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

DATE
June 2001

BUDGET ACTIVITY
03 - Advanced Technology Development

PE NUMBER AND TITLE
0603216F Aerospace Propulsion and Power Technology

	COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	35,345	43,413	114,335	96,161	88,044	83,114	84,861	86,654	Continuing	TBD
2480	Aerospace Fuels and Atmospheric Propulsion	2,134	3,542	12,501	3,185	3,253	3,321	3,391	3,462	Continuing	TBD
3035	Aerospace Power Technology	1,370	2,401	4,647	4,252	4,341	4,431	4,525	4,621	Continuing	TBD
4921	Aircraft Propulsion Subsystems Int	0	0	35,845	32,569	27,287	23,626	24,122	24,632	Continuing	TBD
4922	Space & Missile Rocket Propulsion	0	0	26,506	21,469	22,944	24,644	25,162	25,693	Continuing	TBD
681B	Advanced Turbine Engine Gas Generator	31,841	37,470	34,836	34,686	30,219	27,092	27,661	28,246	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

Note: FY 2003-FY 2007 budget numbers do not reflect the DoD strategy review results.
In FY 2002, all turbine engine technology efforts performed in PE 0603202F, Aircraft Propulsion Subsystem Integration, Project 668A, are transferred to PE 0603216F, Project 4921. Also in FY 2002, all rocket propulsion technology efforts performed in PE 0603302F, Space and Missile Rocket Propulsion, Projects 4373 and 6340, are transferred to PE 0603216F, Project 4922, in order to align projects with the Air Force Research Laboratory organization.

(U) A. Mission Description

The Aerospace Propulsion and Power Technology program develops and demonstrates technologies to achieve enabling and revolutionary advances in turbine and rocket propulsion, power generation and storage, and fuels. The program has five projects, each focusing on technologies with high potential to enhance performance of existing and future Air Force weapons systems. 1) The Advanced Turbine Engine Gas Generator project develops and demonstrates core turbine engine technologies for current and future aircraft propulsion systems. 2) The Aerospace Propulsion Subsystem Integration project integrates the engine cores demonstrated in the Turbine Gas Generator project with low-pressure components into demonstrator engines. 3) The Aerospace Power Technologies project develops and demonstrates power technologies for weapons and aircraft. 4) The Space and Missile Rocket Technology project develops and demonstrates innovative rocket propulsion technologies, propellants, and manufacturing techniques. 5) The Aerospace Fuels and Atmospheric Propulsion project develops and demonstrates improved hydrocarbon fuels and

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE June 2001
BUDGET ACTIVITY **03 - Advanced Technology Development**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**

(U) A. Mission Description Continued

advanced propulsion systems for hypersonic flight. Turbine engine propulsion projects are part of the Integrated High Performance Turbine Engine Technology (IHPTET) program. Rocket propulsion projects within this program are part of the Integrated High Payoff Rocket Propulsion Technology (IHPRPT) program. Note: In FY 2001, Congress added $1.5 million for Next Generation Aerospace Research Initiative and $0.350 million for Vectored Thrust Ducted Propeller Compound Helicopter Demonstration for Combat Rescue.

(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 2000	FY 2001	FY 2002	Total Cost
(U)	Previous President's Budget (FY 2001 PBR)	38,723	41,964	40,254	
(U)	Appropriated Value	39,178	43,814		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-2			
	b. Small Business Innovative Research	-923			
	c. Omnibus or Other Above Threshold Reprogram				
	d. Below Threshold Reprogram	-2,514			
	e. Rescissions	-394	-401		
(U)	Adjustments to Budget Years Since FY 2001 PBR			74,081	
(U)	Current Budget Submit/FY 2002 PBR	35,345	43,413	114,335	TBD

(U) Significant Program Changes:

Changes to this PE since the previous Presidents Budget are due to PE realignments in order to align projects with the Air Force Research Laboratory organization. Fiscal Year 2002 increases are also due to the recent DoD strategy review which increased funding for technologies in space lift propulsion and next generation aerospace vehicles for long range strike.

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

DATE June 2001

BUDGET ACTIVITY
03 - Advanced Technology Development

PE NUMBER AND TITLE
0603216F Aerospace Propulsion and Power Technology

PROJECT
2480

COST ($ in Thousands)		FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
2480	Aerospace Fuels and Atmospheric Propulsion	2,134	3,542	12,501	3,185	3,253	3,321	3,391	3,462	Continuing	TBD

Note: In FY 2001, Congress added $1.5 million for Next Generation Aerospace Research Initiative.

(U) A. Mission Description

The Aerospace Fuels and Atmospheric Propulsion project develops and demonstrates improved hydrocarbon fuels and advanced, novel aerospace propulsion systems, including systems for hypersonic flight and access to space. Emphasis is on developing and demonstrating new thermally stable, high heat sink, and controlled chemically reacting fuels. The project also develops and demonstrates fuel system components that minimize cost, reduce maintenance, and improve performance of future aerospace systems.

(U) FY 2000 ($ in Thousands)

(U) $868 Demonstrated thermally stable JP-8+100 high heat sink fuel that reduces fuel system maintenance on current aircraft and provides greater cooling capacity (performance) for upgraded and future aircraft and missiles. Determined the effects/benefits of thermally stable JP-8+100 and JP-8+225 fuel for several current and advanced fighter configurations.

(U) $702 Demonstrated effectiveness of thermally stable JP-8+100 for reduced maintenance in a variety of aircraft. Fabricated a sub-scale fuel system simulator for testing thermally stable JP-8+225 and other high heat sink fuels that reduce fuel system maintenance for the current inventory and future propulsion configurations.

(U) $396 Demonstrated advanced fuel system designs and high temperature components that permit utilization of the increased cooling capacity of JP-8+100 and high heat sink fuels. Designed and fabricated heat exchanger for indirect cooling concept for advanced, high temperature engine designs.

(U) $168 Demonstrated a direct fuel/air heat exchanger to provide cooled cooling air for hear exchanger systems. Compared performance and benefits of the direct fuel/air heat exchanger to the indirect system.

(U) $2,134 Total

(U) FY 2001 ($ in Thousands)

(U) $842 Continue demonstrating thermally stable JP-8+100 high heat sink fuel that reduces fuel system maintenance on current aircraft and provides greater cooling capacity (performance) for upgraded and future aircraft and missiles. Demonstrate, in a sub-scale fuel system simulator, the effects/benefits of thermally stable JP-8+225 and other high heat sink fuels that reduce fuel system maintenance for advanced fighter configurations.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology	PROJECT 2480

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

(U) $797 Demonstrate effectiveness of thermally stable JP-8+100 for reduced maintenance in a variety of aircraft. Fabricate a sub-scale integrated fuel/air heat exchanger-combustor in a cooled cooling air heat exchanger configuration, using fuel/air heat exchanger technology designed and fabricated in FY 2000.

(U) $403 Demonstrate low-cost fuel-additive approaches to control particulate emissions from gas turbine engines. Demonstrate concepts for improving ignition and combustion in advanced engines.

(U) $1,500 Investigate a broad range of technologies to support propulsion capabilities, improve the nation's aerospace research, development, and manufacturing base, and address the growing shortfall within the aerospace specialized technological workforce. The focus is on propulsion concepts and technologies for next generation military aerospace vehicles. These propulsion concepts will enable practical sustained hypersonic flight and affordable, routine military access to space.

(U) $3,542 Total

(U) FY 2002 ($ in Thousands)

(U) $4,000 Develop 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. Evaluate options to enable variable geometry scramjet technology. Initiate development of variable geometry scramjet flow path. Develop inlet system for air-breathing space access vehicles requiring multiple scramjet engine modules to enable fuller dominance of space. Design, fabricate, and initiate wind tunnel testing of a sub-scale multiple scramjet engine inlet system. Quantify scramjet inlet mass capture and boundary layer characteristics of each module resulting from multi-engine interactions.

(U) $3,500 Develop 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. Identify 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. Conduct analyses to identify optimum transition Mach number between gas turbine engine and ramjet/scramjet engine cycles and the maximum cruise speed of the ramjet/scramjet engine. Conduct pre-design study to evaluate force-multiplier and bomber survivability as a function of maximum sustainable flight Mach number achievable with select gas turbine based combined/combination cycle engine options.

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

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY **03 - Advanced Technology Development**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **2480**

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U)	$1,000	Evaluate advanced high heat sink fuels and advanced fuel cooling technology for next generation aerospace vehicles for long range strike. Determine requirements for fuel/fuel additive combinations to improve component life and durability, improve fuel efficiency, reduce weight, and enable operation of advanced propulsion cycles. Develop comprehensive test and qualification strategy for advanced high heat sink fuels. Initiate design and fabrication of reduced scale fuel system simulation components unique to next generation bombers.
(U)	$251	Demonstrate thermally stable fuels to enhance cooling capacity (performance) and reduce fuel system maintenance. Demonstrate advanced high heat sink fuels to increase fuel delivery system durability at high temperatures and reduce maintenance due to fuel degradation in a sub-scale integrated fuel/air heat exchanger.
(U)	$402	Determine fuel cooling requirements for advanced aircraft sensors and directed energy weapons to meet the needs of evolving manned and unmanned aerospace systems. Determine properties for low temperature additives to prevent fuel from freezing and allow advanced unmanned and manned systems to sustain high altitude loiter for extended periods.
(U)	$805	Develop low-cost fuel additives for Air Force applications. Evaluate and demonstrate optimum low-cost fuel additive to reduce particulate emissions from gas turbine engines by 50 percent. Evaluate and demonstrate low-cost fuel additives to improve ignition characteristics and combustion in current and advanced and combined cycle engines.
(U)	$805	Develop fuel system technology. Design and develop 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. Identify fuel concepts to maximize performance of advanced and combined cycle engines and minimize logistics costs.
(U)	$738	Identify and develop low-cost approaches to reducing the fuel logistics footprint for the Expeditionary Air Force. Determine benefits of advanced additive packages to improve any commercially available jet fuel to meet military standards. Develop 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 aid in mission planning by monitoring mission limiting fuel properties.
(U)	$12,501	Total

(U) B. Project Change Summary

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY **03 - Advanced Technology Development**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **2480**

(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) PE 0603253, Advanced Sensor Integration.

(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 **June 2001**

BUDGET ACTIVITY
03 - Advanced Technology Development

PE NUMBER AND TITLE
0603216F Aerospace Propulsion and Power Technology

PROJECT
3035

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
3035 Aerospace Power Technology	1,370	2,401	4,647	4,252	4,341	4,431	4,525	4,621	Continuing	TBD

(U) A. Mission Description

The Aerospace Power Technology project develops and demonstrates aircraft and ground power technology for engine starters, auxiliary power units, and electrical power generation and distribution systems. This technology enhances reliability and survivability; it reduces vulnerability, weight, and life cycle costs for (manned and unmanned) aircraft and spacecraft. The electric power system components developed are projected to provide a two to five times improvement in aircraft reliability and maintainability, and a 20 percent reduction in power system weight. This project also develops and demonstrates high power generation and storage technologies to enable high power density sources for directed energy weapons.

(U) FY 2000 ($ in Thousands)

(U) $635 Designed, fabricated, and tested a demonstrator aircraft on-board Integrated Power Unit (IPU) which is critical for aircraft engine starting, auxiliary power, and emergency power. Integrated a switched reluctance starter generator with magnetic bearings and the turbomachine to demonstrate IPU feasibility, weight savings, and reliability improvements over conventional Auxiliary Power Unit/Emergency Power Unit (APU/EPU) approaches.

(U) $88 Performed IPU aircraft integration analysis to determine mission available power for Directed Energy Weapon (DEW) applications.

(U) $647 Developed power generation, conditioning, and distribution; energy storage; and thermal management component and subsystem technologies for manned and unmanned aircraft systems. Developed IPU prognostics health management and power electronics for increased reliability, decreased maintenance, and two times increase in power density which is enabling for advanced fighter aircraft and Uninhabited Combat Aerial Vehicles (UCAV).

(U) $1,370 Total

(U) FY 2001 ($ in Thousands)

(U) $573 Design, fabricate, and test an electrical distribution system which ensures fault tolerant architecture, improving aircraft reliability and survivability. Complete test of the demonstrator aircraft on-board IPU. The demonstrator will integrate the switched reluctance starter generator with magnetic bearings and the turbomachine to demonstrate IPU feasibility, weight savings, and reliability improvements over conventional APU/EPU approaches.

(U) $99 Design, fabricate, and test for emergency power capabilities of an IPU. Applications include rapid rotor spin-up and light-off, and continuous power generation using stored oxidizer.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology	PROJECT 3035

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

(U) $1,729 Develop power generation, conditioning, and distribution; energy storage; and thermal management component and subsystem technologies for manned and unmanned aircraft systems. Test IPU prognostics health management and power electronics for increased reliability, decreased maintenance, and two times increase in power density, which is enabling for advanced fighter aircraft and Uninhabited Combat Aerial Vehicles (UCAV).

(U) $2,401 Total

(U) FY 2002 ($ in Thousands)

(U) $2,000 Develop high-density secondary power system and advanced weapons power technology for a next generation aerospace vehicle for long range strike. Initiate trade studies, detailed design, and critical technology development to optimize secondary power system size, weight, and efficiency. Evaluate electric power technology options for advanced weapon systems.

(U) $251 Develop 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. Fabricate lengths of Yttrium Barium Copper Oxide (YBCO) sufficient to fabricate coated conductors for cryogenic generators.

(U) $792 Develop power generation, conditioning, and distribution; energy storage; and thermal management component and subsystem technologies for manned and unmanned aircraft systems. Demonstrate technologies for an integrated power unit for advanced fighter aircraft and unmanned vehicles.

(U) $1,604 Define requirements for high power generation systems for directed energy weapons. Evaluate trade offs and define approaches for superconducting and conventional generators for weapons power systems.

(U) $4,647 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.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE **June 2001**
BUDGET ACTIVITY **03 - Advanced Technology Development**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **3035**

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

(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.

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

DATE
June 2001

BUDGET ACTIVITY
03 - Advanced Technology Development

PE NUMBER AND TITLE
0603216F Aerospace Propulsion and Power Technology

PROJECT
4921

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4921 Aircraft Propulsion Subsystems Int	0	0	35,845	32,569	27,287	23,626	24,122	24,632	0	0

Note: In FY 2002, all turbine engine technology efforts performed in PE 0603202F, Aircraft Propulsion Subsystem Integration, Project 668A, are transferred to Project 4921.

(U) A. Mission Description

The Aerospace Propulsion Subsystems Integration (APSI) project develops and demonstrates gas turbine propulsion system technologies applicable to aircraft. The 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. This project also focuses on system integration aspects of inlets, nozzles, engine/airframe compatibility, and low-observable technologies. APSI provides aircraft with potential for longer range and higher cruise speed 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 (IHPTET) program, which is focused on doubling turbine engine propulsion capabilities while reducing cost of ownership. Anticipated technology advances include turbine engine improvements providing a ~30 percent reduction in tactical fighter aircraft takeoff gross weight and 100 percent increase in aircraft range/loiter. The IHPTET 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.

(U) FY 2000 ($ in Thousands)
(U) $0 Previously accomplished in PE 0603202F, Project 668A.
(U) $0 Total

(U) FY 2001 ($ in Thousands)
(U) $0 Previously accomplished in PE 0603202F, Project 668A.
(U) $0 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY **03 - Advanced Technology Development**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **4921**

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U)	$5,778	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 testing in support of the national High Cycle Fatigue (HCF) program including forward swept fan blade damage tolerance, advanced instrumentation, model validation, and improved test protocol.
(U)	$20,357	Design, fabricate, and demonstrate advanced component technologies for improved performance and fuel consumption of turbofan/turbojet engines for fighters, bombers, and transports. Complete demonstrator engine test of fixed inlet guide vanes and Moderate Aspect Ratio (MAR) rotor, Integrally Bladed Rotor (IBR) repair, fan rim damper, High Cycle Fatigue (HCF) mistuning technologies, vaneless counterrotating high/low pressure turbine, probabilistic rotor system design, gamma titanium aluminide Low Pressure Turbine (LPT) coverplate, sprayform cast hardware, and Ceramic Matrix Composite (CMC) technologies. Continue advanced engine designs for HCF robust front frame, two-stage forward swept fan, tiled LPT blade, uncooled CMC LPT blade, and model-based control with diagnostics.
(U)	$6,210	Design, fabricate, and demonstrate advanced component technologies for limited life engines. These technologies improve performance, durability, and affordability of engines for missile and unmanned air vehicle applications. Complete design and fabricate Organic Matrix Composite (OMC) fan, high stage loading splittered fan, uncooled ceramic high/low pressure turbine, slinger and low volume combustors. Complete engine testing the high stage loading splittered fan and uncooled ceramic low pressure turbine in a demonstrator engine.
(U)	$3,500	Develop high speed turbine engine technology for next generation aerospace vehicles for long range strike. Initiate study to evaluate gas turbine technologies for long range strike vehicles (e.g., gas turbine and ramjet/scramjet combined/combination cycle engines). Initiate integrated design of turbine engine controls, exhaust nozzles, high temperature material components, and mechanical systems for capability beyond low observables.
(U)	$35,845	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 0602122N, Aircraft Technology.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY **03 - Advanced Technology Development**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **4921**

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

(U) PE 0603210N, Aircraft 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.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY **03 - Advanced Technology Development**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **4922**

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4922 Space & Missile Rocket Propulsion	0	0	26,506	21,469	22,944	24,644	25,162	25,693	0	0

Note: In FY 2002, all rocket propulsion technology efforts performed in PE 0603302F, Space and Missile Rocket Propulsion, Projects 4373 and 6340, are transferred to Project 4922, in order to align projects with the Air Force Research Laboratory organization.

(U) A. Mission Description

The Space and Missile Rocket Propulsion project develops advanced and innovative low-cost rocket turbomachinery and components, low-cost space and missile launch propulsion system technologies, and demonstrates advanced propellants for launch and orbit transfer propulsion. 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 ~20 percent and reduce the launch and operations and support (O&S) costs by ~30 percent. Technology advances will also lead to seven-year increase in satellite on-orbit time, a 50 percent increase in satellite maneuvering capability, a 25 percent reduction in orbit transfer operational costs, and a 15 percent increase in satellite payload. The projects in this program are part of the Integrated High Payoff Rocket Propulsion Technology (IHPRPT) program, a joint Department of Defense, National Aeronautics and Space Administration (NASA), and industry effort to focus rocket propulsion technology on national needs.

(U) FY 2000 ($ in Thousands)
(U) $0 Previously accomplished in PE 0603202F, Projects 4373 and 6340.
(U) $0 Total

(U) FY 2001 ($ in Thousands)
(U) $0 Previously accomplished in PE 0603202F, Projects 4373 and 6340.
(U) $0 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY **03 - Advanced Technology Development**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **4922**

(U) A. Mission Description Continued

(U)	FY 2002 ($ in Thousands)	
(U)	$10,814	Develop propulsion technology for current and future space launch vehicles. Continue to develop turbomachinery components for integration into advanced liquid test bed demonstrator. Complete fabrication and assembly of combustion chamber and injector for liquid engine booster. Continue fabrication of oxygen turbopump for integration into an advanced liquid booster engine. Complete testing of oxygen and hydrogen preburner components for integration into an advanced liquid booster engine. Complete the design of advanced hydrocarbon test bed engine and begin fabrication of hardware.
(U)	$5,000	Conduct detailed design of hydrocarbon rocket engine test bed to enable responsive, reliable, operable, and affordable access to space. Conduct analyses to determine optimum operating conditions and cooling requirements for hydrocarbon rocket engine. Develop rocket engine test bed component design to include turbopumps, boost pumps, and thrust chambers. Demonstrate use of hydrocarbon fuels and additives to cool engine without causing coking or stability problems.
(U)	$3,818	Develop propulsion technologies for current and future upper stage and orbit transfer vehicles. Continue to demonstrate solar thermal propulsion technologies, such as strut development, pointing, and tracking, for orbit transfer and maneuvering propulsion. Continue program to develop electric propulsion systems for orbit-transfer by developing high-power Hall thrusters capable of low-earth orbit-geosynchronous earth orbit (LEO-GEO) transfer.
(U)	$4,024	Develop technologies for the sustainment of strategic systems. Continue 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 five times increase in service life for ballistic missiles. Begin evaluating the Strategic Sustainment Demonstration program hardware that integrates advanced propellant, case, and nozzle technologies.
(U)	$2,850	Develop electric propulsion technologies for satellite formation flying, station keeping, and repositioning. Continue development of mathematical models to address different propulsion technologies that could be used for small satellite formation flying. Continue brass board level testing of a pulsed plasma thruster. Continue development of propulsion systems for Air Force small satellites (<100 kg) required for key Air Force Space Command concepts. Complete design of flight hardware and begin technology transition of selected propulsion concepts. Complete the fabrication of engine hardware for the TechSat 21 spacecraft.
(U)	$26,506	Total

(U) B. Project Change Summary

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY **03 - Advanced Technology Development**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **4922**

(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.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY **03 - Advanced Technology Development**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **681B**

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
681B Advanced Turbine Engine Gas Generator	31,841	37,470	34,836	34,686	30,219	27,092	27,661	28,246	Continuing	TBD

Note: In FY 2001, Congress added $0.350 million for Vectored Thrust Ducted Propeller Compound Helicopter Demonstration for Combat Rescue.

(U) A. Mission Description

The Advanced Turbine Engine Gas Generator project develops turbine engine gas generator technology 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 aspects 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. Performance is subsequently proven in demonstrator engines under realistic conditions (Project 4921). Efforts are part of the Integrated High Performance Turbine Engine Technology (IHPTET) program.

(U) FY 2000 ($ in Thousands)

(U) $25,990 Designed, fabricated, and performance tested technology demonstration core engines to provide improved performance and fuel consumption for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Initiated advanced core engine testing for integrally bladed rotor repair, impingement film floatwall combustor, advanced thermal barrier coating, supercooled high pressure turbine castability, and mistunning technologies. Designed advanced hardware for core engine testing of load decoupler fan frame; ceramic matrix composite combustor liner; ceramic bearing; and advanced turbine vane, blade, and disk materials. All of these technology innovations are applicable to a significant part of the Air Force engine inventory along with future engines.

(U) $1,935 Designed, fabricated, and durability tested technology demonstration core engines to provide increased durability and affordability for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Fabricated hardware for core engine testing in support of the national high cycle fatigue program, compressor rotor ring damper, compressor rotor damping coating, and advanced non-intrusive stress measurement system.

(U) $3,916 Designed, fabricated, and tested 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. Conducted core engine testing of splittered compressor rotor, rich quench lean combustor, counter rotating turbines, ceramic turbine vanes, and hybrid ceramic bearings. Designed hardware for core engine testing of forward swept splittered compressor rotor, high temperature

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY **03 - Advanced Technology Development**	PE NUMBER AND TITLE **0603216F Aerospace Propulsion and Power Technology**	PROJECT **681B**

(U) **A. Mission Description Continued**

(U) FY 2000 ($ in Thousands) Continued

rise combustor, counter rotating vaneless turbine, ceramic matrix composite turbine blades and vanes, and magnetic bearings.

(U) $31,841 Total

(U) FY 2001 ($ in Thousands)

(U) $28,442 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 core engine testing for integrally bladed rotor repair, impingement film floatwall combustor, advanced thermal barrier coating, supercooled high pressure turbine castability, and technologies to mitigate High Cycle Fatigue. Design and fabricate long-lead hardware for core engine testing of load decoupler fan frame, ceramic matrix composite combustor liner, ceramic bearing, and advanced turbine vane, blade, and disk materials. All of these technologies are applicable to a significant part of the Air Force engine inventory along with future engines.

(U) $2,054 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. Conduct core engine testing of national High Cycle Fatigue program, compressor rotor ring damper, compressor rotor damping coating, and advanced non-intrusive stress measurement system.

(U) $4,399 Design, fabricate, and test 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. Conduct core engine testing of splittered compressor rotor, rich quench lean combustor, counter rotating turbines, ceramic turbine vanes, and hybrid ceramic bearings. Fabricate hardware for core engine testing of forward swept splittered compressor rotor, high temperature rise combustor, counter rotating vaneless turbine, ceramic matrix composite turbine blades and vanes, and magnetic bearings.

(U) $2,225 Design, develop, and test structures and propulsion designs to demonstrate performance and durability of advanced hypersonic propulsion concepts in support of Defense Advanced Research Projects Agency (DARPA) missile demonstration. Complete fabrication and testing of flight type scramjet combustor and inlet.

(U) $350 Evaluate novel vectored thrust propellers for turboprop/turboshaft engine concepts for application to helicopters for combat rescue.

(U) $37,470 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology	PROJECT 681B

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U)	$29,414	Design, fabricate, and test 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. Complete design and continue fabrication of hardware for core engine testing of load decoupler fan frame, ceramic matrix composite combustor liner, ceramic bearing, and advanced turbine vane, blade, and disk materials. Design advanced hardware for core engine testing of a high pressure ratio four stage compressor with stability enhancing control, integrated lightweight combustor with ceramic matrix composite panels, a microplasma ignitor, revolutionary turbine blade material, and an endothermic fuel/air heat exchanger.
(U)	$2,273	Design, fabricate, and test durability of technology demonstration core engines to provide increased life and affordability for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Design turbine engine advanced hardware for core engine evaluation in the national durability program.
(U)	$3,149	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 unmanned air vehicles. Continue evaluation of core engine forward swept splittered compressor rotor, high temperature rise combustor, counter rotating vaneless turbine, ceramic matrix composite turbine blades and vanes, and magnetic bearings.
(U)	$34,836	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 0602122N, Aircraft Technology.
(U) PE 0603210N, Aircraft Propulsion.
(U) PE 0603003A, Aviation Advanced Technology.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology	PROJECT 681B

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.