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

DATE: February 2000

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602102F Materials

	COST ($ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	70,495	78,103	72,815	70,719	74,667	76,220	76,899	Continuing	TBD
624347	Materials for Structures, Propulsion, and Subsystems	41,812	52,526	44,127	43,178	46,313	47,599	48,058	Continuing	TBD
624348	Materials for Electronics, Optics, and Survivability	13,251	4,761	9,023	7,788	8,015	7,858	7,770	Continuing	TBD
624349	Materials Technology for Sustainment	15,432	20,816	19,665	19,753	20,339	20,763	21,071	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0

(U) A. Mission Description

This program is the primary source of advanced materials and processing technology to reduce life cycle costs and improve performance, affordability, supportability, reliability, and survivability of current and future Air Force systems. Structural, propulsion, and sub-systems materials and processes are being developed for aircraft, missile, space, satellite, and launch systems applications. Electronic, optical, advanced electromagnetic, and laser protection materials and processes are being developed for application in Air Force aircraft, missile, space, and personnel protection systems. Advanced nondestructive materials evaluation methods, materials design data, materials failure analysis, and materials repair methods are being developed to improve the sustainment of Air Force systems for the current and future warfighters. Note: In FY 2000 Congress added $1.8 million for titanium metal matrix composite airframe structures; $1.0 million for titanium metal matrix composite high temperature ceramic fibers; $2.0 million for friction stir welding; $5.0 million for a metals affordability initiative; $0.5 million for high temperature materials; $1.0 million for turbine engine transfer molding high temperature resins; $2.5 million for space structures thermal management; $0.75 million for carbon foams; $0.8 million for metal cleaning, corrosion control, and coatings; $0.5 million for the National Composite Center; $1.0 million for structural monitoring of aging aircraft, and $2.4 million for a nondestructive evaluation electromagnetic fatigue sensor which explains the perceived decrease in FY 2001.

(U) B. Budget Activity Justification

This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

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

DATE: February 2000

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602102F Materials

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

		FY 1999	FY 2000	FY 2001	Total Cost
(U)	Previous President's Budget (FY 2000 PBR)	73,855	63,334	69,521	
(U)	Appropriated Value	75,278	78,811		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-1,423	-45		
	b. Small Business Innovative Research	-1,288			
	c. Omnibus or Other Above Threshold Reprogram		-352		
	d. Below Threshold Reprogram	-1,679			
	e. Rescissions	-393	-311		
	f. Other				
(U)	Adjustments to Budget Years Since FY 2000 PBR			3,294	
(U)	Current Budget Submit/FY 2001 PBR	70,495	78,103	72,815	TBD

(U) Significant Program Changes:

Changes to this program element since the previous President's Budget refelect increased emphasis on turbine engine materials.

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

DATE: February 2000

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602102F Materials

PROJECT: 624347

COST ($ in Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
624347	Materials for Structures, Propulsion, and Subsystems	41,812	52,526	44,127	43,178	46,313	47,599	48,058	Continuing	TBD

(U) A. Mission Description

Develops materials and processing technology base for aircraft, spacecraft, and missiles to improve affordability, maintainability and performance of current and future Air Force systems. The performance, affordability, and sustainability of current and planned Air Force systems are constrained by the characteristics of available materials for structures, propulsion, and subsystems. A family of affordable lightweight materials are being developed, including metals, polymers, ceramics, metallic composites, and nonmetallic composites to provide upgraded capability for existing aircraft, spacecraft, missile, and propulsion systems to meet the future system requirements. Included are high temperature turbine engine materials that will enable engine designs to double the thrust to weight using 1986 engine performance as a baseline. Spacecraft material technologies are being developed that are lightweight, thermally conductive, dimensionally stable, noncontaminating, and resistant to the space environment. Fluids, lubricants, paints, coatings, and other nonstructural material technologies are being developed for the subsystems on aircraft, spacecraft, and missile systems as well as their propulsion systems. Pervasive across the classes of material is the development of advanced processing methods to enable 'adaptive' processing of materials and virtual materials research.

(U) FY 1999 ($ in Thousands)

(U)	$8,084	Developed carbon-carbon (C-C) and thermal protection material (TPM) technologies to improve performance, affordability, and operational capability of strategic and tactical systems.
(U)	$6,973	Developed nonstructural materials (such as fluids, lubricants, seals, greases, and coatings) for improved system performance and reduced life cycle costs.
(U)	$9,270	Developed advanced nonmetallic composite structural materials that are affordable for aircraft applications including lightweight airframes, control surfaces, smart skins, and engine compressor frames and ducts, and for spacecraft applications including lightweight trusses, struts, solar arrays, antenna supports, and space vehicle bus structures.
(U)	$9,367	Developed and transitioned affordable lightweight metals and metal matrix composites, higher-temperature intermetallic alloys, and materials processing technology to enable enhanced performance, lower acquisition costs, and improved reliability of Air Force weapon systems.
(U)	$8,118	Developed ceramic matrix composites to develop an understanding of material response to service life environments and to characterize materials to enable revolutionary performance improvements in advanced propulsion systems and high temperature airframe structures.
(U)	$41,812	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602102F Materials	PROJECT 624347

(U) A. Mission Description Continued

(U) FY 2000 ($ in Thousands)

(U) $9,400 Develop enabling polymeric and carbon-carbon materials technologies for diverse, high-payoff Air Force system needs including structural and thermal applications. Evaluate carbon matrix composites degradation mechanisms to enhance life prediction of advanced aircraft environmental control systems and hot, exhaust-washed structures and engine components. Identify suitable polymers and conductive elastomers as base materials for low-observable gap sealants, thin wires, and electrostatic discharge coatings. Identify and evaluate toughened and nanostructured polymers for thin films to enable inflatable membrane structures such as deployable mirrors for surveillance and space counterforce applications.

(U) $7,559 Develop nonstructural materials technology base for fluids, lubricants, aircraft topcoat, and corrosion resistant coatings and specialty treatments to improve system performance and reduce life cycle costs. Evaluate advanced lubricants for high-speed bearing and rotating components in spacecraft and developed optically tailorable thermal control coatings with controlled emissivity for spacecraft thermal control. Demonstrate the feasibility of electrically conductive elastomers for use in low-observable gap treatments and establish baseline analytical capability to predict the optical properties of specialty coatings. Evaluate permanent corrosion resistant primer resins and environmentally safe corrosion protection with a 30-year life.

(U) $9,314 Develop advanced, affordable nonmetallic composite structural materials and process technologies for Air Force systems applications including lightweight structures (airframes, control surfaces, trusses, struts, engine components, substructures), space vehicle tanks, and space vehicle bus structures. Develop processing and/or mechanics models which predict component dimensions and decrease the amount of shimming, rework, and fit up of large integrated structures for future Air Force air platforms. Develop non-autoclave processes for large structural, cryogenics tanks, and substructures for future Air Force space platforms. Identify materials and processes for low-cost, multifunction composites to enable small, highly tailorable space platforms. Identify and develop novel product forms (foams, nanomaterials) for lightweight, tough, and affordable structural materials.

(U) $21,329 Develop and transition affordable lightweight metallic materials, behavior and life prediction technology, higher temperature intermetallic alloys, and metals processing technology to enable enhanced performance, lower acquisition cost, increased durability, and improved reliability for Air Force weapon systems. Optimize wrought gamma titanium aluminides with a 200°F higher temperature capability for advanced gas turbine engine critical components and characterize advanced intermetallic alloys with the potential of achieving a 300°F temperature increase over current nickel-based superalloy turbine blade materials. Develop life prediction and design methods to better predict theimpact of high cycle fatigue (HCF) on critical engine components and identify critical components and inspection requirements for turbine engine rotor life extension, retirement for cause criteria and enable repair processes. Develop and optimize process technologies, such as spray forming, permanent mold casting and advanced metalworking processes to enable the production of affordable and high quality aluminum, titanium, nickel, and beryllium alloys. Develop process technology for lower tier materials suppliers to improve quality and affordability of components for weapon systems. Develop metallic materials, such as discontinuously reinforced aluminum, nanocrystalline aluminum and high temperature metallic sheets for

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602102F Materials	PROJECT 624347

(U) A. Mission Description Continued

(U) FY 2000 ($ in Thousands) Continued

lighter weight and higher strength components for space systems and thermal protection for space vehicles.

(U) $4,924 Develop ceramics and ceramic matrix composites technology base for revolutionary performance and supportability improvements in advanced propulsion systems and high temperature aerospace structures, and determine the durability of ceramics under service life conditions to guide further materials development and to assess useable life. Conduct rocket engine rig tests of vanes, thrusters, and nozzle ramp subelements, develop integrally woven ceramic composite structures for actively cooled space vehicle applications, and develop thermal protection materials for emerging reusable space vehicles. Identify optimum constituents for 2400°F capable ceramic matrix composite for turbine engine combustors and airfoils, perform subscale dynamometer testing of multiple ceramic composites for next generation aircraft brake friction materials, and initiate extended durability testing of ceramic composites for exhaust components. Develop repair techniques for radar absorbing material (RAM) coatings and engine test a repaired ceramic matrix composite exhaust nozzle seal. Develop advanced constituents such as oxidation resistant interface coatings for longest life, highest performance ceramic composites.

(U) $52,526 Total

(U) FY 2001 ($ in Thousands)

(U) $5,049 Develop enabling polymeric materials technologies for diverse, high-payoff Air Force system needs including structural applications. Evaluate suitable polymers and conductive elastomers as base materials for low-observable gap sealants, thin wires, and electrostatic discharge coatings. Evaluate toughened and nanostructured polymers for thin films to enable inflatable membrane structures such as deployable mirrors for surveillance and space counterforce applications. Develop new methods for rapid fabrication of nanometer to micron three-dimensional structures and rapid composite repair.

(U) $8,116 Develop and transition nonstructural materials technology base for fluids, lubricants, aircraft topcoat and corrosion resistant coatings and specialty treatments to improve system performance and reduced life cycle costs. Develop advanced lubricant materials for high-speed bearing and rotating components (gyroscopes) in spacecraft and fabricate optically tailorable thermal control coatings with controlled emissivity for spacecraft thermal control. Validate feasibility of electrically conductive elastomers for use in low-observable gap treatments and develop analytical techniques to predict the optical properties of specialty coatings. Develop permanent corrosion resistant primer resins and environmentally safe corrosion protection with a 30-year life.

(U) $10,917 Develop affordable, advanced organic matrix composite structural materials and technologies for Air Force systems applications including lightweight structures (airframes, control surfaces, trusses, struts, engine components, substructures), space vehicles tanks, space vehicle bus structures, radiators, and other structures requiring thermal and/or structural management for environmental control. Validate processing and/or mechanics models which predict component dimensions and decrease the amount of shimming, rework, and fit up for large integrated structures for future Air Force air platforms. Develop composite material degradation mechanisms to improve life prediction for aircraft environmental

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602102F Materials	PROJECT 624347

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

control systems and hot, exhaust-washed structures and engine components. Validate non-autoclave processes for large structural, cryogenics tanks, and substructures for future Air Force space platforms and develop materials and process for low-cost, multifunction composites enabling small, highly tailorable space platforms. Evaluate novel product forms (foams, nanomaterials) for lightweight, tough, and affordable structural materials.

(U) $16,056 Develop and transition affordable lightweight metallic materials, behavior and life prediction technology, higher temperature intermetallic alloys, and metals processing technology to enable enhanced performance, lower acquisition cost, increased durability, and improved reliability of Air Force weapon systems. Transition wrought gamma titanium aluminides with a 200°F higher temperature capability for demonstration as advanced gas turbine engine critical components. Develop specific molybdenum-based and niobium-based intermetallic alloys with the potential of achieving a 300°F temperature capability increase over current nickel-based superalloy turbine blade materials. Develop life prediction and design methods to better predictthe impact of high cycle fatigue damage on critical engine components. Develop life prediction methodologies and inspection technologies to extend turbine engine rotor life, establish retirement for cause criteria, and enable repair processes for critical components. Optimize and transition process technologies, such as permanent mold casting, laser forming, and roll forming to enable the production of affordable and high quality metallic components. Optimize metallic materials, such as discontinuously reinforced aluminum, nanocrystalline aluminum, and high temperature metallic sheets to produce lightweight, high strength components for space systems and thermal protection for space vehicles.

(U) $3,989 Develop ceramics and ceramic matrix composites technologies for revolutionary performance and supportability improvements in advanced propulsion systems and high temperature aerospace structures. Determine the durability of ceramics under service life conditions to guide further materials development and to assess useable life. Test integrally woven ceramic composite structures for actively cooled space vehicle applications, develop thermal protection materials with improved durability for emerging reusable space vehicles, and evaluate ceramic composites for space mirror applications. Validate 2400°F material capability for turbine engine combustors and airfoils through extensive coupon and subelement testing, optimize ceramic composites for aircraft brake friction materials, and test durability of reduced cost ceramic composite for exhaust components. Validate repair techniques for radar absorbing material (RAM) coatings and quantifying the shelf life of the repair constituents. Validate advanced constituent, oxidation resistant, interface coatings through fiber and composite testing.

(U) $44,127 Total

(U) B. Project Change Summary

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE
	February 2000

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
02 - Applied Research	0602102F Materials	624347

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

(U) Related Activities:

(U) PE 0603112F, Advanced Materials for Weapon Systems

(U) PE 0603211F, Aerospace Systems

(U) PE 0603202F, Aeropropulsion Subsystem Integration.

(U) PE 0603216F, Aeropropulsion and Power 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: February 2000

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602102F Materials

PROJECT: 624348

COST ($ in Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
624348	Materials for Electronics, Optics, and Survivability	13,251	4,761	9,023	7,788	8,015	7,858	7,770	Continuing	TBD

(U) A. Mission Description

Develops enabling materials for protection of aircrews, sensors, aircraft, and space systems from laser and high power microwave (HPM) threats and infrared (IR) seeker materials. Also develops materials technologies for surveillance and situational awareness systems and subsystems for aircraft, missile, and space applications. The protection of aircrews, sensors, aircraft, and space systems from lasers and HPM is dependent upon the power level and wavelength emanating from the threat device and the susceptibility of the target being irradiated. Additionally, protection schemes are dependent on other characteristics of the directed energy threat such as variability (agility) of the wavelength and mode of operation (continuous wave or pulsed). Current materials are being optimized to counter the most prominent threat wavelengths. New materials are being developed to respond to emerging threat wavelengths and ultimately to reject the directed energy independent of threat wavelengths. Sensor modules, microwave devices, IR detectors, and infrared countermeasures (IRCM) devices are used in target detection, weapons targeting, electronic warfare, and active aircraft protection. The performance of these systems for surveillance and situational awareness is constrained by the quality and physical characteristics of available electronic and optical materials. Electronic and optical materials are being developed to enable surveillance and situational awareness with higher operating speeds, greater tunability, higher output power, improved thermal management, greater sensitivity, and extended dynamic range. The improved materials will also increase production quality, increase yields, and reduce costs for these systems.

(U) FY 1999 ($ in Thousands)

(U) $6,651 Developed new materials and processes to provide improved performance, affordability, and operational capability for Air Force radar and space sensor systems.

(U) $4,980 Developed materials to enhance the safety and survivability of aircrews against laser threats and heat seeking IR missiles.

(U) $1,620 Developed materials to enhance the survivability and mission effectiveness of air and space sensor systems against laser threats.

(U) $13,251 Total

(U) FY 2000 ($ in Thousands)

(U) $100 Develop and transition materials technology base to enhance the safety and survivability of aircrews against heat seeking IR missile threats. Determine viability of new ferroelectric nonlinear-optical (NLO) materials that can be periodically poled for far-infrared laser generation with high energy to replace state-of-the-art lithium niobate for infrared IRCM devices.

(U) $3,780 Develop and transition materials technology base to enhance the safety and survivability of aircrews against laser threats. Develop second generation, nonlinear absorbers as infrared materials. Validate stepped limiter device. Demonstrate damage tolerant, biological limiter host materials for protection of personnel eyes, viewing systems, and night vision goggles.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602102F Materials	PROJECT 624348

(U) A. Mission Description Continued

(U) FY 2000 ($ in Thousands) Continued

(U)	$881	Develop and transition enabling materials technologies to enhance the survivability and mission effectiveness of Air Force sensor systems against laser threats. Identify liquid crystal materials for autonomous tunable filters to block unknown wavelengths in evaluating switchable (hologram) narrow notch filters to provide day and night sensor agile jamming protection and in demonstrating switchable filters.
(U)	$4,761	Total

(U) FY 2001 ($ in Thousands)

(U)	$2,625	Develop materials and process technologies for power control and microwave devices to provide improved performance, affordability, and operational capability of Air Force surveillance and situational awareness systems. Develop materials and materials processes to provide increased reliability and temperature capability while reducing power consumption, weight, cost, cooling, complexity, and size. Develop bulk and epitaxial semiconductor materials with improved performance at and above the X-band wavelength region to enable improved power control devices. Evaluate and optimize defect density, doping, and stoichiometry through advanced process control techniques.
(U)	$2,791	Develop enabling infrared (IR) detector materials and process technologies to enable improved performance, affordability, and operational capability of surveillance and situational awareness systems. Evaluate alternative materials to fabricate IR detector focal plane arrays at very long wavelengths. Demonstrate multi-layered and hyperspectral/multi-spectral IR detector materials that respond to combinations of wavelengths within spectral bands and between spectral bands. Develop new processing techniques to improve yield in small lot manufacturing.
(U)	$2,890	Develop materials technology to enhance the safety and survivability of aircrews against heat seeking IR missile and laser threats. Develop new nonlinear-optical (NLO) materials to replace state-of-the-art lithium niobate for infrared countermeasure (IRCM) devices. Demonstrate second generation, nonlinear absorbers as IR materials; design a gradient limiter device, transition damage tolerant, biological limiter host materials for protection of personnel eyes, viewing systems, and night vision goggles; and establish a hardened night vision goggle testbed.
(U)	$717	Develop and transition enabling materials technologies to enhance the survivability and mission effectiveness of Air Force sensor systems against laser threats. Evaluate liquid crystal materials for autonomous tunable filters to block unknown wavelengths. Evaluate switchable (hologram) narrow notch filters to provide day and night sensor agile jamming protection. Demonstrate dual wavelength, high optical density switchable filter stacks.
(U)	$9,023	Total

(U) B. Project Change Summary

Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602102F Materials	PROJECT 624348

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

(U) Related Activities:

(U) PE 0603112F, Advanced Materials for Weapon Systems

(U) PE 0602202F, Human Effectiveness Applied Research

(U) PE 0602204F, Aerospace Sensors.

(U) PE 0603231F, Crew Systems and Personnel Protection Technology.

(U) PE 0603211F, Aerospace Structures.

(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 2000

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602102F Materials

PROJECT: 624349

COST ($ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
624349 Materials Technology for Sustainment	15,432	20,816	19,665	19,753	20,339	20,763	21,071	Continuing	TBD

(U) A. Mission Description

Develops and transitions materials and materials processing technologies to support operational Air Force mission areas by providing technologies to inspect the quality of delivered systems, transitioning more reliable and maintainable materials, establishing capability to detect and characterize performance threatening defects, characterizing materials processes and property necessary for materials transition, and providing quick reaction support and failure analysis to the operational commands and repair centers. Also develops repair techniques and nondestructive inspection/evaluation (NDI/E) methods. Repair techniques are needed for metallic and non-metallic structures, coatings, corrosion control processes, and to support integration of composite structures for space and aircraft systems. NDI/E methods are essential to ensure optimum quality in the design and production of aircraft, spacecraft, propulsion, and missile systems. NDI/E methods are also essential to monitor and detect the onset of any service-initiated damage and/or deterioration due to aging of operational systems.

(U) FY 1999 ($ in Thousands)

(U) $5,449 Developed NDI/E technologies to evaluate and characterize damage in complex, low-observable materials and structures, and to inspect and maintain integrity of aging aerospace structures and propulsion systems.

(U) $7,865 Developed support capabilities, information, and processes to resolve problems in the use of materials, in conducting failure analysis of components, in materials repair of aircraft structures, and in reducing corrosion in aircraft structures.

(U) $2,118 Developed alternative materials, processes, and environmentally friendly technologies which will eliminate dependency on hazardous and toxic substances in the acquisition, maintenance, and repair of aerospace systems.

(U) $15,432 Total

(U) FY 2000 ($ in Thousands)

(U) $7,187 Develop and transition NDI/E technology base to evaluate and characterize damage in complex, low-observable materials and structures, and to inspect and maintain integrity of aging aerospace structures and propulsion systems. Demonstrate enhanced laser generated ultrasound capabilities to detect the onset of hidden corrosion between metallic structural elements for aging aircraft structures. Establish design and laboratory scale baseline feasibility capability to evaluate remote inspection capabilities for crack detection within complex structures. Identify methods to nondestructively measure near surface (100 micron) residual stress depth gradients which will allow depots to safely extend the service life of turbine engine rotors.

(U) $2,500 Develop alternative materials, processes, and environmentally friendly technologies which will eliminate dependency on hazardous and toxic substances in the acquisition, maintenance, and repair of low-observable aerospace systems. Identify NDI/E point inspection device

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2000
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602102F Materials	PROJECT 624349

(U) A. Mission Description Continued

(U) FY 2000 ($ in Thousands) Continued

requirements to verify repair quality. Establish the baseline criteria for an integrated low-observable repair kit. Fabricate high temperature and/or ultraviolet (UV) gap sealants and conductive elastomers. Evaluate ultrasonically applied and/or removed thermoplastic Radar Absorbing Material (RAM) repairs, high temperature RAM coating repairs, and Radar Absorbing Structures (RAS) field level repairs.

(U) $11,129 Develop and transition support capabilities, information, and processes to resolve problems in the use of materials, to perform electronic and structural failure analysis of components, in the repair of aircraft structures, and to reduce aircraft corrosion. Provide failure analysis and materials investigations for field, acquisition, and depot organizations. Develop alternative wiring and connector technologies and investigate new techniques for analyzing structural failures of replacement materials for aging Air Force systems. Measure and characterize high cycle fatigue (HCF) foreign object damage (FOD) propagation values for turbine engine blade materials and transition funding to industry of military handbook 5 (MIL-HDBK 5), the primary source of static design allowables for metallic materials and structural elements (fasteners). Develop standard test procedures to assess application of low-observable gap-filler materials and evaluate on-aircraft processed adhesive and patch repair of high-temperature composite aircraft structures. Test capabilities for evaluation of corrosion and erosion resistance of new and emerging materials used in operationally fielded Air Force systems and develop technical understanding of corrosion to model and reduce corrosion in aircraft structures.

(U) $20,816 Total

(U) FY 2001 ($ in Thousands)

(U) $4,432 Develop and transition non-destructive inspection/evaluation (NDI/E) technology to identify and characterize damage in complex, low-observable materials and structures, and to inspect and maintain integrity of aging aerospace structures and propulsion systems. Transition enhanced laser generated ultrasound capabilities to detect the onset of hidden corrosion between metallic structural elements. Initiate development of an NDI/E response computer simulation model for integrated product design. Develop and design laboratory scale capability to evaluate remote inspection capabilities for crack detection within complex structures. Evaluate methods to nondestructively measure near surface (100 micron) residual stress depth gradients to allow depots to safely extend the service life of turbine engine rotors.

(U) $3,000 Develop and transition enabling technologies to reduce the Air Force maintenance burden due to low-observable requirements. Establish baseline capability for NDI/E point inspection devices to verify repair quality. Assemble an integrated low-observable repair kit. Demonstrate high temperature and/or ultraviolet (UV) gap sealants and conductive elastomers. Develop ultrasonically applied and/or removed thermoplastic RAM repairs, high temperature RAM coating repairs, and RAS field level repairs.

(U) $4,760 Develop and transition support capabilities, information, and processes to resolve problems in the use of materials and provide electronic and structural failure analysis of components. Perform failure analysis and materials investigations for field, acquisition, and depot organizations. Transition electrostatic discharge (ESD) protection materials technologies for space and low-observable applications. Experimentally evaluate

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602102F Materials	PROJECT 624349

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

testing techniques needed for analyzing structural failures of replacement materials for aging Air Force systems.

(U) $7,473 Develop and transition support capabilities, information, and processes to resolve problems in the use of materials, in the repair of aircraft structures and to reduce aircraft corrosion. Establish residual stresses baseline criteria of high cycle fatigue (HCF) and foreign object damage (FOD) in turbine engine blade materials. Evaluate advanced composite materials compatibility with laser effluents as an alternative to metallic materials for high energy chemical oxygen-iodine laser devices. Develop improved gap-filler materials for low-observable platforms and test on-aircraft processed adhesive and patch repair of high-temperature composite aircraft structures. Develop capabilities to evaluate corrosion and erosion resistance of new and emerging materials used in operationally fielded Air Force systems. Validate technical understanding of corrosion.

(U) $19,665 Total

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:

(U) PE 0603112F, Advanced Materials for Weapons Systems.

(U) PE 0603211F, Aerospace Structures

(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.