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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2012 Air Force **DATE:** February 2011

<b>APPROPRIATION/BUDGET ACTIVITY</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				<b>R-1 ITEM NOMENCLATURE</b> PE 0602203F: <i>Aerospace Propulsion</i>							
<b>COST (\$ in Millions)</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	<b>FY 2013</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	218.323	207.049	207.508	-	207.508	204.967	190.705	188.546	192.073	Continuing	Continuing
623012: <i>Advanced Propulsion Technology</i>	17.061	22.859	20.377	-	20.377	23.095	20.688	21.160	21.553	Continuing	Continuing
623048: <i>Combustion and Mechanical Systems</i>	19.171	18.679	20.079	-	20.079	18.925	16.579	15.712	15.999	Continuing	Continuing
623066: <i>Turbine Engine Technology</i>	60.738	67.274	67.735	-	67.735	63.495	53.969	50.376	51.301	Continuing	Continuing
623145: <i>Aerospace Power Technology</i>	40.488	32.604	32.655	-	32.655	32.768	31.623	32.361	32.963	Continuing	Continuing
624847: <i>Rocket Propulsion Technology</i>	74.121	58.954	60.420	-	60.420	60.144	61.312	62.432	63.633	Continuing	Continuing
625330: <i>Aerospace Fuel Technology</i>	6.744	6.679	6.242	-	6.242	6.540	6.534	6.505	6.624	Continuing	Continuing

**A. Mission Description and Budget Item Justification**

This program develops propulsion and power technologies to achieve enabling and revolutionary aerospace technology capabilities. The program has six projects, each focusing on a technology area critical to the Air Force. The Advanced Propulsion Technology project develops high-speed air breathing propulsion engines to include combined cycle, ramjet, and hypersonic scramjet technologies to enable revolutionary propulsion capability for the Air Force. The Combustion and Mechanical Systems project evaluates lubricants and combustion concepts and technologies for new and existing engines. The Turbine Engine Technology project develops enabling capabilities to enhance performance and affordability of existing weapon systems and develops component technologies for ultra high pressure ratio, substantially improved durability, and adaptive cycle engine architecture to provide optimized performance, fuel efficiency, and life for widely varying mission needs. The Aerospace Power Technology project develops electrical power and thermal management technologies for military applications that are part of energy optimized aircraft development. The Rocket Propulsion Technology project develops advances in rocket propulsion technologies for space access, space maneuver, missiles, the sustainment of strategic systems, and tactical rockets. The Aerospace Fuel Technology project evaluates hydrocarbon-based fuels for legacy and advanced turbine engines, scramjets, pulse detonation, and combined-cycle engines. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

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APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE				
3600: Research, Development, Test & Evaluation, Air Force		PE 0602203F: Aerospace Propulsion				
BA 2: Applied Research						
B. Program Change Summary (\$ in Millions)		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget		221.503	207.049	209.957	-	209.957
Current President's Budget		218.323	207.049	207.508	-	207.508
Total Adjustments		-3.180	-	-2.449	-	-2.449
• Congressional General Reductions			-			
• Congressional Directed Reductions			-			
• Congressional Rescissions		-	-			
• Congressional Adds			-			
• Congressional Directed Transfers			-			
• Reprogrammings		-	-			
• SBIR/STTR Transfer		-3.181	-			
• Other Adjustments		0.001	-	-2.449	-	-2.449
Congressional Add Details (\$ in Millions, and Includes General Reductions)						
Project: 623048: Combustion and Mechanical Systems						
Congressional Add: Hybrid Bearings.						
Congressional Add Subtotals for Project: 623048						
Project: 623066: Turbine Engine Technology						
Congressional Add: Split Discharge Variable Delivery Pump for Military Aircraft.						
Congressional Add Subtotals for Project: 623066						
Project: 623145: Aerospace Power Technology						
Congressional Add: Advanced Lithium Battery Scale-Up and Manufacturing.						
Congressional Add: Energy Superior Lithium Battery Technology for Defense Applications.						
Congressional Add: High-Energy Li-Ion Technology for Aviation Batteries.						
Congressional Add: Integrated Engine Starter/Generator.						
Congressional Add: Thermal and Energy Management for Aerospace.						
Congressional Add: Wavelength Agile Spectral Harmonic Oxygen Sensor and Cell-Level Battery Controller.						
Congressional Add Subtotals for Project: 623145						

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<b>Exhibit R-2, RDT&amp;E Budget Item Justification:</b> PB 2012 Air Force		<b>DATE:</b> February 2011	
<b>APPROPRIATION/BUDGET ACTIVITY</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		<b>R-1 ITEM NOMENCLATURE</b> PE 0602203F: <i>Aerospace Propulsion</i>	
<b>Congressional Add Details (\$ in Millions, and Includes General Reductions)</b>		<b>FY 2010</b>	<b>FY 2011</b>
<b>Project: 624847: <i>Rocket Propulsion Technology</i></b>			
Congressional Add: <i>Advanced Vehicle Propulsion Center.</i>		2.390	-
Congressional Add: <i>Aerospace Lab Equipment Upgrade.</i>		1.195	-
Congressional Add: <i>AFRL Edwards Rocket Test Stand 2-A Technical Improvements.</i>		3.187	-
Congressional Add: <i>Development and Testing of Advanced Hybrid Rockets for Space Applications.</i>		2.788	-
Congressional Add: <i>Integrated Propulsion Analysis and Spacecraft Engineering Tools (IPAT/ISET).</i>		4.780	-
Congressional Add: <i>Multi-Mode Propulsion Phase II-A: High Performance Green Propellant.</i>		1.593	-
Congressional Add: <i>Next Generation Solar Electric In-Space Propulsion.</i>		0.797	-
Congressional Add Subtotals for Project: 624847		16.730	-
<b>Project: 625330: <i>Aerospace Fuel Technology</i></b>			
Congressional Add: <i>National Test Facility for Aerospace Fuels Propulsion.</i>		1.306	-
Congressional Add Subtotals for Project: 625330		1.306	-
Congressional Add Totals for all Projects		30.782	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research				R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion				PROJECT 623012: Advanced Propulsion Technology			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
623012: Advanced Propulsion Technology	17.061	22.859	20.377	-	20.377	23.095	20.688	21.160	21.553	Continuing	Continuing
A. Mission Description and Budget Item Justification											
This project develops combined/advanced cycle air breathing high-speed (up to Mach 4) and hypersonic (Mach 4 to 8+) propulsion technologies to provide revolutionary propulsion options for the Air Force. These new engine technologies will enable future high-speed/hypersonic weapons and aircraft concepts. The primary focus is on hydrocarbon-fueled engines capable of operating over a broad range of flight Mach numbers. Efforts include modeling, simulations, and proof of concept demonstrations of critical components; advanced component development; and ground-based demonstrations.											
B. Accomplishments/Planned Programs (\$ in Millions)							FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.							1.650	2.565	1.650	-	1.650
Description: Develop advanced fuel-cooled scramjet engine technologies to support flight demonstration and enable the broad application of hypersonics to meet future warfighter needs.											
FY 2010 Accomplishments: Developed and demonstrated flight weight engine components and advanced engine control logic. Performed trajectory optimization for flight test. Fabricated hardware for ground test of advanced scramjet start technique. Initiated fabrication of flight test hardware to demonstrate ramjet to scramjet transition. Note: In FY 2011, efforts in this thrust are increased due to higher AF priorities.											
FY 2011 Plans: Develop and demonstrate flight weight engine components and advanced engine control logic. Assess advanced instrumentation with control logic to improve scramjet operability. Perform trajectory optimization for flight test. Conduct ground test of advanced scramjet start technique. Complete fabrication of flight test hardware to demonstrate ramjet to scramjet transition. Note: In FY 2011, efforts in this thrust are increased due to higher AF priorities.											
FY 2012 Base Plans: Develop and demonstrate advanced engine control systems and flight weight scramjet engine components. Develop and demonstrate closed loop engine control system with advanced instrumentation to increase											

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion	PROJECT 623012: Advanced Propulsion Technology				
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
scramjet engine operability at low scramjet Mach numbers. Conduct flight test using sounding rocket launch to demonstrate transition from ramjet to scramjet. <b>FY 2012 OCO Plans:</b>						
<b>Title:</b> Major Thrust 2. <b>Description:</b> Conduct assessments, technology design trades, and simulations to integrate combined cycle engines (CCEs) and air breathing hypersonic propulsion technologies into future systems.  <b>FY 2010 Accomplishments:</b> Conducted trade studies to determine military payoff and establish component technology goals. Defined component and engine performance objectives to enable development of affordable hypersonic flight demonstrators jointly with the National Aeronautics and Space Administration (NASA) and the Defense Advanced Research Projects Agency (DARPA). Developed technology maturation plan for advanced components for turbine-based and rocket-based CCEs.  <b>FY 2011 Plans:</b> Conduct further trade studies to determine military payoff and establish component technology goals. Define component and engine performance objectives to enable development of affordable hypersonic flight demonstrators jointly with NASA and DARPA. Develop technology maturation plan, including test facility requirements, for advanced components for turbine-based and rocket-based CCEs.  <b>FY 2012 Base Plans:</b> Continue to conduct trade studies to determine military payoff and establish component technology goals. Improve definition of component and engine performance objectives to enable development of affordable hypersonic flight demonstrators jointly with NASA and DARPA. Update technology maturation plan, including test facility requirements, for advanced components for turbine-based and rocket-based CCEs.  <b>FY 2012 OCO Plans:</b>		0.165	0.165	0.165	-	0.165
<b>Title:</b> Major Thrust 3. <b>Description:</b> Develop robust hydrocarbon fueled scramjet engine components and technologies to improve performance, operability, durability, and scalability for future platforms.  <b>FY 2010 Accomplishments:</b>		15.246	20.129	18.562	-	18.562

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2012 Air Force						<b>DATE:</b> February 2011					
<b>APPROPRIATION/BUDGET ACTIVITY</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				<b>R-1 ITEM NOMENCLATURE</b> PE 0602203F: <i>Aerospace Propulsion</i>				<b>PROJECT</b> 623012: <i>Advanced Propulsion Technology</i>			
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>											
						<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	
<p>Developed advanced engine components to improve scramjet operating margin and to refine scramjet scaling laws for reusable applications. Developed techniques to decrease scramjet take-over from Mach 4.5 to Mach 3.5 to provide robust options for CCEs. Developed low internal drag flame stabilization devices and flight test engine components. Completed fabrication of subscale components/combustors to represent medium scale (5 to 20 times) scramjet engines.</p> <p><b><i>FY 2011 Plans:</i></b> Develop advanced engine components to improve scramjet operating margin and to refine scramjet scaling laws for reusable applications. Develop techniques to decrease scramjet take-over from Mach 4.5 to Mach 3.5 to provide robust options for CCEs. Develop low internal drag flame stabilization devices and flight test engine components. Ground test subscale components/combustors to represent medium scale (5 to 20 times) scramjet engines. Note: In FY 2011, efforts in this thrust are increased due to higher AF priorities.</p> <p><b><i>FY 2012 Base Plans:</i></b> Develop advanced engine components to improve scramjet operating margin and to refine scramjet scaling laws for reusable applications. Develop techniques to decrease scramjet take-over from Mach 4.5 to Mach 3.5 to provide robust options for CCEs. Develop low internal drag flame stabilization devices and flight test engine components. Design and initiate fabrication of heavy weight scramjet combustor in medium scale (5 to 20 times) scramjet engines.</p> <p><b><i>FY 2012 OCO Plans:</i></b></p>											
<b>Accomplishments/Planned Programs Subtotals</b>						17.061	22.859	20.377	-	20.377	
<b>C. Other Program Funding Summary (\$ in Millions)</b>											
<b>Line Item</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	<b>FY 2013</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
<b>D. Acquisition Strategy</b>											
N/A											

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2012 Air Force		<b>DATE:</b> February 2011
<b>APPROPRIATION/BUDGET ACTIVITY</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602203F: <i>Aerospace Propulsion</i>	<b>PROJECT</b> 623012: <i>Advanced Propulsion Technology</i>

**E. Performance Metrics**

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

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research				<b>R-1 ITEM NOMENCLATURE</b> PE 0602203F: Aerospace Propulsion				<b>PROJECT</b> 623048: Combustion and Mechanical Systems			
<b>COST (\$ in Millions)</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	<b>FY 2013</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
623048: Combustion and Mechanical Systems	19.171	18.679	20.079	-	20.079	18.925	16.579	15.712	15.999	Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> This project evaluates lubricants, mechanical systems, and combustion concepts for advanced turbine engines, pulse detonation engines, and combined cycle engines. This project also develops technologies to increase turbine engine operational reliability, durability, mission flexibility, maintainability, and performance while reducing weight, fuel consumption, and cost of ownership. Applications include missiles, aircraft, and sustained high-speed vehicles. Analytical and experimental areas of emphasis include lubricants, bearings, mechanical systems diagnostics, mechanical systems prognostics, rotordynamics, oil-less engine technology, optical diagnostics, fundamental combustion, detonations, combustors, and afterburners. Lubricants for these engines must be thermally stable, cost-effective, and operate over a broad range of conditions. Advanced combustion concepts must be cost-effective, durable, and reduce pollutant emissions. A portion of this project supports adaptive cycle technologies. This effort develops component technology for an adaptive cycle engine architecture that provides optimized performance/fuel efficiency for widely varying mission needs.											
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>							<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>
<b>Title:</b> Major Thrust 1.  <b>Description:</b> Develop, test, and evaluate revolutionary combustion and propulsion concepts for gas turbine, pulse detonation, and combined cycle engines for missiles, manned and unmanned systems.  <b>FY 2010 Accomplishments:</b> Tested concept designs for larger-scale inter-turbine burners at relevant gas turbine engine conditions. Evaluated performance characteristics in small internal combustion engines burning military fuels. Identified potential performance improvements for small engines. Investigated novel combustor, augmentor, continuous detonation, and pulse-detonation concepts that reduce fuel burn and improve system performance. Studied combustion processes using alternative fuels. Developed new chemistry models for combustion processes. Employed modeling and simulation tools to evaluate advanced combustion systems. Investigated high-efficiency direct injection methods for pulse detonation engines.  <b>FY 2011 Plans:</b> Test full-scale inter-turbine burner concepts at relevant engine conditions. Investigate novel valving concepts for pulse detonation engines. Study pulse detonation engine-turbine interactions. Explore the use of regenerative fuel cooling with pulse detonation engines and other combustion systems. Demonstrate novel small internal combustion engine concepts that improve system performance. Use advanced modeling and simulation tools							6.924	8.128	8.669	-	8.669

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion		PROJECT 623048: Combustion and Mechanical Systems	
B. Accomplishments/Planned Programs (\$ in Millions)					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
to understand combustion processes and to guide combustion system design. Employ new chemistry models for alternative fuels. Test concept designs for adaptive combustors for ultra efficient turbine engine components which reduce harmful emissions.  <b>FY 2012 Base Plans:</b> Evaluate alternative fuels in combustion systems at relevant engine conditions. Test full-scale compact combustor concept relevant to highly efficient, embedded turbine engine goals. Demonstrate small-scale propulsion system operation using reduced-octane fuels. Employ new physical models in simulation tools. Investigate pressure gain combustion concepts for application to propulsion systems. Continue studies of pulse detonation engine-turbine interactions. Investigate feasibility of rotary detonation engines and continuous detonation engines.  <b>FY 2012 OCO Plans:</b>					
<b>Title:</b> Major Thrust 2.  <b>Description:</b> Develop and demonstrate optical, electromechanical, and laser diagnostic tools and sensors for application to revolutionary propulsion technologies.  <b>FY 2010 Accomplishments:</b> Developed megahertz-rate high-speed measurement techniques for combustion species. Used two-color planar laser-induced fluorescence techniques to measure temperature in experimental combustion systems. Developed robust line-of-sight measurement techniques for temperature and species and apply to relevant combustion devices. Applied ultrafast spectroscopy techniques developed in FY 2009 to practical combustion devices and engine systems. Applied advanced optical diagnostics suites to characterize and improve engine combustors and afterburners.  <b>FY 2011 Plans:</b> Use two-color planar laser induced fluorescence techniques to measure temperature in relevant-environment combustion systems. Develop robust line-of-sight measurement techniques for temperature and species and apply to engine systems. Develop simultaneous high-speed planar laser-induced fluorescence and particle-image velocimetry for measurements of species and velocity fields in practical combustion devices. Expand line-of-sight measurement techniques for temperature and species to include many simultaneous lines of sight and	0.975	1.212	1.311	-	1.311

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion	PROJECT 623048: Combustion and Mechanical Systems				
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
tomographic reconstruction of complex reacting flowfields characteristic of real-world hardware. Apply advanced optical diagnostics suites for characterization and improvement of engine combustors and afterburners.  <b>FY 2012 Base Plans:</b> Apply line-of-sight measurement techniques for temperature and species to combustion systems in a relevant engine environment. Demonstrate simultaneous high-speed planar laser-induced fluorescence and particle-image velocimetry for measurements of species and velocity fields in practical combustion devices. Demonstrate tomographic reconstruction of reacting flowfields in relevant combustion systems.  <b>FY 2012 OCO Plans:</b>						
<b>Title:</b> Major Thrust 3.  <b>Description:</b> Develop, test, and qualify advanced turbine engine lubricants. Generate and maintain military specifications for aviation engine lubricants.  <b>FY 2010 Accomplishments:</b> Completed testing of enhanced ester oil candidate in Technology Readiness Level (TRL) 5 full-scale bearing endurance rigs and in a technology demonstrator engine. Finalized elastomer and load capacity limits jointly with US Navy, initiated draft of joint USAF-Navy enhanced ester oil specification and supported initial transition activities to aircraft. Conducted TRL 2-3 component level testing of high-Mach ester lubricant for future high-mach turbine engine aircraft. Investigated anti-coke lube system surface modifiers using vapor phase coke (VPC) test rig for sustained supersonic engine oil system. Developed intelligent prognostics for lubrication system health monitoring.  <b>FY 2011 Plans:</b> Complete TRL 5 full-scale bearing endurance test on second enhanced ester candidate oil in preparation for an engine demonstration. Support full transition of enhanced ester oil to the operational fleet by coordinating with engine manufacturers and users. Conduct adaptive components for high efficiency risk mitigation bearing and gear rig tests with enhanced ester oil in preparation for 2013 demonstration engine test. Demonstrate anti-coke surface modifiers on sub-scale supersonic lube system components. Expand development of intelligent prognostics for lubrication system health monitoring. Investigate advanced lube system thermal and health management technologies for highly embedded efficient turbine engines.  <b>FY 2012 Base Plans:</b>		5.111	4.620	4.996	-	4.996

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APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion		PROJECT 623048: Combustion and Mechanical Systems	
B. Accomplishments/Planned Programs (\$ in Millions)					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Demonstrate anti-coke surface modifiers on full-scale lubrication system components. Develop engine mechanical system health management control algorithms for active rotor thrust balancing. Develop suite of technologies for intelligent lube system prognostics and health monitoring, such as integrated debris capture devices, real-time oil debris monitoring, and vibration sensing. Develop lubrication system thermal management technologies for reduced heat generation and improved heat dissipation for efficient turbine engines. <b>FY 2012 OCO Plans:</b>					
<b>Title:</b> Major Thrust 4. <b>Description:</b> Develop and test advanced bearing material technology and bearing concepts for small, intermediate, and large-sized turbine engine applications.  <b>FY 2010 Accomplishments:</b> Investigated spall propagation of nitrided bearings. Continued experimental validation of bearing heat generation models. Initiated fabrication of adaptive components for high efficiency and ultra efficient turbine engine mechanical systems components and initiated risk mitigation tests. Tested bearing concepts, such as foil bearings for high Mach missile and other future applications. Continued developing in-house rotor dynamic modeling expertise in support of adaptive components for high efficiency, ultra efficient turbine engine components, and future advanced turbine engine efforts.  <b>FY 2011 Plans:</b> Investigate fatigue life and spall propagation of Vacuum Induction Melted-Vacuum Arc Remelted (VIM-VAR) bearings. Complete mechanical systems risk mitigation test activities for adaptive components for high efficiency. Develop coupled bearing and rotor dynamic models for virtual simulation of mechanical systems for advanced engines. Continue developing reliable bearing technologies for sustained hi-mach reusable and limited-life engines. Complete fabrication of active rotor thrust balance bearing test rig.  <b>FY 2012 Base Plans:</b> Conduct shakedown tests of active thrust balance rig. Develop and demonstrate robust thrust load sensing devices for highly loaded engine thrust bearings. Develop bearing spall debris monitoring model and limits and incorporate into thrust load control algorithm. Demonstrate oil debris monitoring technology fused with vibration sensing on seeded fault bearing rig tests. Develop new bearing heat generation models for engines and validate with full-scale bearing experimental performance data.  <b>FY 2012 OCO Plans:</b>	5.364	4.719	5.103	-	5.103

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>
<b>Accomplishments/Planned Programs Subtotals</b>	18.374	18.679	20.079	-	20.079

  

	<b>FY 2010</b>	<b>FY 2011</b>
<b>Congressional Add:</b> Hybrid Bearings.	0.797	-
<b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort.		
<b>FY 2011 Plans:</b>		
<b>Congressional Adds Subtotals</b>	0.797	-

  

<b>C. Other Program Funding Summary (\$ in Millions)</b>											
<b>Line Item</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	<b>FY 2013</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

  

<b>D. Acquisition Strategy</b> N/A
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<b>E. Performance Metrics</b> Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.
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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2012 Air Force								<b>DATE:</b> February 2011			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				<b>R-1 ITEM NOMENCLATURE</b> PE 0602203F: <i>Aerospace Propulsion</i>				<b>PROJECT</b> 623066: <i>Turbine Engine Technology</i>			
<b>COST (\$ in Millions)</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	<b>FY 2013</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
623066: <i>Turbine Engine Technology</i>	60.738	67.274	67.735	-	67.735	63.495	53.969	50.376	51.301	Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> This project develops technology to increase turbine engine operational reliability, durability, mission flexibility, and performance, while reducing weight, fuel consumption, and cost of ownership. Analytical and experimental areas of emphasis are fans and compressors, high temperature combustors, turbines, internal flow systems, controls, augmentor and exhaust systems, integrated power and thermal management systems, engine inlet integration, mechanical systems, adaptive cycle technologies, and structural design. This project develops component technology for an adaptive cycle engine architecture that provides optimized performance/fuel efficiency for widely varying mission needs. This project supports joint DoD, agency, and industry efforts to focus turbine propulsion technology on national needs. The program plan is relevant across capability areas for global responsive strike, capable unmanned war-fighting, tactical and global mobility, responsive space lift, and persistent intelligence, surveillance, and reconnaissance (ISR).											
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>							<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>
<b>Title:</b> Major Thrust 1.  <b>Description:</b> Develop core turbofan/turbojet engine components (i.e., compressors, combustors, and turbines) for fighters, bombers, sustained supersonic/hypersonic cruise vehicles, and transports.  <b>FY 2010 Accomplishments:</b> Developed and applied advanced modeling and simulation rules and tools for advanced components. Developed computational fluid dynamics methodology for analyzing turbine flows. Developed ceramic matrix composite lifing models. Conducted bench and rig tests for validation of components with significantly improved efficiency. Rig tested lightweight, simple, adaptive cycle features; an efficient, wide-flow range compressor; an efficient, high temperature turbine capable of operating over large swings in required work; and an efficient, lightweight, low observable (LO)-compatible exhaust system. Rig tested an efficient, very high pressure ratio compressor and associated thermal management features that will offer a step change improvement in engine specific fuel consumption (SFC).  <b>FY 2011 Plans:</b> Develop and apply advanced modeling and simulation rules and tools for advanced components. Develop computational fluid dynamics methodology for analyzing turbine flows. Develop ceramic matrix composite lifing models. Conduct bench and rig tests for validation of components with significantly improved efficiency. Perform rig testing of lightweight, simple, adaptive cycle features, an efficient, wide-flow range compressor, an efficient,							42.589	41.097	41.166	-	41.166

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion	PROJECT 623066: Turbine Engine Technology				
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
high temperature turbine capable of operating over large swings in required work, and an efficient, lightweight, LO-compatible exhaust system. Develop and apply advanced modeling and simulation rules and tools to initiate definition and design of efficient, very high pressure ratio core component technologies that will offer a step change improvement in engine specific fuel consumption.  <b>FY 2012 Base Plans:</b> Develop modeling and simulation rules and tools for advanced components including advanced interactive cost analysis tools for adaptive core components and unsteady aerodynamics/aeromechanics models. Conduct bench and rig tests to validate unsteady aerodynamics/aeromechanics models. Continue rig testing adaptive cycle features, an efficient compressor, an efficient turbine, and an efficient exhaust system. Continue to develop and apply advanced modeling and simulation rules and tools to initiate definition and design of efficient, very high pressure ratio core component technologies.  <b>FY 2012 OCO Plans:</b>						
<b>Title:</b> Major Thrust 2.  <b>Description:</b> Develop turbofan/turbojet engine components (i.e. fans, nozzles, etc.) used in engines for fighters, bombers, sustained supersonic strike and hypersonic cruise vehicles, and transports.  <b>FY 2010 Accomplishments:</b> Developed and applied advanced modeling and simulation rules and tools for advanced components. Developed durable damping/erosion coating systems. Conducted rig testing of advanced fan design for application to a variable cycle engine concept. Conducted rig testing of advanced low pressure turbine design for application to a variable cycle engine concept. Rig tested a lightweight, simple, LO-compatible inlet and exhaust system.  <b>FY 2011 Plans:</b> Develop and apply advanced modeling and simulation rules and tools for advanced components. Develop durable damping/erosion coating systems. Conduct rig testing of advanced fan design for application to a variable cycle engine concept. Conduct rig testing of advanced low pressure turbine design for application to a variable cycle engine concept. Rig test of lightweight, simple, LO-compatible inlet and exhaust system. Note: In FY 2011, efforts in this thrust are increased due to higher AF priorities.  <b>FY 2012 Base Plans:</b> Develop and modeling and simulation rules and tools for advanced components including: advanced interactive cost analysis tools for adaptive engine components; unsteady aerodynamics and aeromechanics models;		14.485	19.237	19.510	-	19.510

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion	PROJECT 623066: Turbine Engine Technology				
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
augmentor combustion processes; and probability-based cooled turbine airfoil high cycle fatigue prediction methods. Conduct bench and rig tests to validate unsteady aerodynamics/aeromechanics models and probabilistic cooled turbine airfoil high cycle fatigue prediction methods. Develop and validate test protocols and improved augmentor rig test capabilities. Continue rig testing of advanced fan design, advanced low pressure turbine design, and lightweight, simple, LO-compatible inlet and exhaust systems. <b>FY 2012 OCO Plans:</b>						
<b>Title:</b> Major Thrust 3. <b>Description:</b> Develop limited life engine components for missile and remotely piloted aircraft (RPA) applications, including long-range supersonic and hypersonic vehicles.  <b>FY 2010 Accomplishments:</b> Developed and applied advanced modeling and simulation rules and tools for advanced limited life components. Designed and rig tested advanced limited life components. Note: In FY 2010, efforts in this thrust were reduced due to higher AF priorities.  <b>FY 2011 Plans:</b> Develop and apply advanced modeling and simulation rules and tools for advanced limited life components. Design and rig test advanced limited life components.  <b>FY 2012 Base Plans:</b> Develop and apply advanced modeling and simulation rules and tools for ceramic material small turbine blades, variable area turbines, and integration/performance of lubeless bearings. Develop and evaluate components to increase pressure ratio by 50% in this size class with minimum efficiency loss.  <b>FY 2012 OCO Plans:</b>		0.868	5.309	5.400	-	5.400
<b>Title:</b> Major Thrust 4. <b>Description:</b> Develop components for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, and theater transports.  <b>FY 2010 Accomplishments:</b> Developed and applied advanced modeling and simulation rules and tools for advanced limited life components.  <b>FY 2011 Plans:</b>		1.203	1.631	1.659	-	1.659

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2012 Air Force							<b>DATE:</b> February 2011				
<b>APPROPRIATION/BUDGET ACTIVITY</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				<b>R-1 ITEM NOMENCLATURE</b> PE 0602203F: <i>Aerospace Propulsion</i>			<b>PROJECT</b> 623066: <i>Turbine Engine Technology</i>				

  

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>
Develop and apply advanced modeling and simulation rules and tools for advanced limited life components. <b>FY 2012 Base Plans:</b> Develop and apply advanced modeling and simulation rules and tools for emissions and noise to decrease detection. Develop and evaluate components to increase thrust-to-weight ratio and to decrease specific fuel consumption, production cost, and development cost. <b>FY 2012 OCO Plans:</b>					
<b>Accomplishments/Planned Programs Subtotals</b>	59.145	67.274	67.735	-	67.735

  

	<b>FY 2010</b>	<b>FY 2011</b>
<b>Congressional Add:</b> Split Discharge Variable Delivery Pump for Military Aircraft. <b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort. <b>FY 2011 Plans:</b>	1.593	-
<b>Congressional Adds Subtotals</b>	1.593	-

  

<b>C. Other Program Funding Summary (\$ in Millions)</b>											
<b>Line Item</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	<b>FY 2013</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

  

<b>D. Acquisition Strategy</b> N/A
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<b>E. Performance Metrics</b> Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force									DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research				R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion				PROJECT 623145: Aerospace Power Technology			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
623145: Aerospace Power Technology	40.488	32.604	32.655	-	32.655	32.768	31.623	32.361	32.963	Continuing	Continuing
A. Mission Description and Budget Item Justification											
This project develops electrical and thermal management technologies for military aerospace applications. Power component technologies are developed to increase reliability, maintainability, commonality, affordability, and supportability of aircraft and flight line equipment. Research is conducted in energy storage and hybrid power system technologies to enable special purpose applications. Electrical power and thermal management technologies enable future military megawatt level power and thermal management needs. This project supports development of electrical power and thermal management component and systems suitable for applications to legacy and future aircraft platforms including strike and mobility concepts. Lightweight power systems suitable for other aerospace applications are also developed.											
B. Accomplishments/Planned Programs (\$ in Millions)							FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.							25.973	28.624	25.530	-	25.530
Description: Develop electrical power and thermal management component and subsystem technologies with low volume displacement for delivery of high power for manned and unmanned systems.											
FY 2010 Accomplishments: Assessed component performance objectives needed to meet systems level, energy optimized performance goals. Completed investigation of high-rate thermal energy storage for directed energy applications.											
FY 2011 Plans: Perform hardware-in-the-loop simulation tests to validate power and thermal management systems that provide continuous thermal balancing of critical systems over a range of mission profiles. Assess component technologies for application to directed energy weapon concepts.											
FY 2012 Base Plans: Perform tip-to-tail modeling and simulation to identify solutions for platform level power and thermal management needs of next generation military air platforms.											
FY 2012 OCO Plans:											
Title: Major Thrust 2.							4.159	3.980	7.125	-	7.125
Description: Develop technologies for special purpose applications, including hybrid electrical power, thermal management systems, and energy conversion/storage components and subsystems.											

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion		PROJECT 623145: Aerospace Power Technology		
B. Accomplishments/Planned Programs (\$ in Millions)						
		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<b>FY 2010 Accomplishments:</b> Investigated and developed hybrid energy harvesting storage, management, and distribution architectures. Integrated the energy harvesting technologies with novel battery and fuel cell technologies. Integrated and tested thermal management components and subsystems. Implemented methods of energy harvesting and increased energy savings for special purpose applications. Demonstrated long endurance flight tests of integrated systems for remotely piloted aircraft (RPAs).						
<b>FY 2011 Plans:</b> Develop increased fuel flexibility and integrated energy harvesting technologies for expanded special purpose applications for improved power and energy density. Perform integrated flight-weight subsystems flight tests to demonstrate power and energy density goals.						
<b>FY 2012 Base Plans:</b> Perform energy harvesting component flight tests to demonstrate achievement of power and energy dense goals for special purpose applications. Explore technology set for development of power systems for micro air vehicles. Note: In FY 2012, efforts in this thrust are increased due to higher AF priorities.						
<b>FY 2012 OCO Plans:</b>						
Accomplishments/Planned Programs Subtotals		30.132	32.604	32.655	-	32.655
		FY 2010	FY 2011			
<b>Congressional Add:</b> Advanced Lithium Battery Scale-Up and Manufacturing.		1.593	-			
<b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort.						
<b>FY 2011 Plans:</b>						
<b>Congressional Add:</b> Energy Superior Lithium Battery Technology for Defense Applications.		1.593	-			
<b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort.						
<b>FY 2011 Plans:</b>						
<b>Congressional Add:</b> High-Energy Li-Ion Technology for Aviation Batteries.		1.195	-			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2012 Air Force			<b>DATE:</b> February 2011
<b>APPROPRIATION/BUDGET ACTIVITY</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602203F: <i>Aerospace Propulsion</i>	<b>PROJECT</b> 623145: <i>Aerospace Power Technology</i>	

	FY 2010	FY 2011
<b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort.		
<b>FY 2011 Plans:</b>		
<b>Congressional Add:</b> Integrated Engine Starter/Generator.	1.593	-
<b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort.		
<b>FY 2011 Plans:</b>		
<b>Congressional Add:</b> Thermal and Energy Management for Aerospace.	3.187	-
<b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort.		
<b>FY 2011 Plans:</b>		
<b>Congressional Add:</b> Wavelength Agile Spectral Harmonic Oxygen Sensor and Cell-Level Battery Controller.	1.195	-
<b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort.		
<b>FY 2011 Plans:</b>		
<b>Congressional Adds Subtotals</b>	10.356	-

**C. Other Program Funding Summary (\$ in Millions)**

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	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.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2012 Air Force								<b>DATE:</b> February 2011			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				<b>R-1 ITEM NOMENCLATURE</b> PE 0602203F: <i>Aerospace Propulsion</i>				<b>PROJECT</b> 624847: <i>Rocket Propulsion Technology</i>			
<b>COST (\$ in Millions)</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>	<b>FY 2013</b>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
624847: <i>Rocket Propulsion Technology</i>	74.121	58.954	60.420	-	60.420	60.144	61.312	62.432	63.633	Continuing	Continuing
<b>A. Mission Description and Budget Item Justification</b> This project develops rocket propulsion technologies for space access, space maneuver, missiles, the sustainment of strategic systems (including solid boost/missile propulsion, post boost control, aging and surveillance efforts), and tactical missiles. Analytical and experimental areas of emphasis are propellants, propellant management, combustion, rocket material applications, technology for sustainment of strategic systems, and innovative space propulsion concepts. Technologies of interest will improve reliability, performance, survivability, affordability, and environmental compatibility of these systems. Technologies are developed to reduce the weight and cost of components using new materials and improved designs and manufacturing techniques. All efforts in this project contribute to the sustainment of the rocket propulsion industry, providing rocket propulsion technology for the entire Department of Defense. Technologies developed under this program enable capabilities of interest to both the Department of Defense and NASA. Efforts include modeling and simulation, proof of concept tests of critical components, advanced component development, and ground-based tests. Aging and surveillance efforts could reduce lifetime prediction uncertainties for individual motors by 50 percent, enabling motor replacement for cause.											
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>							<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012 Base</b>	<b>FY 2012 OCO</b>	<b>FY 2012 Total</b>
<b>Title:</b> Major Thrust 1.							4.109	4.152	5.001	-	5.001
<b>Description:</b> Develop, characterize, and test advanced hydrocarbons, energetics, solid propellants, and monopropellants to increase space launch payload capability and refine new synthesis methods.											
<b>FY 2010 Accomplishments:</b> Performed screening analysis of potential hydrocarbon fuel additives to improve performance of kerosene. Proceeded with downselect and scale-up promising high energy-density materials candidates. Evaluated scaled-up propellants in advanced combustion devices to determine materials compatibility and performance to include supporting large-scale motor tests. Explored and developed ionic liquids. Initiated scale-up of promising ionic liquids for further characterization. Conducted proof of concept for new computational code to predict molecular properties of promising propellant ingredients. Evaluated suitability for ionic liquid propellants for missile defense interceptor and spacecraft propulsion demonstrations. Initiated technology transfer to industry for production of downselected propellants. Initiated high performance bi-propellant identification program.											
<b>FY 2011 Plans:</b> Conduct experimental and analytical evaluation of potential hydrocarbon fuel additives to improve performance of kerosene. Continue synthesis and downselect process and scale-up of promising high energy-density											

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion	PROJECT 624847: Rocket Propulsion Technology				
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
materials candidates. Evaluate scaled-up propellants in advanced combustion devices to determine materials compatibility and performance to include supporting large-scale motor tests. Explore and develop advanced ionic liquids. Continue scale up experiments of promising ionic liquids for further characterization. Continue proof of concept for new computational code to predict molecular properties of various promising propellant ingredients. Continue evaluation of suitability for ionic liquid propellants for missile defense interceptor and spacecraft propulsion demonstrations. Continue technology transfer to industry for production of downselected propellants. Continue high performance bi-propellant identification and synthesis program. <b>FY 2012 Base Plans:</b> Conduct experimental and analytical evaluation of potential hydrocarbon fuel additives to improve performance of kerosene. Continue synthesis and downselect process and scale-up of promising high energy-density materials candidates. Evaluate scaled-up propellants in advanced combustion devices to determine materials compatibility and performance to include supporting large-scale motor tests. Explore and develop of advanced ionic liquids including synthesis and characterization. Continue scale up experiments of promising ionic liquids for further characterization. Continue evaluation of suitability for ionic liquid propellants for missile defense interceptor and spacecraft propulsion demonstrations. Continue technology transfer to industry for production of downselected propellants. Continue high performance bi-propellant identification and synthesis program. <b>FY 2012 OCO Plans:</b>						
<b>Title:</b> Major Thrust 2. <b>Description:</b> Develop advanced liquid engine combustion technology for improved performance, while preserving chamber lifetime and reliability needs for engine uses in heavy lift space vehicles. <b>FY 2010 Accomplishments:</b> Characterized, studied, and evaluated shear injector performance to ensure chamber/injector compatibility and prevent damage to engines. Developed, analyzed, and transitioned advanced combustion device technology, including injectors and chambers. Developed improved understanding of fundamental combustion and fluid flow/heat transfer processes leading to new methodologies for thermal management, scaling, and combustion instabilities in hydrocarbon fueled liquid rocket engines, reducing the need for conducting large numbers of costly full-scale component and engine tests. Performed pre-selection of most promising advanced propulsion concepts. Applied realistic computational models to optimize performance. Refined experimental demonstrations		6.536	7.095	6.688	-	6.688

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion	PROJECT 624847: Rocket Propulsion Technology				
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
of proof-of-concepts. Continued development of realistic computational models. Conducted system trade studies with improved performance models to evaluate potential return on investment.  <b>FY 2011 Plans:</b> Characterize, study, and evaluate shear injector performance to ensure chamber/injector compatibility and prevent damage to engines. Validate study results in more realistic rocket-chamber conditions and begin transition of predictive tools to industry. Develop, analyze, and transition advanced combustion device technology, including injectors and chambers. Develop improved understanding of fundamental combustion and fluid flow/heat transfer processes leading to new methodologies for thermal management, scaling, and combustion instabilities in hydrocarbon fueled liquid rocket engines, reducing the need for conducting large numbers of costly full-scale component and engine tests. Characterize design changes in high heat flux test rig in preparation for evaluating cooling channel designs. Conduct validation and verification of advanced modeling and simulation capabilities. Perform pre-selection of most promising advanced propulsion concepts; apply realistic computational models to optimize performance. Refine experimental demonstrations of proof-of-concepts, continue development of realistic computational models. Conduct system trade studies with improved performance models to evaluate potential return on investment.  <b>FY 2012 Base Plans:</b> Using data obtained from a hydrocarbon demonstrator engine, characterize, study, and evaluate injector performance to ensure chamber/injector compatibility and prevent damage to engines. Validate study results in more realistic rocket-chamber conditions and transition of predictive tools to industry. Feed advanced combustion device technology into Hydrocarbon Boost Demo and to various contractor designs, continue additional analysis on changing designs and concepts. Develop improved understanding of fundamental combustion and fluid flow/heat transfer processes leading to new methodologies for thermal management, scaling, and combustion instabilities in hydrocarbon fueled liquid rocket engines, reducing the need for conducting large numbers of costly full-scale component and engine tests. Evaluate novel nozzle cooling channels for use with hydrocarbon fuels in the high heat flux test rig. Conduct validation and verification of advanced modeling and simulation capabilities. Perform pre-selection of most promising advanced propulsion concepts; apply realistic computational models to optimize performance. Refine experimental demonstrations of proof-of-concepts, continue development of realistic computational models. Conduct system trade studies with improved performance models to evaluate potential return on investment.  <b>FY 2012 OCO Plans:</b>						

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion		PROJECT 624847: Rocket Propulsion Technology	
B. Accomplishments/Planned Programs (\$ in Millions)					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<b>Title:</b> Major Thrust 3.	5.420	5.941	5.857	-	5.857
<b>Description:</b> Develop advanced material applications for lightweight components and material property enhancements for current and future rocket propulsion systems.					
<b>FY 2010 Accomplishments:</b> Developed new advanced ablative components using hybrid polymers. Characterized and refined processing parameters of new nano-reinforced high temperature polymers and scale-up processing of carbon-carbon materials. Developed new advanced materials for use with high-energy propellants. Continued to explore using nanocomposites for liquid rocket engine components and optimized processing technology using multifunctional nanomaterials. Characterized and understood the mechanisms behind a new class of hydrophobic and oleophobic materials exploring various transition opportunities.					
<b>FY 2011 Plans:</b> Develop new advanced ablative components using hybrid polymers. Continue to characterize and finalize processing parameters of new nano-reinforced high temperature polymers and scale-up processing of carbon-carbon materials. Develop new advanced materials for use with high-energy propellants. Continue to explore applications of nanocomposites for the hydrocarbon boost demo and other liquid rocket engine components and optimize processing technology using multifunctional nanomaterials. Continue to characterize and understand the mechanisms behind a new class of hydrophobic and oleophobic materials exploring various transition opportunities.					
<b>FY 2012 Base Plans:</b> Develop new material formulations that better address the challenges inside solid rockets. Continue to characterize and finalize processing parameters of new reinforced high temperature polymers and scale-up processing of carbon-carbon materials. Refine formulations of polymers for use in various liquid rocket engine components. Continue to characterize and understand the mechanisms behind a new class of hydrophobic and oleophobic materials exploring various transition opportunities.					
<b>FY 2012 OCO Plans:</b>					
<b>Title:</b> Major Thrust 4.	18.146	23.652	16.569	-	16.569
<b>Description:</b> Develop advanced liquid engine technologies for improved performance, while increasing life and reliability needs for engine uses in expendable and reusable launch vehicles.					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion		PROJECT 624847: Rocket Propulsion Technology		
B. Accomplishments/Planned Programs (\$ in Millions)						
		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<b>FY 2010 Accomplishments:</b> Updated advanced modeling, simulation, and analysis tools with results from full-scale component testing. Developed enabling hydrocarbon boost technology for future spacelift concepts and initiated risk reduction activities. Developed engine health monitoring technologies supporting the hydrocarbon engine technology development effort. Developed advanced hydrocarbon engine technologies using fuels other than kerosene. Developed and demonstrated in-house, moderate scale liquid rocket component testing capability. Initiated evaluation of high performance compact liquid rocket engine technology and bipropellant liquid rocket engine technologies.						
<b>FY 2011 Plans:</b> Develop enabling hydrocarbon boost technology for future spacelift concepts and continue risk reduction activities. Continue development of engine health monitoring technologies supporting the hydrocarbon boost technology development effort. Develop advanced hydrocarbon engine technologies using fuels other than kerosene. Develop and demonstrate in-house, moderate scale liquid rocket component testing capability. Develop high performance compact liquid rocket engine technologies. Continue development and evaluation of bipropellant technologies. Note: In FY 2011, efforts in this thrust are increased due to multiple programs scheduled for major hardware scale-up and production.						
<b>FY 2012 Base Plans:</b> Develop enabling hydrocarbon boost technology for future spacelift concepts and continue risk reduction activities for the development of hydrocarbon boost technologies. Continue development of engine health monitoring technologies supporting the hydrocarbon boost technology development effort. Develop advanced hydrocarbon engine technologies using fuels other than kerosene. Develop and demonstrate in-house, moderate scale liquid rocket component testing capability. Develop high performance compact liquid rocket engine technologies. Continue development and evaluation of bipropellant technologies. Note: In FY 2012, efforts in this thrust are decreased due to higher AF priorities.						
<b>FY 2012 OCO Plans:</b>						
<b>Title:</b> Major Thrust 5.		5.648	5.831	4.987	-	4.987
<b>Description:</b> Develop solar electric, solar thermal, chemical, and advanced propulsion technologies for station-keeping, repositioning, and orbit transfer for satellites and satellite constellations.						
<b>FY 2010 Accomplishments:</b>						

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion		PROJECT 624847: Rocket Propulsion Technology	
B. Accomplishments/Planned Programs (\$ in Millions)					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Completed Hall thruster development efforts. Evaluated Hall thrusters for microsatellites propulsion systems. Scale-up tested monopropellants, evaluated advanced ignition schemes and chamber concepts. Assessed advanced chemical propulsion technology developments for satellite thrusters. Developed advanced multi-mode chemical-electric propulsion concepts for satellites. Developed next generation high power spacecraft propulsion. Initiated advanced modeling and simulation tool developments to improve design and analysis tools for a wide range of spacecraft propulsion concepts/technologies.  <b>FY 2011 Plans:</b> Evaluate advanced plasma thrusters for microsatellites propulsion systems. Scale-up testing monopropellants, evaluate advanced ignition schemes and chamber concepts. Assess advanced chemical propulsion technology developments for satellite thrusters, continue component developments. Develop advanced multi-mode chemical-electric propulsion concepts for satellites, continue component developments. Develop next generation high power electric spacecraft propulsion. Continue advanced modeling and simulation tool developments to improve design and analysis tools for a wide range of spacecraft propulsion concepts/technologies.  <b>FY 2012 Base Plans:</b> Characterize advanced plasma thrusters for microsatellites propulsion systems. Conduct scale-up of advanced monopropellants, evaluate advanced ignition schemes and chamber concepts. Assess advanced chemical propulsion technology developments for satellite thrusters, continue component developments. Develop advanced multi-mode chemical-electric propulsion concepts for satellites, continue component developments. Continue development of next generation high power electric spacecraft propulsion. Continue advanced modeling and simulation tool developments to improve design and analysis tools for a wide range of spacecraft propulsion concepts/technologies.  <b>FY 2012 OCO Plans:</b>					
<b>Title:</b> Major Thrust 6.  <b>Description:</b> Develop missile propulsion and boost technologies for space access and strike applications.  <b>FY 2010 Accomplishments:</b> Continued component development and risk reduction efforts for missile propulsion demonstration. Used physics-based modeling, simulation, and analysis tools to design and analyze sub-scale components. Verified development of rapid densification nozzle technology using improved strategic propellants for future ballistic missiles. Demonstrated low-cost, high temperature, non-erosive components for solid rocket motors. Developed	14.969	9.297	15.136	-	15.136

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion	PROJECT 624847: Rocket Propulsion Technology				
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
advanced tactical propulsion technologies. Evaluated next generation of updated, physics-based modeling, simulation, and analysis tools for missile propulsion components and applications.  <b>FY 2011 Plans:</b> Continue the component development and risk reduction efforts for future Missile Propulsion demonstration. Demonstrate components for solid rocket motors. Develop advanced tactical propulsion technologies. Continue development and evaluation of next generation of updated, physics-based modeling, simulation, and analysis tools for missile propulsion components and applications. Complete sub-scale propellant development efforts. Note: In FY 2011, efforts in this thrust are decreased due to higher AF priorities.  <b>FY 2012 Base Plans:</b> Test components as part of risk reduction efforts for future missile propulsion demonstration. Develop advanced tactical propulsion technologies. Continue development and evaluation of next generation of updated, physics-based modeling, simulation, and analysis tools for missile propulsion components and applications.  <b>FY 2012 OCO Plans:</b>						
<b>Title:</b> Major Thrust 7.  <b>Description:</b> Develop missile propulsion technologies and aging and surveillance technologies for ballistic missiles.  <b>FY 2010 Accomplishments:</b> Conducted advanced service life prediction technology program. Developed and applied existing and advanced sensors to be attached to solid rocket motors, and tools that can integrate sensor data into existing aging and surveillance tool suite. Continued efforts to integrate advanced aging and surveillance technologies into demonstrations to validate and verify efforts to reduce uncertainties and accurately model motor behavior. Continued development of next generation of chemical and aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, and non-destructive analysis tools.  <b>FY 2011 Plans:</b> Conduct advanced service life prediction technology program. Develop and apply existing and advanced sensors to be attached to solid rocket motors, and tools that can integrate sensor data into existing aging and surveillance tool suite. Continue efforts to integrate advanced aging and surveillance technologies into demonstrations to validate and verify efforts to reduce uncertainties and accurately model motor behavior.		2.563	2.986	6.182	-	6.182

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion	PROJECT 624847: Rocket Propulsion Technology				
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Continue development of next generation of chemical and aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, and non-destructive analysis tools. <b>FY 2012 Base Plans:</b> Conduct sub-scale testing of existing and advanced sensors to be attached to solid rocket motors, and tools that can integrate sensor data into existing aging and surveillance tool suite. Integrate advanced aging and surveillance technologies into demonstrations to validate and verify efforts to reduce uncertainties and accurately model motor behavior. Apply next generation of chemical and aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, and non-destructive analysis tools. Note: In FY 2012, efforts in this thrust are increased due to higher AF priorities. <b>FY 2012 OCO Plans:</b>						
Accomplishments/Planned Programs Subtotals		57.391	58.954	60.420	-	60.420
		FY 2010	FY 2011			
Congressional Add: Advanced Vehicle Propulsion Center. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:		2.390	-			
Congressional Add: Aerospace Lab Equipment Upgrade. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:		1.195	-			
Congressional Add: AFRL Edwards Rocket Test Stand 2-A Technical Improvements. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:		3.187	-			
Congressional Add: Development and Testing of Advanced Hybrid Rockets for Space Applications. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:		2.788	-			
Congressional Add: Integrated Propulsion Analysis and Spacecraft Engineering Tools (IPAT/ISET).		4.780	-			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2012 Air Force								<b>DATE:</b> February 2011			
<b>APPROPRIATION/BUDGET ACTIVITY</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				<b>R-1 ITEM NOMENCLATURE</b> PE 0602203F: <i>Aerospace Propulsion</i>				<b>PROJECT</b> 624847: <i>Rocket Propulsion Technology</i>			

  

	<b>FY 2010</b>	<b>FY 2011</b>
<b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort.		
<b>FY 2011 Plans:</b>		
<b>Congressional Add:</b> Multi-Mode Propulsion Phase II-A: High Performance Green Propellant.	1.593	-
<b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort.		
<b>FY 2011 Plans:</b>		
<b>Congressional Add:</b> Next Generation Solar Electric In-Space Propulsion.	0.797	-
<b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort.		
<b>FY 2011 Plans:</b>		
<b>Congressional Adds Subtotals</b>	16.730	-

  

**C. Other Program Funding Summary (\$ in Millions)**

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	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.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research				R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion				PROJECT 625330: Aerospace Fuel Technology			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
625330: Aerospace Fuel Technology	6.744	6.679	6.242	-	6.242	6.540	6.534	6.505	6.624	Continuing	Continuing
A. Mission Description and Budget Item Justification											
This project evaluates hydrocarbon-based fuels for legacy and advanced turbine engines, scramjets, pulse detonation and combined cycle engines. This project also considers fuel related concepts that can increase turbine engine operational reliability, durability, mission flexibility, energy efficiency, and performance while reducing weight, fuel consumption, and cost of ownership. Applications include missiles, aircraft, sustained high-speed vehicles, and responsive space launch. Analytical and experimental areas of emphasis include evaluations of fuel properties and characteristics of alternative fuels developed from unconventional sources (such as coal, natural gas, biomass, and combinations thereof), unique/alternate fuels and components used in integrated thermal and energy management systems including high heat sink fuel capability, fuels logistics and associated vulnerabilities, and combustion diagnostics and engine emissions measurements.											
B. Accomplishments/Planned Programs (\$ in Millions)							FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.							2.821	3.200	3.153	-	3.153
Description: Conduct evaluations and perform technical assessments of alternative hydrocarbon fuels derived from coal, natural gas, and biomass for use in legacy and advanced aerospace systems.											
FY 2010 Accomplishments: Completed component evaluations of 50 percent synthetic paraffinic kerosene (SPK) produced by Fischer-Tropsch synthesis blended with 50 percent conventional aviation fuel. Conducted component "fit-for-purpose" evaluations of up to 100 percent SPK. Conducted initial evaluations of biomass derived aviation fuels, both blended with conventional aviation fuel and used 100 percent. Assessed analytical tools being developed to assess CO2 footprint of coal and biomass derived alternative fuels.											
FY 2011 Plans: Complete component "fit-for-purpose" evaluations of up to 100 percent SPK and make recommendation as to maximum SPK in blend use. Complete initial evaluations of biomass derived aviation fuels and assessment of associated CO2 footprint. Conduct follow-on component evaluations as available fuel quantities permit.											
FY 2012 Base Plans: Develop link between fully-synthetic fuel composition and basic physical properties and rig test performance.											
FY 2012 OCO Plans:											
Title: Major Thrust 2.							0.780	1.100	1.089	-	1.089

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research		R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion		PROJECT 625330: Aerospace Fuel Technology		
B. Accomplishments/Planned Programs (\$ in Millions)						
		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p><b>Description:</b> Develop and demonstrate advanced components and conduct performance assessments of advanced aircraft integrated thermal and energy management systems for engines and aircraft.</p> <p><b>FY 2010 Accomplishments:</b> Assessed advanced aircraft thermal management designs. Developed and assessed techniques to improve the thermal characteristics of aviation fuels used in integrated thermal and energy management systems. Developed advanced hydrocarbon based endothermic fuel technologies applicable to combined cycle engines.</p> <p><b>FY 2011 Plans:</b> Assess advanced aircraft thermal management designs. Develop and assess techniques to improve the thermal characteristics of aviation fuels used in integrated thermal and energy management systems. Develop advanced hydrocarbon based endothermic fuel technologies applicable to combined cycle engines.</p> <p><b>FY 2012 Base Plans:</b> Assess advanced catalyst approaches to enhancing heat sink in hydrocarbon-based endothermic fuels.</p> <p><b>FY 2012 OCO Plans:</b></p>						
<p><b>Title:</b> Major Thrust 3.</p> <p><b>Description:</b> Study and evaluate low-cost approaches to reduce fuel logistics footprint to reduce cost. Study fuel logistics vulnerabilities and develop detection and mitigation technologies.</p> <p><b>FY 2010 Accomplishments:</b> Assessed aberrant logistical fuels to support field operations and recommend possible corrective actions. Evaluated low cost fuel additives and assessed the impact on biological growth in fuel. Completed the development of experimental systems to simulate biological contamination in aircraft fuel systems and ground storage facilities and investigated possible mitigation actions.</p> <p><b>FY 2011 Plans:</b> Assess aberrant logistical fuels to support field operations and investigate impact of novel corrective actions. Evaluate low cost fuel additives and assessment of the impact on biological growth in fuel. Continue the investigation of actions to mitigate the growth of biological agents in fuel. Investigate the development of biological mutations in fuel leading to the development of resistance to chemical biocides and antifungal agents.</p> <p><b>FY 2012 Base Plans:</b></p>		0.976	1.000	1.000	-	1.000

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: Research, Development, Test & Evaluation, Air Force BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602203F: Aerospace Propulsion	PROJECT 625330: Aerospace Fuel Technology				
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Develop biological growth mitigation approaches for commercial jet fuels in support of AF effort to implement commercial off-the-shelf jet fuels. Evaluate approaches for portable hydrogen generation to support emergency field power generation. <b>FY 2012 OCO Plans:</b>						
<b>Title:</b> Major Thrust 4. <b>Description:</b> Develop and test advanced emissions diagnostic techniques for airbreathing propulsion systems. Conduct evaluations of the combustion and emissions characteristics of aviation fuels.  <b>FY 2010 Accomplishments:</b> Completed combustion emissions evaluations of high pressure combustor sectors operating on 100 percent pure and blends of synthetic paraffinic kerosene with conventional aviation fuel and compared to analytical predictions. Developed diagnostic protocols for aircraft ground emissions measurements and perform emissions evaluations on fielded engines to investigate particulate formation and composition. Initiated development of emissions diagnostics applicable to advanced high pressure combustor systems. Conducted preliminary assessment of combustion emissions from biomass derived aviation fuels.  <b>FY 2011 Plans:</b> Develop diagnostic protocols for aircraft ground emissions measurements and perform emissions evaluations on fielded engines to investigate particulate formation and composition. Develop emissions diagnostics applicable to advanced high pressure combustor systems. Assess combustion emissions from biomass derived aviation fuels. Conduct assessment of combustion emissions from blends of coal/biomass derived aviation fuels.  <b>FY 2012 Base Plans:</b> Implement advanced particulate diagnostics in high-pressure combustor test rig. Assess emissions from fully-synthetic fuels relative to JP-8 and JP-8/synthetic blends.  <b>FY 2012 OCO Plans:</b>		0.861	1.379	1.000	-	1.000
Accomplishments/Planned Programs Subtotals		5.438	6.679	6.242	-	6.242
		FY 2010	FY 2011			
Congressional Add: National Test Facility for Aerospace Fuels Propulsion.		1.306	-			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2012 Air Force			<b>DATE:</b> February 2011
<b>APPROPRIATION/BUDGET ACTIVITY</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	<b>R-1 ITEM NOMENCLATURE</b> PE 0602203F: <i>Aerospace Propulsion</i>	<b>PROJECT</b> 625330: <i>Aerospace Fuel Technology</i>	

	<b>FY 2010</b>	<b>FY 2011</b>
<b>FY 2010 Accomplishments:</b> Conducted Congressionally-directed effort.		
<b>FY 2011 Plans:</b>		
<b>Congressional Adds Subtotals</b>	1.306	-

**C. Other Program Funding Summary (\$ in Millions)**

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	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.

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