RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE
February 2003

BUDGET ACTIVITY
03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE
0603216F Aerospace Propulsion and Power Technology

	COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	112,738	88,236	114,726	62,578	67,710	72,298	82,408	82,878	Continuing	TBD
2480	Aerospace Fuels and Atmospheric Propulsion	11,456	10,971	3,128	3,182	7,076	15,783	18,872	18,491	Continuing	TBD
3035	Aerospace Power Technology	4,254	6,104	4,221	4,308	4,344	4,421	4,489	4,553	Continuing	TBD
4921	Aircraft Propulsion Subsystems Int	34,672	35,991	26,345	22,779	22,709	20,077	26,545	26,878	Continuing	TBD
4922	Space & Missile Rocket Propulsion	28,546	1,433	12,848	6,055	7,084	5,048	5,125	5,196	Continuing	TBD
5098	Advanced Aerospace Propulsion	0	0	38,885	0	0	0	0	0	Continuing	TBD
681B	Advanced Turbine Engine Gas Generator	33,810	33,737	29,299	26,254	26,497	26,969	27,377	27,760	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

Note: In FY 2002, all turbine engine technology efforts performed in PE 0603202F, Project 668A, were transferred to PE 0603216F, Project 4921. Also in FY 2002, all rocket propulsion technology efforts performed in PE 0603302F, Projects 4373 and 6340, were transferred to PE 0603216F, Project 4922, in order to align projects with the Air Force Research Laboratory organization. In FY 2003, space unique tasks in Project 4922 were transferred to PE 0603500F, Project 5033, in conjunction with the Space Commission recommendation to consolidate all space unique activities. In Project 4922, space unique includes all Integrated High Payoff Rocket Propulsion Technology activities except Technology for the Sustainment of Strategic Systems and tactical missiles. In FY 2004, Project 5098 is a new project, but not a New Start. This effort supports increased emphasis being placed on the National Aerospace Initiative and ongoing hypersonics effort.

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(U) A. Mission Description

This program develops and demonstrates technologies to achieve enabling and revolutionary advances in turbine, advanced cycle, and rocket propulsion, as well as power generation and storage, and fuels. The program has five projects, each focusing on technologies with a high potential to enhance the performance of existing and future Air Force weapons systems. 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 project integrates the engine cores demonstrated in the ATEGG project with low-pressure components into demonstrator engines. The Aerospace Power Technologies project develops and demonstrates power technologies for weapons and aircraft. The Space and Missile Rocket Technology project develops and demonstrates innovative rocket propulsion technologies, propellants, and manufacturing techniques. Finally, the Aerospace Fuels and Atmospheric Propulsion project develops and demonstrates improved hydrocarbon fuels and advanced propulsion systems for high-speed/hypersonic flight. Turbine engine propulsion projects within this program are part of the Integrated High Performance Turbine Engine Technology and the Versatile Affordable Advanced Turbine Engine programs. Rocket propulsion projects within this program are part of the Integrated High Payoff Rocket Propulsion Technology program, which includes the area of Technology for the Sustainment of Strategic Systems. In FY 2003, Congress added $3.5 million for the Variable Flow Ducted Rocket Propulsion System and $1.0 million for the Joint Expendable Turbine Engine Concept Phase III.

(U) B. Budget Activity Justification

This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

(U) C. Program Change Summary ($ in Thousands)

		FY 2002	FY 2003	FY 2004	Total Cost
(U)	Previous President's Budget	121,548	85,650	72,863	
(U)	Appropriated Value	122,735	90,150		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-1,187	-953		
	b. Small Business Innovative Research	-3,566			
	c. Omnibus or Other Above Threshold Reprogram		-961		
	d. Below Threshold Reprogram	-4,684			
	e. Rescissions	-560			
(U)	Adjustments to Budget Years Since FY 2003 PBR			41,863	
(U)	Current Budget Submit/FY 2004 PBR	112,738	88,236	114,726	TBD

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(U) C. Program Change Summary ($ in Thousands) Continued

(U) Significant Program Changes:

Changes to this program since the previous President' Budget are due to increased funding for technologies supporting the National Aerospace Initiative. Outyear funding for the hypersonic activity will be addressed in the FY 2005 President's Budget development.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: **February 2003**

BUDGET ACTIVITY
03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE
0603216F Aerospace Propulsion and Power Technology

PROJECT
2480

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
2480 Aerospace Fuels and Atmospheric Propulsion	11,456	10,971	3,128	3,182	7,076	15,783	18,872	18,491	Continuing	TBD

(U) A. Mission Description

This project develops and demonstrates improved hydrocarbon fuels and advanced, novel aerospace propulsion systems, including systems for high-speed/hypersonic flight and access to space. The advanced fuel emphasis is on developing and demonstrating new thermally stable, high-heat sink, and controlled chemically reacting fuels for a conventional turbine engine and other advanced propulsion systems. The project also develops 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.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $3,650 Developed techniques for merging the scramjet with other engine cycles such as, rockets and gas turbine engines to enable responsive, reliable, operable, and affordable access to space. Evaluated options to enable variable geometry scramjet technologies. Initiated development of a variable geometry scramjet flow path. Developed an inlet system for airbreathing space access vehicles requiring multiple scramjet engine modules to enable fuller dominance of space. Designed, fabricated, and initiated wind tunnel testing of a sub-scale multiple scramjet engine inlet system. Quantified scramjet inlet mass capture and boundary layer characteristics of each module resulting from multi-engine interactions.

(U) $3,059 Developed high fidelity analytical tools to evaluate combined cycle engine options (e.g., gas turbine and ramjet/scramjet combinations) for next generation aerospace vehicles and their weapons for long-range strike. Identified key combined/combination cycle engine technologies to maximize the use of vehicle speed in force miniaturization and platform survivability for a capability beyond low-observables. Conducted analyses to identify an optimum transition Mach number between gas turbine engine and ramjet/scramjet engine cycles and the maximum cruise speed of the ramjet/scramjet engine. Conducted a pre-design study to evaluate force-multiplier and bomber survivability as a function of a maximum sustainable flight Mach number achievable with select gas turbine-based combined/combination cycle engine options.

(U) $1,000 Developed an enhanced high-heat sink endothermic fuel system cooling technology to enable responsive, reliable, operable, and affordable access to space. Determined optimum operating conditions to ensure low catalyst coking and high efficiency cooling. Began evaluation of advanced fuel/additive combinations to improve ignition and aerospace vehicle operational characteristics. Designed and fabricated subscale hardware to assess component operability and durability in small scale simulators.

(U) $1,000 Evaluated advanced high-heat sink fuels and advanced fuel cooling technologies for next generation aerospace vehicles for long-range strike.

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BUDGET ACTIVITY **03 - Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **2480**

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

Determined requirements for fuel/fuel additive combinations to improve component life and durability, improve fuel efficiency, reduce weight, and enable operation of advanced propulsion cycles. Developed a comprehensive test and qualification strategy for advanced high-heat sink fuels. Initiated design and fabrication of reduced scale fuel system simulation components unique to next generation bombers.

(U) $20 — Demonstrated thermally stable fuels to enhance cooling capacity (performance) and reduce fuel system maintenance. Demonstrated advanced high-heat sink fuels to increase fuel delivery system durability at high temperatures and to reduce maintenance due to fuel degradation in a sub-scale integrated fuel/air heat exchanger.

(U) $400 — Determined fuel cooling requirements for advanced aircraft sensors and directed energy weapons to meet the needs of evolving manned and unmanned aerospace systems. Determined properties for low temperature additives to prevent fuel from freezing and to allow advanced unmanned and manned systems to sustain high altitude loiter for extended periods.

(U) $797 — Developed low-cost fuel additives for Air Force applications. Evaluated and demonstrated optimum low-cost fuel additives to reduce particulate emissions from gas turbine engines by 50 percent. Evaluated and demonstrated low-cost fuel additives to improve ignition characteristics and combustion in current, advanced, and combined cycle engines.

(U) $800 — Developed fuel system technology. Designed and developed fuel system simulators to evaluate key high temperature fuel system components of reusable aerospace vehicles. The focus will be on aerospace vehicles with advanced and combined cycle engines that require high levels of fuel cooling. Identified fuel concepts to maximize performance of advanced and combined cycle engines and minimize logistics costs.

(U) $730 — Identified and developed low-cost approaches to reducing the fuel logistics footprint for the Expeditionary Air Force. Determined benefits of advanced additive packages to improve any commercially available jet fuel to meet military standards. Developed novel methods to inject additives to improve fuels and advanced field diagnostic techniques, such as smart nozzles, to assess fuel quality, additive injection requirements, and to aid in mission planning by monitoring mission limiting fuel properties.

(U) $11,456 — Total

(U) FY 2003 ($ in Thousands)

(U) $0 — Accomplishments/Planned Program

(U) $4,473 — Continue development of high fidelity analytical tools to evaluate combined cycle engine options, such as gas turbine and ramjet/scramjet combinations, for next generation aerospace vehicles and their weapons for long-range strike. Continue evaluation of advanced (ramjet/scramjet) and combined cycle engine options for next generation aerospace vehicles and their weapons for long-range strike. Develop key engine technologies to maximize the use of vehicle speed in force miniaturization and platform survivability for a capability beyond low-observables.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2003
BUDGET ACTIVITY **03 - Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **2480**

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

		Continue to conduct analyses and experiments to optimize component technologies for transition between gas turbine engine and ramjet/scramjet engine cycles, and to optimize the cruise speed of ramjet/scramjet engines. Continue to conduct a pre-design study to evaluate force-multiplier and bomber survivability as a function of a flight Mach number achievable for next generation aerospace vehicles and their weapons.
(U)	$672	Demonstrate thermally stable fuels that will enhance cooling capacity (performance) and reduce fuel system maintenance. Continue to study, test, and demonstrate advanced high-heat sink fuels that can increase fuel delivery system durability at high temperatures and reduce maintenance due to fuel degradation in a sub-scale integrated fuel/air heat exchanger. Demonstrate long-term JP-8+225 performance in a fuel system simulator.
(U)	$384	Continue determination of fuel cooling requirements for advanced aircraft sensors and directed energy weapons that will meet the needs of evolving manned and unmanned aerospace systems. Develop requirements for low temperature additives to prevent fuel from freezing to allow advanced manned and unmanned systems sustain high altitude loiter for extended periods. Refine design and build an Unmanned Aerial Vehicle fuel system/tank simulator to study high and low temperature fuel behavior.
(U)	$769	Develop low-cost fuel additives for Air Force applications. Continue to perform demonstration testing with low-cost fuel additives to reduce particulate emissions from gas turbine engines by 50 percent and to improve ignition characteristics and combustion in current and advanced propulsion concepts, including combined cycle engines. Demonstrate effectiveness of particulate mitigation additives in a full-scale engine test.
(U)	$384	Develop fuel system technology. Continue to design and develop fuel system simulators that will evaluate key high temperature fuel system components of reusable aerospace vehicles. The focus will be on aerospace vehicles with advanced and combined cycle engines that require high levels of fuel cooling. Continue to investigate fuel concepts that will maximize the performance of advanced or combined cycle engines and minimize logistic costs. Complete characterization of hydrocarbon fuel candidates for combined cycle engines.
(U)	$841	Identify and develop low-cost approaches to reducing the fuel logistics footprint for the Expeditionary Air Force. Determine the benefits of advanced additive packages to improve any commercially available jet fuel that can meet military standards. Develop novel methods to inject additives packages to improve fuels and advanced field diagnostic techniques, such as smart nozzles, to assess fuel quality, additive injection requirements, and aid in mission planning by monitoring mission limiting fuel properties. Demonstrate a field-capable concept for fuel identification and characterization.
(U)	$3,448	Develop a preliminary design for an integrated tactical missile technology demonstrator using a Variable Flow Ducted Rocket (VFDR). Develop conceptual designs for VFDR tactical missiles that are compatible with the internal carriage in the F/A-22. Define a preliminary flight test plan. Develop high-fidelity models and simulations for engineering, engagement, and mission analysis. Perform critical experiments to reduce the risk of key component technologies.

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BUDGET ACTIVITY **03 - Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **2480**

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

(U)	$10,971	Total

(U) FY 2004 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$829	Demonstrate thermally stable fuels and fuel system hardware concepts to enhance cooling capacity (performance), minimize fuel coking, and reduce fuel system maintenance. Continue to study, test, and demonstrate advanced high-heat sink fuels and hardware concepts that can increase fuel delivery system durability and performance at high temperatures and can reduce maintenance due to fuel degradation in aircraft fuel systems and engine control hardware. Demonstrate long-term JP-8+225 performance in bench and full-scale fuel systems. Demonstrate performance of fuel developed from alternative (non-petroleum) sources in reduced scale fuel system simulators and engine tests.
(U)	$415	Continue determination of fuel requirements to meet the needs of evolving manned and unmanned aerospace systems. Demonstrate low temperature additives for use in jet fuel to allow advanced manned and unmanned systems to sustain high altitude loiter for extended periods. Refine design and build an Unmanned Aerial Vehicle fuel system/tank simulator to study low temperature fuel behavior. Demonstrate the use of low temperature additives in Unmanned Aerial Vehicle engine components and engine.
(U)	$802	Develop and demonstrate efficacy of low-cost, environmentally friendly fuel additives to reduce soot particulate emissions from gas turbine engines using advanced research combustors and small turbine engines. Demonstrate additives that reduce soot emissions by at least 50 percent. Develop additives to improve ignition and combustion characteristics in current and advanced propulsion concepts, including combined cycle engines. Qualify additives through material compatibility, toxicology, and hot section tests, and demonstrate additive effectiveness in engine component tests.
(U)	$682	Demonstrate enhancements to fuel system technology. Continue to design and develop concept hardware and fuel system simulators to evaluate key high temperature fuel system components of reusable aerospace vehicles, focusing on aerospace vehicles with advanced and combined cycle engines that require high levels of fuel cooling. Complete characterization of hydrocarbon fuel candidates and enhanced hardware concepts for combined cycle engines.
(U)	$400	Continue developing low-cost methods to reduce the fuel logistics footprint for the Expeditionary Air Force and to support Global Reach. Continue to develop novel methods for fuel analysis and additization in order to extend the usable temperature range of commercially available aviation fuel through application of smart nozzle technologies, including biologically related approaches. Demonstrate applicability of rapid fuel screening and identification using chromatography-based statistical analysis methods and commercially available fuel vapor analyzers.
(U)	$3,128	Total

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(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:
(U) PE 0602203F, Aerospace Propulsion.
(U) PE 0602102F, Materials.
(U) PE 0602204F, Aerospace Sensors.
(U) PE 0603112F, Advanced Materials for Weapons Systems.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2003

BUDGET ACTIVITY: **03 - Advanced Technology Development (ATD)**

PE NUMBER AND TITLE: **0603216F Aerospace Propulsion and Power Technology**

PROJECT: **3035**

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
3035 Aerospace Power Technology	4,254	6,104	4,221	4,308	4,344	4,421	4,489	4,553	Continuing	TBD

(U) A. Mission Description

This project develops and demonstrates electrical power generation, energy storage, thermal management, and distribution systems 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 also develops and demonstrates high power generation, energy storage, and thermal management technologies to enable high power density sources for directed energy weapons.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Programs

(U) $1,887 Developed a high-density secondary power system and advanced weapons power technologies for a next generation aerospace vehicle for long-range strike. Initiated trade studies, detailed design, and critical technology development to optimize secondary power system size, weight, and efficiency. Evaluated electric power technology options for advanced weapon systems.

(U) $236 Developed cryogenic power generation, high rate batteries, energy storage and power conditioning components, and system technologies with low volume displacement for delivery of high power to operate directed energy weapons. Fabricated lengths of Yttrium Barium Copper Oxide sufficient to fabricate test coils for cryogenic generators.

(U) $777 Developed power generation/conditioning/distribution, energy storage, and thermal management components and subsystem technologies for manned and unmanned aircraft systems. Demonstrated technologies for an integrated power unit for advanced fighter aircraft and unmanned vehicles.

(U) $1,354 Defined requirements for high power generation systems for directed energy weapons. Evaluated trade offs and defined approaches for superconducting and conventional generators for weapons power systems.

(U) $4,254 Total

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BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology	PROJECT 3035

(U) A. Mission Description Continued

(U)	FY 2003 ($ in Thousands)	
(U)	$0	Accomplishments/Planned Programs
(U)	$1,921	Continue to develop and demonstrate high-density secondary power systems and advanced weapons power technologies for a next generation aerospace vehicle for long-range strike. Conduct trade studies, detailed design, and critical technology development to optimize secondary power system size, weight, and efficiency. Continue to evaluate electric power technology options for advanced weapon systems.
(U)	$896	Develop power generation and conditioning, high rate batteries, and energy storage component and subsystem technologies for integration of high power subsystems with directed energy weapons. Develop a high power, low duty cycle generator for pulsed directed energy weapons. Continue to fabricate lengths of Yttrium Barium Copper Oxide sufficient to fabricate coated conductors for cryogenic generators.
(U)	$1,109	Develop power generation/conditioning/distribution component, energy storage, and thermal management components and subsystem technologies for manned and unmanned aircraft systems. These technologies will improve aircraft self-sufficiency, reliability, maintainability, and supportability while reducing life cycle costs and enabling new capabilities. Develop a power generator system that is closely coupled with the propulsion system.
(U)	$2,178	Develop power generation/conditioning/distribution, energy storage, and thermal management components and subsystem technologies that are synergistic with air, space, and weapons platforms. Demonstrate advanced power conditioning technologies with motor drives and lithium-ion batteries to provide reductions in both volume and weight.
(U)	$6,104	Total
(U)	FY 2004 ($ in Thousands)	
(U)	$0	Accomplishments/Planned Programs
(U)	$1,200	Develop power generation/conditioning, high rate batteries, and energy storage component and subsystem technologies for integration of high power subsystems. These technologies will enable the delivery of high power for operation of directed energy weapon. Fabricate high power, low duty cycle generator systems for pulsed directed energy weapon.
(U)	$2,061	Develop power generation/conditioning/distribution component, energy storage, and thermal management components and subsystem technologies for manned and unmanned aircraft systems. These technologies improve aircraft self-sufficiency, reliability, maintainability, and supportability while reducing life cycle costs and enabling new capabilities. Initiate design of the demonstration generator for integration into mid-thrust class engines. Fabricate and test large amp-hour (200) cells and batteries.
(U)	$960	Develop power generation/conditioning/distribution, energy storage, and thermal management components and subsystem technologies that are synergistic with aerospace and weapons platforms. Fabricate low volume/low weight high temperature motor drive.

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued
(U) $4,221 Total

(U) B. Project Change Summary
Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)
(U) Related Activities:
(U) PE 0602203F, Aerospace Propulsion.
(U) PE 0602201F, Aerospace Flight Dynamics.
(U) PE 0602605F, Directed Energy Technology.
(U) PE 0603605F, Advanced Weapons Technology.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy
Not Applicable.

(U) E. Schedule Profile
(U) Not Applicable.

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development (ATD)	0603216F Aerospace Propulsion and Power Technology	4921

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
4921 Aircraft Propulsion Subsystems Int	34,672	35,991	26,345	22,779	22,709	20,077	26,545	26,878	Continuing	TBD

Note: In FY 2002, all turbine engine technology efforts performed in PE 0603202F, Project 668A, were transferred into this project.

(U) A. Mission Description

This project develops and demonstrates gas turbine propulsion system technologies applicable to aircraft. The Aerospace Propulsion Subsystems Integration (APSI) project 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, and exhaust nozzles. Additionally, these efforts include activities under the national High Cycle Fatigue program. This project also focuses on system integration of inlets, nozzles, engine/airframe compatibility, and low-observable 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. The APSI project supports the goals of the national Integrated High Performance Turbine Engine Technology program, which is focused on doubling turbine engine propulsion capabilities while reducing cost of ownership. Anticipated technology advances include turbine engine improvements providing an approximate 30 percent reduction in tactical fighter aircraft takeoff gross weight and 100 percent increase in aircraft range/loiter. The Integrated High Performance Turbine Engine Technology 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. APSI is also fully integrated into the Versatile Affordable Advanced Turbine Engine program.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Programs

(U) $5,736 Designed, fabricated, and demonstrated durability and integration technologies for turbofan/turbojet engines. These technologies will improve durability, supportability, and affordability of current and future Air Force aircraft. Completed engine testing in support of the national High Cycle Fatigue program including forward swept fan blade damage tolerance, advanced instrumentation, model validation, and improved test protocol.

(U) $17,835 Designed, fabricated, and demonstrated advanced component technologies for improved performance and fuel consumption of turbofan/turbojet engines for fighters, bombers, and transports. Completed demonstrator engine test of fixed inlet guide vanes and Moderate Aspect Ratio rotor, Integrally Bladed Rotor repair, fan rim damper, High Cycle Fatigue mistuning technologies, vaneless counter-rotating high/low pressure turbine,

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

probabilistic rotor system design, gamma titanium aluminide Low Pressure Turbine coverplate, sprayform cast hardware, and Ceramic Matrix Composite technologies. Continued advanced engine designs for High Cycle Fatigue robust front frame, two-stage forward swept fan, tiled low pressure turbine blade, uncooled Ceramic Matrix Composite low pressure turbine blade, and model-based control with diagnostics.

(U) $6,120 Designed, fabricated, and demonstrated advanced component technologies for limited life engines. These technologies improve performance, durability, and affordability of engines for missile and unmanned air vehicle applications. Completed design and fabricated Organic Matrix Composite fan, high stage loading splittered fan, uncooled ceramic high/low pressure turbine, slinger and low volume combustors. Completed engine testing the high stage loading splittered fan and uncooled ceramic low pressure turbine in a demonstrator engine.

(U) $3,000 Developed high-speed turbine engine technology for next generation aerospace vehicles for long-range strike. Initiated a study to evaluate gas turbine technologies for long-range strike vehicles (e.g., gas turbine and ramjet/scramjet combined/combination cycle engines). Initiated an integrated design of turbine engine controls, exhaust nozzles, high temperature material components, and mechanical systems for capability beyond low-observables.

(U) $1,981 Developed turbine engines that reduce fuel consumption, increase thrust/airflow ratio, and reduce production costs for supersonic expendable and limited life unmanned vehicle turbine engines. This is the goal of the Joint Expendable Turbine Engine Concept demonstrator, an important demonstrator in the Integrated High Performance Turbine Engine Technology program. Performed design, fabrication, assembly, and test of materials and high pressure ratio technologies. These technologies include single crystal Lamilloy blades and advanced thermal barrier coated cast cool vanes.

(U) $34,672 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Programs

(U) $5,934 Design, fabricate, and demonstrate durability and integration technologies for turbofan/turbojet engines. These technologies will improve durability, supportability, and affordability of current and future Air Force aircraft. Complete engine structural durability testing of fixed inlet guide vanes and Moderate Aspect Ratio rotor, Integrally Bladed Rotor repair, fan rim damper, High Cycle Fatigue mistuning and damping technologies, vaneless counter-rotating high/low pressure turbine, probabilistic rotor system design, gamma titanium aluminide low pressure turbine coverplate, sprayform cast hardware, and Ceramic Matrix Composite technologies.

(U) $20,637 Design, fabricate, and test advanced component technologies for improved performance and fuel consumption of turbofan/turbojet engines for fighters, bombers, and transports. Complete advanced engine designs and initiate fabrication of High Cycle Fatigue robust front frame,

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

affordable Organic Matrix Composite fan frame, two-stage forward swept fan, tiled low pressure turbine blade, uncooled Ceramic Matrix Composite low pressure turbine blade, Metal Matrix Composite shaft and model-based flexible control with diagnostics. Initiate advanced engine designs for tandem fan with Organic Matrix Composite tip shroud, carbon counter-rotating intershaft seal, and active augmenter screech control. Each of these component technology innovations can be applied to a significant part of the Air Force's engine inventory and offer potentially significant performance enhancements to future aircraft engines.

(U) $5,097 Design, fabricate, and test advanced component technologies for limited life engines. These technologies improve the performance, durability, and affordability of engines for missile and unmanned air vehicle applications. Complete fabrication and conduct testing on an Organic Matrix Composite fan, uncooled ceramic high pressure turbine, and slinger combustor. Complete fabrication of a low volume combustor. Complete engine structural durability testing of a high stage loading splittered fan and uncooled ceramic low pressure turbine.

(U) $3,362 Develop high-speed turbine engine technology for next generation aerospace vehicles for long-range strike. Complete study to evaluate gas turbine technologies for long-range strike vehicles (e.g., gas turbine and ramjet/scramjet combined/combination cycle engines). Continue to integrate design and initiate long lead hardware for turbine engine controls, exhaust nozzles, high temperature material components, and mechanical systems for capability beyond low-observables.

(U) $961 Design and fabricate a fixed composite nozzle and add instrumentation to the combustor for the Joint Expendable Turbine Engine Concept Phase III demonstrator engine test, an important demonstrator in the Integrated High Performance Turbine Engine Technology program. The Joint Expendable Turbine Engine Concept goal is to develop turbine engines that reduce fuel consumption, increase thrust/airflow ratio, and reduce production costs for supersonic expendable and limited life unmanned vehicle turbine engines. These efforts will contribute to the continued detailed design, fabrication, assembly, and test of materials and high pressure ratio technologies. Technologies include single crystal Lamilloy blades and advanced thermal barrier coated cast cool vanes.

(U) $35,991 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Programs

(U) $5,807 Design, fabricate, and demonstrate durability and integration technologies for turbofan/turbojet engines. These technologies will improve durability, supportability, and affordability of current and future Air Force aircraft. Complete design, analysis, and fabrication of advanced engine components/instrumentation for structural durability testing.

(U) $16,182 Design, fabricate, and test advanced component technologies for improved performance and fuel consumption of turbofan/turbojet engines for

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

		fighters, bombers, and transports. Continue fabrication of High Cycle Fatigue robust front frame, affordable Organic Matrix Composite fan frame, two-stage forward swept fan, tiled low pressure turbine blade, uncooled Ceramic Matrix Composite low pressure turbine blade, Titanium Matrix Composite shaft and model-based flexible control with diagnostics. Complete advanced engine designs for a tandem fan with Organic Matrix Composite tip shroud, carbon counter-rotating intershaft seal, and active augmentor screech control. Each of these component technology innovations can be applied to a significant part of the Air Force's engine inventory and offer potentially significant performance enhancements to future aircraft engineers.
(U)	$4,356	Design, fabricate, and test advanced component technologies for limited life engines. These technologies improve performance, durability, and affordability of engines for missile and unmanned air vehicle applications. Complete testing of an Organic Matrix Composite fan, an uncooled ceramic high pressure turbine, and slinger combustor. Complete fabrication and conduct durability testing on an uncooled Ceramic Matrix Composite turbine blisk/nozzle, and a Carbon/Carbon exhaust nozzle. Complete testing of low volume combustor. Initiate designs of advanced component technologies for intelligent and durability engine testing.
(U)	$26,345	Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities

(U) PE 0602201F, Aerospace Flight Dynamics.

(U) PE 0602203F, Aerospace Propulsion.

(U) PE 0603003A, Aviation Advanced Technology.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development (ATD)	0603216F Aerospace Propulsion and Power Technology	4922

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
4922 Space & Missile Rocket Propulsion	28,546	1,433	12,848	6,055	7,084	5,048	5,125	5,196	Continuing	TBD

Note: In FY 2002, all rocket propulsion technology efforts performed in PE 0603302F, Projects 4373 and 6340, were transferred into this project, in order to align projects with the Air Force Research Laboratory organization. In FY 2003, space unique technology efforts in this project were transferred to PE 0603500F, Project 5033, in conjunction with the Space Commission recommendation to consolidate all space unique activities. In this project, space unique includes all Integrated High Payoff Rocket Propulsion Technology activities except Technology for the Sustainment of Strategic Systems and tactical missiles.

(U) A. Mission Description

This project develops advanced and innovative low-cost rocket turbomachinery and components, low-cost space and missile launch propulsion system technologies, demonstrates advanced propellants for launch and orbit transfer propulsion, demonstrates technologies for sustainment of strategic systems, and demonstrates technologies for tactical rockets. Characteristics such as environmental acceptability, affordability, reliability, 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 system technologies for station keeping and on-orbit maneuvering applications. Technology areas investigated include ground demonstrations of compact, lightweight, advanced propulsion systems, higher efficiency energy conversion systems (derived from an improved understanding of combustion fundamentals), and high-energy propellants. Technological advances developed in this program will improve the performance of expendable systems' payload capabilities by approximately 20 percent and reduce the launch and operations and support costs by approximately 30 percent. Technology advances will 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 projects in this program are part of the Integrated High Payoff Rocket Propulsion Technology program, a joint DoD, NASA, and industry effort to focus rocket propulsion technology on national needs.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $10,213 Developed propulsion technology for current and future space launch vehicles. Continued to develop turbomachinery components for integration into an advanced liquid test bed demonstrator. Completed fabrication and assembly of a combustion chamber and injector for a liquid engine booster. Continued fabrication of an oxygen turbopump for integration into an advanced liquid booster engine. Completed testing of oxygen and hydrogen preburner components for integration into an advanced liquid booster engine. Completed the design of an advanced hydrocarbon test bed engine and began fabrication of hardware.

(U) $4,047 Conducted a detailed design of hydrocarbon rocket engine test bed to enable responsive, reliable, operable, and affordable access to space.

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

		Conducted analyses to determine the optimum operating conditions and cooling requirements for a hydrocarbon rocket engine. Developed a rocket engine test bed component design to include turbopumps, boost pumps, and thrust chambers. Conducted an initial demonstration using hydrocarbon fuels and additives to cool engine without causing coking or stability problems.
(U)	$3,612	Developed propulsion technologies for current and future upper stage and orbit transfer vehicles. Continued to demonstrate solar thermal propulsion technologies, such as strut development, pointing, and tracking, for orbit transfer and maneuvering propulsion. Continued program to develop electric propulsion systems for orbit-transfer by developing high-power Hall thrusters capable of low-earth orbit-geosynchronous earth orbit.
(U)	$3,827	Developed technologies for the sustainment of strategic systems. Continued the Post Boost Control System program to demonstrate component technologies with readily available materials to reduce hardware costs, achieve a 90 percent reduction in hydrazine leakage, and increase in service life for ballistic missiles by a factor of 5. Began evaluating the Strategic Sustainment Demonstration program hardware that integrates advanced propellant, case, and nozzle technologies.
(U)	$2,679	Developed electric propulsion technologies for satellite formation flying, station keeping, and repositioning. Continued development of mathematical models to address different propulsion technologies that could be used for small satellite formation flying. Continued brass board level testing of a pulsed plasma thruster. Continued development of propulsion systems for Air Force small satellites (<100 kg) required for key Air Force Space Command concepts. Completed design of flight hardware and began technology transition of selected propulsion concepts. Completed the fabrication of engine hardware for the TechSat 21 spacecraft.
(U)	$4,168	Continued to develop turbomachinery components for integration into an advanced liquid propellant test bed demonstration. Completed fabrication and assembly of the combustion chamber and injector for a liquid engine booster. Continued fabrication of an oxygen turbopump for integration into an advanced liquid booster engine. Completed testing of oxygen and hydrogen preburner components for integration into an advanced liquid booster engine.
(U)	$28,546	Total

(U) FY 2003 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$1,433	This project previously included space unique funding which has been transferred to PE 0603500F, Project 5033. These funds represent the civilian salaries for the work effort transferred and will be transferred at a later date.
(U)	$1,433	Total

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands)

(U) $0		Accomplishments/Planned Program
(U) $6,619		Develop technologies for the sustainment of strategic systems in support of FY 2003 work being conducted in 63500F, BPAC 5033. This work is part of the Technology for the Sustainment of Strategic Systems Phase I. Continue the Post Boost Control System program to demonstrate component technologies with readily available materials to reduce hardware costs with increased performance. Continue hardware development for the Missile Propulsion Demo integrating case, nozzle, insulation and propellant.
(U) $6,229		Develop Technology for Sustainment of Strategic Systems Phase II. Continue evaluation and scale-up of technologies for demonstration. Integrate case, propellant, insulation, and nozzle technologies into an integrated demonstration. Continue integration, scale-up, and demonstration of advanced aging and surveillance codes, analysis tools, and inspection techniques and tools.
(U) $12,848		Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:
(U) PE 0602102F, Materials.
(U) PE 0602601F, Spacecraft Technology.
(U) PE 0603401F, Advanced Spacecraft Technology.
(U) PE 0603853F, Evolved Expendable Launch Vehicle Program.
(U) PE 0603114N, Power Projection Advanced Technology.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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BUDGET ACTIVITY
03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE
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PROJECT
5098

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
5098 Advanced Aerospace Propulsion	0	0	38,885	0	0	0	0	0	Continuing	TBD

Note: In FY 2004, this Project is a new project, but not a New Start. This effort supports increased emphasis being placed on the National Aerospace Initiative and ongoing hypersonics effort.

(U) A. Mission Description

This 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) to provide revolutionary propulsion options for the Air Force. The primary focus is on the hydrocarbon-fueled, scramjet engine. Multi-cycle engines will provide the propulsion systems necessary 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 potential low speed propulsion systems during hypersonic flight.

(U) FY 2002 ($ in Thousands)
(U) $0 No Activity; activities previously part of other projects in this PE .
(U) $0 Total

(U) FY 2003 ($ in Thousands)
(U) $0 No Activity; activities previously part of other projects in this PE .
(U) $0 Total

(U) FY 2004 ($ in Thousands)
(U) $38,885 Design, fabricate, and initiate testing of a near-fixed geometry flow-path for a hydrocarbon-fueled scramjet with robust operation over a range of Mach 4 to 8. This effort includes optimization of the flow-path cross-section and the flame-holding/fuel-mixing geometry. Develop a robust engine start system to achieve full engine light after boost to Mach 4. Initiate design of an active engine sense-control system to manage start transient and engine mode changes during acceleration. Initiate vehicle design capable of rocket-boost to Mach 4, full integration with scramjet engine and hydrocarbon fuel system, and acceleration from Mach 4 to 8. Initiate selection of rocket boosters.
(U) $38,885 Total

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(U) B. Project Change Summary

Not Applicable

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) This project will be coordinated through the Reliance process to harmonize efforts and eliminate duplication

(U) D. Acquisition Strategy

Not Applicable

(U) E. Schedule Profile

(U) Not Applicable

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development (ATD)	0603216F Aerospace Propulsion and Power Technology	681B

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
681B Advanced Turbine Engine Gas Generator	33,810	33,737	29,299	26,254	26,497	26,969	27,377	27,760	0	0

(U) A. Mission Description

This project develops turbine engine gas generator technologies for current and future aircraft propulsion systems. 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 real engine environment. The gas generator, or core, is the basic building block of the engine and it consists of a compressor, a combustor, and a high-pressure turbine. Experimental core engine testing enhances early, 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, and ships. Component technologies are demonstrated in a core (sub-engine) test. The core performances of this project are proven in demonstrator engines in Project 4921 of this PE. Efforts are part of the Integrated High Performance Turbine Engine Technology and the Versatile Affordable Advanced Turbine Engine programs.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $26,410 Designed, fabricated, and tested performance of technology demonstrator core engines to provide improved performance and fuel consumption for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Completed design and continued fabrication of hardware for core engine testing of a load decoupler fan frame, a ceramic matrix composite combustor liner, a ceramic bearing, and advanced turbine vane, blade, and disk materials. Designed advanced hardware for core engine testing of a high pressure ratio four stage compressor with stability enhancing control, an integrated lightweight combustor with ceramic matrix composite panels, a microplasma ignitor, revolutionary turbine blade material, and an endothermic fuel/air heat exchanger.

(U) $2,270 Designed, fabricated, and tested durability of technology demonstration core engines to provide increased life and affordability for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Designed turbine engine advanced hardware for core engine evaluation in the national durability program.

(U) $3,149 Designed, fabricated, and evaluated technology demonstration core engines to provide improved performance and fuel consumption for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, theater transports, and large unmanned air vehicles. Continued evaluation of a core engine forward swept splittered compressor rotor, a high temperature rise combustor, a counter rotating vaneless turbine, ceramic matrix composite turbine blades and vanes, and magnetic bearings.

(U) $1,981 Developed turboprop/turboshaft engine technologies that are applicable to military helicopter applications such as combat search and rescue.

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BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology	PROJECT 681B

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U) $33,810 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $28,298 Design, fabricate, and performance test technology demonstration core engines to provide improved performance and fuel consumption for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Complete design and continue hardware fabrication of a core engine test article with a load decoupler fan frame, a trapped vortex combustor, ceramic matrix composite combustor liner, a ceramic bearing, and advanced turbine blisk and vane materials. Complete design and continue fabrication of hardware for core engine testing of a high-pressure ratio four stage compressor with an integrated lightweight combustor with ceramic matrix composite panels, microcircuit cooling, revolutionary hot section material, and an endothermic fuel/air heat exchanger. Each of these technology innovations can be applied to a significant part of the Air Force's engine inventory and offer potentially significant performance enhancements to future aircraft engines.

(U) $1,944 Design, fabricate, and durability test technology demonstration core engines to provide increased durability and affordability for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Continue to design and initiate fabrication of long lead hardware for turbine engine advanced hardware for core engine evaluations in the national durability programs.

(U) $3,495 Design, fabricate, and evaluate technology demonstration core engines to provide improved performance and fuel consumption for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, theater transports, and large uninhabited air vehicles. Complete core engine testing of a forward swept splittered compressor rotor, a high temperature rise combustor, a counter rotating vaneless turbine, ceramic matrix composite turbine blades and vanes, and magnetic bearings.

(U) $33,737 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $24,390 Design, fabricate, and test performance demonstration core engines, using advanced materials including Titanium Matrix Composites, to provide improved performance and fuel consumption for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Continue hardware fabrication of a core engine test article with a load decoupler fan frame, a trapped vortex combustor, a ceramic matrix composite combustor liner, ceramic bearings, and advanced turbine blisk and vane materials. Continue fabrication of hardware for core engine testing of a high-pressure ratio four-stage compressor with an integrated lightweight combustor with ceramic matrix composite panels, microcircuit cooling, revolutionary hot section material, and an endothermic fuel/air heat exchanger. Each of these technology innovations can be applied to a

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BUDGET ACTIVITY **03 - Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **681B**

(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

significant part of the Air Force's engine inventory and offer potentially significant performance enhancements to future aircraft engines.

(U) $1,755 Design, fabricate, and durability test demonstration core engines to provide increased durability and affordability for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Complete design and continue fabrication of long lead hardware for turbine engine advanced core evaluations in the national durability programs.

(U) $3,154 Design, fabricate, and evaluate technology demonstration core engines to provide improved performance and fuel consumption for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, theater transports, and large uninhabited air vehicles. Continue core engine testing of forward swept splittered compressor rotor, a high temperature rise combustor, a counter-rotating vaneless turbine, ceramic matrix composite turbine blades and vanes, and magnetic bearings. Initiate design of small versatile affordable core engine technologies.

(U) $29,299 Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0602201F, Aerospace Flight Dynamics.

(U) PE 0602203F, Aerospace Propulsion.

(U) PE 0603003A, Aviation Advanced Technology.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.