aerospace Flight Dynamics.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: *Aerospace Propulsion.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603003A: *Aviation Advanced Technology.*											

D. Acquisition Strategy

Not Applicable.

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 2011 Air Force			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634922: *Space & Missile Rocket Propulsion*	4.736	29.515	31.840	0.000	31.840	28.059	31.925	39.865	41.610	Continuing	Continuing

Note

Note: In FY 2010, this work was moved from Project 10SP within this Program Element to better align efforts.

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 Technology for Sustainment of Strategic Systems (TSSS) Phase II (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 TSSS program and Integrated High Payoff Rocket Propulsion Technology program (IHPRPT), a joint Department of Defense, National Aeronautics and Space Administration, and industry effort to focus rocket propulsion technology on national space launch needs.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop liquid rocket propulsion technology for current and future space launch vehicles.	0.000	19.707	25.608	0.000	25.608

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Demonstrate through hot fire testing advanced cryogenic upper stage hardware to validate and verify modeling and simulation tools developed. Continue development of hydrocarbon engine components for integration and demonstration in advanced hydrocarbon engine concepts for future reusable launch vehicles. Initiate sub-scale component testing to demonstrate hydrocarbon boost technologies. Continue material manufacturing scale-up effort to support hydrocarbon boost demonstration program. *FY 2011 Base Plans:* In FY 2011: 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 demonstration in an advanced hydrocarbon engine concept for future reusable launch vehicles. Continue sub-scale component testing to demonstrate hydrocarbon boost technologies. Continue material manufacturing scale-up effort to support hydrocarbon boost demonstration program. Initiate component demonstration for advanced hydrocarbon engine technologies using fuels other than kerosene that address IHPRPT Phase III goals. Note: In FY 2011, funding is increased due to initiation of component demonstration for advanced hydrocarbon engine technologies. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Develop solar electric, electric, and monopropellant propulsion technologies for existing and future satellites, upper stages, orbit transfer vehicles, and satellite maneuvering.	0.000	1.051	3.196	0.000	3.196

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Continue hardware scale-up for an advanced multi-mode (high thrust or high efficiency) propulsion system for satellites. Complete demonstration of advanced chemical propulsion system for satellites. *FY 2011 Base Plans:* In FY 2011: Conduct scale-up of micro propulsion technologies for spacecraft with the need for high mobility on orbit. Continue hardware scale-up and prepare to conduct testing of hardware for an advanced multi-mode (high thrust or high efficiency) propulsion system for satellites. Note: In FY 2011, this thrust is combined with the following thrust, and reduced in order to better align technologies. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Develop electric and advanced chemical based monopropellant propulsion technologies for future satellite propulsion systems. Phases are referring to IHPRPT program phases. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Complete development and demonstration of IHPRPT Phase III monopropellant thruster technologies for spacecraft. Initiate scale-up of next generation of chemical thrusters for spacecraft propulsion systems.	0.000	5.226	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 Base Plans: In FY 2011: Not Applicable. Note: In FY 2011, this thrust is combined with the previous thrust, and reduced in order to better align technologies. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Develop and demonstrate missile propulsion and Post Boost Control Systems technologies for ballistic missiles. *FY 2009 Accomplishments:* In FY 2009: Completed testing of motor demonstrating TSSS Phase I goals. *FY 2010 Plans:* In FY 2010: Develop advanced missile propulsion technologies. Conduct sub-scale component developments providing sub-scale validation of modeling and simulation tools. Note: In FY 2010 and out, efforts are reduced due to higher AF priorities. *FY 2011 Base Plans:* In FY 2011: Continue development of advanced missile propulsion technologies. Continue sub-scale component developments providing sub-scale validation of modeling and simulation tools. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.	3.982	1.896	1.911	0.000	1.911
MAJOR THRUST: Develop and demonstrate aging and surveillance technologies for strategic systems to reduce lifetime prediction uncertainty for individual motors, enabling motor replacement for cause.	0.754	1.635	1.125	0.000	1.125

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Conducted 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 2010 Plans:* In FY 2010: Conduct 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 2011 Base Plans:* In FY 2011: 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 2011 OCO Plans:* In FY 2011 OCO: N/A.					
Accomplishments/Planned Programs Subtotals	4.736	29.515	31.840	0.000	31.840

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602102F: *Materials.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: *Aerospace Propulsion.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602601F: *Spacecraft Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603401F: *Advanced Spacecraft Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603500F: *Multi-Disciplinary Advanced Development Space Technology.*											
• PE 0603853F: *Evolved Expendable Launch Vehicle Program.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603114N: *Power Projection Advanced Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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 2011 Air Force			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635098: *Advanced Aerospace Propulsion*	28.301	23.832	13.177	0.000	13.177	20.457	17.959	18.617	20.357	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates, via ground and flight tests, the scramjet propulsion cycle to a technology readiness level appropriate for full integration with other engine cycles (including turbine and rocket-based) to provide the Air Force with transformational military capabilities. The primary focus is on the hydrocarbon-fueled, scramjet engine. Multi-cycle engines will provide the propulsion systems for possible application to support aircraft and weapon platforms operating 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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and demonstrate technologies for a hydrocarbon-fueled scramjet with robust operation over a range of Mach 4 to 8.	28.301	23.832	13.177	0.000	13.177
FY 2009 Accomplishments: In FY 2009: Conducted integrated air vehicle/propulsion flight tests and conducted post test data reduction and reporting.					
FY 2010 Plans: In FY 2010: Complete integrated air vehicle/propulsion flight tests; conduct post test data reduction and write X-51A final report. Demonstrate small scale scramjet engine to technology readiness level 6.					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 Base Plans: In FY 2011: Develop and demonstrate tactically compliant subsystems, including scramjet engine start system, fuel system, and engine controls. Note: In FY 2011, the efforts in this thrust are reduced due to higher AF priorities. *FY 2011 OCO Plans:* In FY 2001 OCO: N/A.					
Accomplishments/Planned Programs Subtotals	28.301	23.832	13.177	0.000	13.177

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602102F: *Materials.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: *Aerospace Propulsion.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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 2011 Air Force			DATE: February 2010
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 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
63681B: *Advanced Turbine Engine Gas Generator*	48.405	57.842	34.766	0.000	34.766	33.540	34.756	27.725	29.409	Continuing	Continuing

Note

Note: The funding in this project decreases in FY 2011 due to planned taper of turbine engine technologies.

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 PE. Efforts are part of the Versatile Affordable Advanced Turbine Engines (VAATE) program. A portion of this project supports the demonstration of adaptive cycle technologies, which develop component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Design, fabricate, and demonstrate performance predictions in core engines, using innovative engine cycles and advanced materials for turbofan/turbojet engines.	37.681	46.648	21.410	0.000	21.410

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Completed assembly and demonstration of advanced core engine components, including advanced turbine materials incorporating next generation cooling schemes, novel coatings to reduce combustor and turbine heat loads, ceramic turbine components, and systems for active control, thermal management, and power extraction. Completed fabrication, assembly, and experimental demonstration of unique compression system components. Completed preliminary design of high temperature capable, durable compressor, combustor, and turbine for sustained supersonic long range strike core engine. Conducted conceptual design and initiated preliminary design of component technologies for a core-centric durability engine demonstration. Conducted preliminary design of component technologies for increased reliability, maintainability, and affordability for potential transition to fielded systems. Conducted analysis and conceptual design of system-level technologies and weapon systems integration on core engine performance. *FY 2010 Plans:* In FY 2010: Complete detailed design and initiate hardware fabrication of high temperature capable, durable compressor, combustor, and turbine for sustained supersonic long range strike core engine. Complete preliminary design and initiate detailed design of component technologies for a core-centric durability engine demonstration. Conduct detailed design of component technologies for increased reliability, maintainability, and affordability for potential transition to fielded systems. Conduct analysis and conceptual design of system-level technologies and weapon systems integration on core engine performance. Note: Funding increased in FY 2010 to complete hardware fabrication and conduct engine demonstrations *FY 2011 Base Plans:* In FY 2011: Continue hardware fabrication and initiate assembly of high temperature capable, durable compressor, combustor, and turbine for sustained supersonic long range strike core engine. Complete detailed design and initiate fabrication of component technologies for a core-centric durability engine demonstration. Conduct fabrication of component technologies for increased					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
reliability, maintainability, and affordability for potential transition to fielded systems. Conduct preliminary design and initiate detailed design of system-level technologies and weapon systems integration on core engine performance. Note: Fudning reduced in FY 2011 due to completion of hardware fabrication and engine demonstrations. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Design, fabricate, and demonstrate high overall pressure ratio cores to provide increased durability and affordability with lower fuel consumption for turbofan/turboshaft engines. *FY 2009 Accomplishments:* In FY 2009: Completed fabrication, assembly, and demonstration of a highly 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. Initiated design of higher pressure ratio core components. Conducted preliminary design of core for highly efficient core engine concept with an integrated thermal management system and advanced mechanical systems. Completed design, initiated hardware fabrication, and continued selective risk reduction experimental demonstrations of UAS small versatile affordable advanced core engine technologies including a high heat release combustor, durable high performance turbine, systems for thermal management, and advanced power extraction. Conducted preliminary design of efficient small scale propulsion technologies for use in UAS applications. *FY 2010 Plans:* In FY 2010: Complete preliminary design and initiate long lead fabrication of core for highly 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	10.724	11.194	13.356	0.000	13.356

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
advanced mechanical systems. Complete hardware fabrication, and continue selective risk reduction experimental demonstrations of UAS small versatile affordable advanced core engine technologies including a high heat release combustor, durable high performance turbine, and systems for thermal management and advanced power extraction. Complete preliminary design and initiate long lead fabrication of efficient small engine component technologies for use in UAS applications. *FY 2011 Base Plans:* In FY 2011: Conduct detailed design of core for highly 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 UAS small versatile affordable advanced core engine. Complete 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 UAS applications. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
Accomplishments/Planned Programs Subtotals	48.405	57.842	34.766	0.000	34.766

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602201F: *Aerospace Flight Dynamics.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: *Aerospace Propulsion.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010
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 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603003A: *Aviation Advanced Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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.