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

DATE: February 2003

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602102F Materials

	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	96,064	106,955	68,657	68,283	70,539	75,917	77,926	75,504	Continuing	TBD
4347	Materials for Structures, Propulsion, and Subsystems	60,490	66,493	38,879	37,461	39,409	44,026	45,133	41,954	Continuing	TBD
4348	Materials for Electronics, Optics, and Survivability	14,686	18,552	11,317	11,692	11,850	12,176	12,523	12,808	Continuing	TBD
4349	Materials Technology for Sustainment	19,501	17,212	16,343	16,725	16,823	17,200	17,691	18,099	Continuing	TBD
4915	Deployed Air Base Technology	1,387	3,422	2,118	2,405	2,457	2,515	2,579	2,643	Continuing	TBD
5015	Rocket Materials Technology	0	1,276	0	0	0	0	0	0	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

Note: In FY 2002, Project 4915, Deployed Air Base Technology, efforts were transferred from PE 0602201F, Project 4397. In FY 2003, space unique tasks in Projects 4347 and 4348 were transferred to PE 0602500F, Project 5025, Space Materials Development, as a result of the Space Commission recommendation to consolidate all space unique activities. In FY 2004, space unique tasks in Project 5015 will be transferred to PE 0602500F, Project 5025, as a result of the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description

The Materials program develops advanced materials and processing technologies to reduce life cycle costs and improve performance, affordability, supportability, reliability, and survivability of current and future Air Force systems. The program has four projects which: (1) develop structural, propulsion, and sub-systems materials and processes technologies; (2) develop electronic, optical, and survivability materials and processes technologies; (3) develop sustainment materials and processes technologies; and (4) develop air base operations technologies including power generation, deployable shelters, and fire fighting. Note: In FY 2003, Congress added $6.0 million for the Strategic Partnership for Nanotechnology Research, $5.3 million for the Metals Affordability Initiative, $4.4 million for titanium matrix composites, $3.25 million for nanostructured materials, $2.8 million for durable coatings for aircraft systems, $1.3 million for thermal management for military aircraft and space structures, $1.25 million for cost-effective composite materials for unmanned aerial vehicles, $1.0 million for closed cell foam material, $1.0 million

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(U) A. Mission Description Continued

for environmentally sound aircraft coatings, $1.0 million for nanostructured protective coatings, $0.5 million for composite materials training program, $3.4 million for advanced wide bandgap materials technology, $2.1 million for free electron laser materials processing, $1.1 million for advanced materials deposition for semiconductor nanotechnology, and $1.2 million for Tyndall Air Force Research Laboratory. This explains the perceived overall decrease in FY 2004 and out.

(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.

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

		FY 2002	FY 2003	FY 2004	Total Cost
(U)	Previous President's Budget	97,989	75,272	77,104	
(U)	Appropriated Value	98,564	110,872		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-575	-3,623		
	b. Small Business Innovative Research	-1,456			
	c. Omnibus or Other Above Threshold Reprogram		-294		
	d. Below Threshold Reprogram				
	e. Rescissions	-469			
(U)	Adjustments to Budget Years Since FY 2003 PBR			-8,447	
(U)	Current Budget Submit/FY 2004 PBR	96,064	106,955	68,657	TBD

(U) Significant Program Changes:

In FY 2003, space unique efforts in Projects 4347 and 4348 were transferred to PE 0602500F, Project 5025, Space Materials Development, as a result of the Space Commission recommendation to consolidate all space unique activities. In FY 2004, space unique efforts in Project 5015 are transferred to PE 0602500F, Project 5025, as a result of the Space Commission recommendation to consolidate all space unique activities. In addition, in FY 2003, this program received Congressional Adds, which explains the perceived decrease in FY 2004.

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

DATE: February 2003

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602102F Materials

PROJECT: 4347

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
4347	Materials for Structures, Propulsion, and Subsystems	60,490	66,493	38,879	37,461	39,409	44,026	45,133	41,954	Continuing	TBD

Note: In FY 2003, space unique tasks in Project 4347 were transferred to PE 0602500F, Project 5025, as a result of the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description

Develops materials and processing technology base for aircraft and missiles to improve affordability, maintainability, and performance of current and future Air Force systems. Advanced thermal protection materials are being developed that are affordable, lightweight, dimensionally stable, thermally conductive, and/or ablation and erosion resistant to meet aerospace and missile requirements. A family of affordable lightweight materials is being developed, including metals, polymers, ceramics, metallic composites, and nonmetallic composites to provide upgraded capabilities for existing aircraft, missile, and propulsion systems to meet the future system requirements. Develops high-temperature turbine engine materials that will enable engine designs to double the turbine engine thrust to weight ratio. Alternative or replacement materials are being developed to maintain the performance of aging operational systems. Friction and wear-resistant materials, paints, coatings, and other pervasive nonstructural materials technologies are being developed for propulsion and subsystems on aircraft, spacecraft, and missiles. Concurrently develops advanced processing methods to enable adaptive processing of aerospace materials. Note: In FY 2003, Congress added $6.0 million for the Strategic Partnership for Nanotechnology Research, $5.3 million for the Metals Affordability Initiative, $4.4 million for titanium matrix composites, $3.25 million for nanostructured materials, $2.8 million for durable coatings for aircraft systems, $1.3 million for thermal management for military aircraft and space structures, $1.25 million for cost-effective composite materials for unmanned aerial vehicles, $1.0 million for closed cell foam materials, $1.0 million for environmentally sound aircraft coatings, $1.0 million for nanostructured protective coatings, and $0.5 million for composite materials training program. These adds explain the perceived decrease in FY 2004 and out.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $8,110 Developed enabling polymeric materials for diverse aerospace structural applications including spacecraft mirror applications, enhanced aircraft canopies, micromechanical devices, and advanced wiring concepts. Evaluated toughened and nanostructured polymers as temperature resistant in Air Force aircraft and space applications. Demonstrated and verified new methods for rapid fabrication of micron three-dimensional structures for Air Force micromechanical devices. Demonstrated use of hybrid thin wires for aircraft and spacecraft applications. Investigated feasibility of flexible, higher efficiency polymeric fibers for photovoltaic advanced solar cells. Optimized light-absorbing polymeric materials for incorporation into paint formulations for corrosion characterization applications.

(U) $13,800 Developed affordable, advanced organic matrix composite structural materials and technologies for Air Force systems applications including

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PROJECT: 4347	

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

lightweight structures requiring thermal and/or structural management for environmental control. Scaled-up and published demonstrated processing and/or mechanics models which predict component dimensions improving low-observability and affordability for large integrated structures for future Air Force air platforms. Investigated specific composite material degradation mechanisms to improve life prediction for aircraft environmental control systems and hot, exhaust-washed structures and engine components. Evaluated next generation high temperature organic matrix composites for air and space platforms. Evaluated non-autoclave materials and processes for composite cryogenic tank structures for future space platforms. Processed and fabricated novel product foams such as nanomaterials, nanotubes, and carbon foams for lightweight, tough, and affordable structural materials.

(U) $10,570 Developed and transitioned nonstructural materials for fluids, lubricants, aircraft topcoat, and corrosion resistant coatings and specialty treatments to improve system performance and reduce life cycle costs. Tested optically tailorable thermal control coatings with controlled heat dissipation for spacecraft thermal control. Evaluated effects of the space environment on polymer and thermal control coatings. Explored electrically conductive elastomers for use in low-observable gap treatments. Established baseline analytical techniques to predict the optical properties of specialty coatings. Processed permanent corrosion resistant primer resins and environmentally safe corrosion protection with a 30-year life for aircraft surfaces. Identified nanostructured multifunctional coatings to control friction and wear in extreme operating environments. Evaluated surface treatments for friction, stiction, and wear control in micro-scale devices and micromechanical applications.

(U) $24,005 Developed and transitioned affordable lightweight metallic materials, behavior and life prediction technologies, higher temperature intermetallic alloys, and metals processing technology to enhance performance, lower acquisition costs, increase durability, and improve reliability for weapon systems. Demonstrated life prediction methodology and surface treatments needed to prevent High Cycle Fatigue damage in integrally bladed rotors. Characterized high temperature metallic alloys with the potential of achieving a 300°F temperature capability increase over current turbine blade materials. Refined damage-tolerant life prediction methodologies for high temperature resistant titanium alloy for their use in fracture-critical turbine engine applications. Developed advanced affordable process technologies to enable more affordable production of complex structural metal components for air and space vehicles. Developed processing methods for the metallic materials for lightweight, high-strength components in future space vehicles.

(U) $4,005 Developed ceramics and ceramic matrix composite technologies for enhanced performance and supportability improvements in advanced propulsion systems and high temperature aerospace structures. Evaluated ceramic composites for exhaust and hot section components under real and simulated service life conditions, with a focus toward life prediction and durability assessment. Developed highly durable thermal protection materials for aerospace vehicles with aircraft-like operability. Developed ceramic composites for lightweight space mirror applications. Identified best performing aircraft brake material and performed full-scale dynamometer tests. Optimized radar absorbing material coating repair for superalloy and/or titanium alloy substrates. Evaluated advanced oxidation-resistant interface coatings in severe applications. Initiated the

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

development of more durable ceramic composites based on these new coatings.

(U) $60,490 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $9,560 Develop enabling polymeric materials for diverse aerospace structural applications including enhanced aircraft canopies, micromechanical devices, advanced wiring concepts, and improved low-observable platforms. Demonstrate feasibility of nanostructured materials for temperature-resistant applications and evaluate applicability for gas and fluid containment components for pervasive Air Force aerospace subcomponent applications. Demonstrate and transition new methods for rapid fabrication of micron-scale three-dimensional structures for Air Force micromechanical devices. Demonstrate and transition use of hybrid thin wires for Air Force aerospace component applications. Demonstrate light-absorbing polymeric materials for incorporation into paint formulations for corrosion characterization applications. Investigate new methods for room temperature cure of resins for advanced Air Force composite applications. Evaluate the use of conductive materials for low-observable gap sealants in Air Force aircraft applications.

(U) $13,912 Develop affordable, advanced organic matrix composite structural materials and technologies for Air Force systems applications including lightweight structures for aerospace subcomponents and other structures requiring thermal and/or structural management for environmental control. Develop composite material degradation mechanisms to improve life prediction for aircraft environmental control systems, hot exhaust-washed structures, and engine components. Develop next generation high temperature organic matrix composites for aerospace platforms. Continue processing and fabrication of novel product foams such as nanomaterials, nanotubes, and carbon foams for lightweight, tough, and affordable structural materials.

(U) $11,234 Develop and transition nonstructural materials for fluids, lubricants, aircraft topcoat and corrosion resistant coatings, and specialty treatments to improve system performance and reduce life-cycle costs. Develop electrically conductive elastomers for use in electrostatic discharge control gap treatments. Develop advanced analytical techniques to predict the optical properties of specialty coatings. Test permanent corrosion-resistant primer resins and environmentally safe corrosion protection with a 30-year life. Establish baseline for nanostructured multifunctional coatings to control friction and wear in extreme environments. Develop surface treatments for friction, stiction, and wear control in micro-devices.

(U) $26,493 Develop and transition affordable lightweight metallic materials, behavior and life prediction technologies, higher temperature intermetallic alloys, and metals processing technology to enable enhanced performance, lower acquisition costs, increased durability, and improved reliability for Air Force weapon systems. Transition life prediction methodology and surface treatments needed to prevent High Cycle Fatigue damage in

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

integrally bladed rotors. Develop processing methods for second-generation alloys with the potential of achieving a 300°F temperature capability increase over current turbine blade materials. Develop computational methods for modeling the mechanical properties of specific metallic alloys. Optimize and transition advanced affordable process technologies to enable more affordable production of complex structural metal components for Air Force aerospace vehicles.

(U) $3,260 Develop ceramics and ceramic matrix composite technologies for revolutionary performance and supportability improvements in advanced propulsion systems and high temperature aerospace structures. Test advanced ceramic composites for exhaust and hot section components under real and simulated service life conditions, using the data for durability assessment and life prediction development. Demonstrate highly durable thermal protection materials for aerospace vehicles with aircraft-like operability through hot acoustic and other specialized testing. Demonstrate radar absorbing material coating repair for superalloy and/or titanium alloy substrates. Evaluate more durable ceramic composites based on emerging fibers and advanced interface coatings.

(U) $2,034 Develop and transition materials processing technologies involving process models, multi-objective optimization methods, and advanced non-invasive sensors. Investigate the feasibility of using evanescent microwave or inelastic photon (Raman) imaging of the surface and near-surface region as a process sensor. Evaluate new techniques for generating large-scale dynamic and phase behavior simulations for nanomaterial process design. Transition an interactive design-manufacturing environment which allows rapid design interaction between multiple sites over the Internet. Demonstrate high-power, tunable laser processing tool for micro-engineered aerospace components and subsystems.

(U) $66,493 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $2,608 Develop enabling polymeric materials for diverse aerospace structural applications including enhanced aircraft canopies, micromechanical devices, advanced wiring concepts, and improved low-observable platforms. Test clay infiltrated nanostructured polymeric materials for impermeability of gas and fluids. Develop rapid fabrication of nanoscale three-dimensional structures for Air Force electromechanical devices. Test hybrid thin wires under rigorous environmental conditions and extreme mechanical stresses. Transition light-absorbing polymer materials for corrosion characterization applications. Develop the curing process for and initiate testing of composites containing advanced resins. Demonstrate the use of nanostructured polymer materials for low-observable applications.

(U) $7,710 Develop affordable, advanced organic matrix composite structural materials and technologies for Air Force systems applications including lightweight structures for aerospace subcomponents and other structures requiring thermal and/or structural management for environmental

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

control. Continue to develop understanding of degradation mechanisms and life prediction capabilities for aircraft turbine engine and exhaust-washed structures as a function of their environments. Validate materials, processing, and fabrication scale-up of high-temperature organic matrix composites for turbine engine and aircraft applications. Evaluate nanomaterials technologies for multifunctional properties required by military aircraft. Evaluate innovative carbon materials, such as carbon foams, and processing techniques for aircraft thermal management applications.

(U) $7,105 Develop and transition nonstructural materials for fluids, lubricants, aircraft topcoat and corrosion-resistant coatings, and specialty treatments to improve system performance and reduce life-cycle costs. Formulate the most promising electrically conductive elastomers for specific electrostatic discharge control gap treatments. Continue to develop advanced analytical techniques to predict the optical properties of specialty coatings. Demonstrate non-chromate surface treatments with advanced performance coatings for aircraft corrosion protection systems. Develop environmentally friendly corrosion protection systems with a 30-year life expectancy. Evaluate nanostructured multifunctional coatings to control friction and wear in extreme environments. Refine candidate surface treatments for friction, stiction, and wear control in micro-devices. Investigate potential health monitoring techniques for hydraulic fluids and related subsystems to extend aircraft life and establish condition-based maintenance procedures. Identify materials technologies suitable for use in secure and/or tamper resistant electronics.

(U) $16,441 Develop and transition affordable lightweight metallic materials, behavior and life prediction technologies, higher temperature intermetallic alloys, and metals processing technology to enable enhanced performance, lower acquisition costs, increased durability, and improved reliability for Air Force weapon systems. Initiate development of new life prediction technologies for improving aircraft turbine engine rotor durability in thermal-mechanical fatigue design systems. Continue to develop and analyze second-generation high-temperature structural materials that are Nickel (Ni) and Molybdenum (Mo) based for turbine engine applications. Demonstrate computational methods for modeling mechanical properties of metals and alloys and validate these tools so that they can be used to reduce the amount of proof testing required to release metals for final component production. Identify processes and protocols for unitized manufacturing of aerospace components.

(U) $2,410 Develop ceramics and ceramic matrix composite technologies for revolutionary performance and supportability improvements in advanced propulsion systems and high-temperature aerospace structures. Design advanced ceramics and ceramic composites with improved durability and fracture resistance for aircraft applications. Develop advanced analytical techniques to predict the life of advanced ceramic composites containing stress concentration sites. Develop advanced analytical models to design integrally woven, actively cooled ceramic composite structures for advanced combustor applications. Design advanced ceramic composites for severe environments using the best available fiber-matrix interface technology.

(U) $2,605 Develop and transition materials processing technologies involving process models, multi-objective optimization methods, and advanced non-invasive sensors. Validate the use of evanescent microwave sensors for evaluating laser damage and subsurface corrosion. Establish

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

baseline parameters for selected techniques for generating large-scale dynamic and phase behavior simulations for nanomaterial process design. Investigate process control of optical deposition for scale-up and stress control of optical and multi-functional coatings.

(U) $38,879 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 Weapon Systems.
(U) PE 0603211F, Aerospace Technology Dev/Demo.
(U) PE 0603202F, Aerospace Propulsion Subsystems Integration.
(U) PE 0603216F, Aerospace Propulsion and Power Technology.
(U) PE 0602500F, Multi-Disciplinary Space 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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DATE: February 2003

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602102F Materials

PROJECT: 4348

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
4348	Materials for Electronics, Optics, and Survivability	14,686	18,552	11,317	11,692	11,850	12,176	12,523	12,808	Continuing	TBD

Note: In FY 2003, space unique tasks in Project 4348 were transferred to PE 0602500F, Project 5025, as a result of the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description

Develops materials technologies for surveillance and terrestrial situational awareness systems and subsystems for aircraft and missile applications. Develops materials for protection of aircrews, sensors, and aircraft from laser and high-power microwave directed energy threats. Develops sensor modules, microwave devices, infrared detectors, and infrared countermeasures devices that are used in target detection, weapons targeting, electronic warfare, and active aircraft protection. Electronic and optical materials are being developed to enable surveillance and terrestrial situational awareness with faster operating speeds, greater tunability, higher power output, improved thermal management (including higher operating temperatures), greater sensitivity, and extended dynamic range. New materials are being developed to counter the most prominent laser threat wavelengths, to respond to emerging threat wavelengths, and to reject the directed energy of agile threat wavelengths without impairing mission effectiveness. Note: In FY 2003, Congress added $3.4 million for advanced wide bandgap materials technology, $2.1 million for free electron laser materials processing, and $1.1 million for advanced materials deposition for semiconductor nanotechnology, which explains the perceived decrease in FY 2004.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $8,009 Developed and demonstrated materials and process technologies for power generation, power control, and microwave components to provide improved performance, affordability, and operational capability for surveillance, tracking, targeting, situational awareness, and lethal and non-lethal weapon systems. Developed and demonstrated materials and materials processing technologies to enable increased power generation and power control components reliability and temperature capability while reducing power consumption, weight, cost, cooling, complexity, and size. Developed and demonstrated materials and materials processes to provide presently unattainable performance for power control systems, advanced radar, and electronic countermeasures systems. Developed materials and materials process technologies for ultra-lightweight, ultra-high-power aircraft electrical generators enabling airborne lethal and non-lethal directed energy weapons in fighter-sized aircraft.

(U) $2,402 Developed and demonstrated infrared (IR) detector materials and processing technologies to enable improved performance, affordability, and operational capability of surveillance, tracking, targeting, and situational awareness systems. Developed alternative IR detector materials for space applications capable of detecting very long wavelengths. Developed the process control required for growth of complex IR detector materials that are responsive to multiple wavelengths within and between spectral bands. Validated new processing techniques to improve IR detector materials yield and affordability in small lots.

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U)	$3,608	Developed and demonstrated materials technologies to enhance the safety and survivability of aircrews and related assets against heat seeking missiles and laser threats. Demonstrated improved growth and processing techniques for large nonlinear crystals for generating higher power far-infrared (IR) laser radiation for advanced infrared countermeasures. Developed and validated materials processing techniques and materials that will enable high performance optical control of phased array radar and satellite to satellite data links. Identified and characterized organic materials with large nonlinear absorption properties for the protection of personnel eyes, viewing systems, and night vision goggles.
(U)	$667	Developed enabling materials technologies to enhance the survivability and mission effectiveness of aerospace sensors, viewing systems, and night vision goggles against laser threats. Developed liquid crystal materials for autonomous tunable filters to block agile laser wavelengths. Evaluated high optical density, multiple wavelength switchable filter stacks on curved substrates for agile laser wavelength eye protection.
(U)	$14,686	Total

(U) FY 2003 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$9,346	Develop and demonstrate materials and process technologies for power generation, power control, and microwave components to provide improved performance, affordability, and operational capability for Air Force surveillance, tracking, targeting, situational awareness, and lethal and non-lethal weapon systems. Demonstrate and validate materials and materials processing technologies to enable increased Air Force systems reliability and temperature capability while reducing power consumption, weight, cost, cooling, complexity, and size. Develop and transition materials and materials processes to provide presently unattainable performance for power control systems, advanced radar, and electronic countermeasures. Scale-up and transition materials and materials process technologies for ultra-lightweight, ultra-high-power aircraft electrical generators enabling airborne lethal and non-lethal directed energy weapons in fighter-sized aircraft.
(U)	$2,932	Develop, demonstrate, and transition IR detector materials and materials processing technologies to enable improved performance, affordability, and operational capability of Air Force surveillance, tracking, targeting, and situational awareness systems. Demonstrate the process control required for growth of complex IR detector materials that are responsive to multiple wavelengths within and between spectral bands. Transition new processing techniques to improve detector materials yield and affordability in small lots. Investigate IR detector materials that provide enhanced real-time tracking capability.
(U)	$5,326	Develop, demonstrate, and transition materials technologies to enhance the safety and survivability of aircrews and related assets against heat seeking missiles and laser threats. Develop growth and processing techniques for large nonlinear crystals for generating higher power mid-IR laser radiation for future IR countermeasures. Incorporate promising nonlinear absorbing materials into candidate host materials and demonstrate their performance in the Air Force Optical Limiting Testbed for the protection of personnel eyes, viewing systems, and night vision

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

goggles.

(U) $948 Develop and transition enabling materials technologies to enhance the survivability and mission effectiveness of Air Force sensors, viewing systems, and night vision goggles against laser threats. Demonstrate liquid crystal materials employed in autonomous tunable filters to block near-infrared (IR) wavelengths. Develop high optical density, multiple wavelength switchable filter stacks on curved substrates.

(U) $18,552 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $3,948 Develop and demonstrate materials and process technologies for power generation, power control, and microwave components to provide improved performance, affordability, and operational capability for Air Force surveillance, tracking, targeting, situational awareness, and lethal and non-lethal weapon systems. Validate and transition materials and materials processing technologies to enable increased Air Force systems reliability and temperature capability while reducing power consumption, weight, cost, cooling, complexity, and size. Continue development and transition of materials and processes to provide presently unattainable performance for power control systems, advanced radar, and electronic countermeasures. Complete scale-up of baseline materials and materials process technologies for ultra-lightweight, ultra-high-power aircraft electrical generators enabling airborne lethal and non-lethal directed energy weapons in fighter-sized aircraft.

(U) $448 Develop, demonstrate, and transition IR detector materials and materials processing technologies to enable improved performance, affordability, and operational capability of Air Force surveillance, reconnaissance, tracking, targeting, and situational awareness systems. Validate the military utility of complex IR detector materials that are responsive to multiple wavelengths within and between spectral bands. Exploit validated processing techniques to enhance detector materials performance and improve military utility. Demonstrate the process control required for growth of complex infrared detector materials that require control on an atomic level to structure their detection properties. Investigate potential materials solutions for detection of chemical and biological threats.

(U) $4,888 Develop, demonstrate, and transition materials technologies to enhance the safety and survivability of aircrews and related assets against heat seeking missiles and laser threats. Investigate growth and processing techniques for nonlinear optical crystals including surface coatings and nanostructuring for generating laser radiation with significantly higher energy per pulse for future infrared countermeasures. Optimize the performance of promising nonlinear absorbing materials in candidate host materials and demonstrate their improved performance in the Air Force Optical Limiting Testbed for the protection of personnel eyes, viewing systems, and night vision goggles.

(U) $2,033 Develop and transition enabling materials technologies to enhance the survivability and mission effectiveness of Air Force sensors, viewing systems, and night vision goggles against laser threats. Validate the performance of liquid crystal materials employed in autonomous tunable

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

filters to block near-infrared wavelengths. Fabricate laboratory samples of high optical density, multiple wavelength switchable filter stacks on curved substrates.

(U) $11,317 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 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 Technology Dev/Demo.
(U) PE 0602500F, Multi-Disciplinary Space 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 2003

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602102F Materials

PROJECT: 4349

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
4349	Materials Technology for Sustainment	19,501	17,212	16,343	16,725	16,823	17,200	17,691	18,099	Continuing	TBD

(U) A. Mission Description

Develops and transitions materials and materials processing technologies to support operational Air Force mission areas by providing the ability to inspect the quality of delivered systems, transitioning more reliable and maintainable materials, establishing a capability to detect and characterize performance threatening defects, characterizing materials processes and properties necessary for materials transition, and providing quick reaction support and failure analysis to the operational commands and repair centers. Develops repair techniques and nondestructive inspection/evaluation (NDI/E) methods that are needed for metallic and non-metallic structures, coatings, corrosion control processes, and to support integration of composite structures for aerospace systems. Various NDI/E methods are essential to ensure optimum quality in the design and production of aircraft, propulsion, and missile systems. These 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 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $4,445 Developed NDI/E technology to identify and characterize damage in complex, low-observable materials and structures. Developed inspection technology for aging aerospace structures and propulsion systems. Identified methods to rapidly detect and characterize multi-site damage and cracks in large area, aging structures. Identified computer simulations and models of NDI/E technique response which will enable the development of improved inspections in a virtual environment to permit the depots to rapidly assess the potential of new corrosion and crack detection NDI/E methods. Developed transition methods to measure residual stress to allow depots to safely extend the service life of turbine engine rotors. Identified and developed methods to detect and characterize the severity of fretting fatigue in engine components. Identified NDI/E methods to characterize the low-observable properties of paints and coatings during and after application.

(U) $3,148 Developed enabling technologies to reduce the Air Force maintenance burden due to low-observable requirements. Developed capability for NDI/E point inspection devices and verify repair quality. Evaluated an integrated low-observable repair kit. Validated high temperature and/or ultraviolet gap sealants and conductive elastomers. Demonstrated ultrasonically applied and/or removed thermoplastic radar absorbing material (RAM) repairs, high temperature RAM coating repairs, and radar absorbing structure field level repairs.

(U) $4,605 Developed and transitioned support capabilities, information, and processes to resolve problems in the use of materials and provide electronic and structural failure analysis of components. Performed failure analysis and materials investigations for field, acquisition, and depot organizations. Continued certification and transition of emerging electrostatic discharge protection materials technologies and techniques for space and low-observable applications. Continued experimental evaluation of testing techniques needed for analyzing structural failures of

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BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602102F Materials	PROJECT 4349

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

replacement materials for aging Air Force systems.

(U) $7,303 Developed support capabilities, information, and processes to resolve problems in the use of materials in the repair of aircraft structures and to reduce aircraft corrosion. Validated residual stresses baseline criteria of high cycle fatigue foreign object damage in turbine engine blade materials. Demonstrated advanced composite materials compatibility with laser effluents as an alternative to metallic materials for high energy chemical oxygen-iodine laser devices. Evaluated improved gap-filler materials for low-observable platforms and test on-aircraft processed adhesive and patch repair of high-temperature composite aircraft structures. Demonstrated capabilities to evaluate corrosion and erosion resistance of new and emerging materials used in operationally fielded Air Force systems. Established a baseline for improved corrosion management procedures.

(U) $19,501 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $4,848 Develop non-destructive inspection/evaluation (NDI/E) technology to identify and characterize damage in complex, low-observable (LO) materials and structures. Develop inspection for aging aerospace structures and propulsion systems. Evaluate methods to rapidly detect and characterize multi-site damage and cracks in large area, aging structures. Evaluate computer simulations and models of non-destructive evaluation (NDE) technique response which will enable the development of improved inspections in a virtual environment to permit the depots to rapidly assess the potential of new corrosion and crack detection NDE methods. Evaluate methods to detect and characterize the severity of fretting fatigue in engine components. Evaluate NDI/E methods to characterize the LO properties of paints and coatings during and after application.

(U) $2,466 Develop and transition enabling technologies to reduce the Air Force maintenance burden due to LO requirements. Validate capability for NDE point inspection devices and verify repair quality. Demonstrate an integrated LO repair kit. Transition high temperature and/or ultraviolet gap sealants and conductive elastomers. Transition ultrasonically applied and/or removed thermoplastic radar absorbing material (RAM) repairs, high temperature RAM coating repairs, and radar absorbing structure field level repairs.

(U) $3,896 Develop 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. Continue certification and transition of emerging electrostatic discharge protection materials technologies and techniques for LO applications. Continue experimental evaluation of testing techniques needed for analyzing structural failures of replacement materials for aging Air Force systems.

(U) $6,002 Develop support capabilities, information, and processes to resolve problems in the use of materials in the repair of aircraft structures and to

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

reduce aircraft corrosion. Publish residual stresses baseline criteria of high cycle fatigue foreign object damage in turbine engine blade materials. Transition advanced composite materials compatibility with laser effluents as an alternative to metallic materials for high-energy chemical oxygen-iodine laser devices. Transition improved gap-filler materials for low-observable (LO) platforms and demonstrate on-aircraft processed adhesive and patch repair of high-temperature composite aircraft structures. Demonstrate capabilities to evaluate corrosion and erosion resistance of new and emerging materials used in operationally fielded Air Force systems. Publish baseline for improved corrosion management procedures.

(U) $17,212 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $3,551 Develop non-destructive inspection/evaluation (NDI/E) technology to identify and characterize damage in complex, LO materials and structures. Transition methods to inspect and maintain the integrity of aging aerospace structures and propulsion systems. Develop electromagnetic methods to rapidly detect and characterize multi-site damage and cracks in large-area, aging structures. Develop computer simulations and models of NDI/E technique response, which will enable the development of improved inspections in a virtual environment to permit the depots to rapidly assess the potential of new corrosion and crack detection NDI/E methods. Develop methods to detect and characterize the severity of fretting fatigue in engine components. Evaluate technology concepts for measuring complex electromagnetic material properties beneath dielectric tiles in LO applications.

(U) $3,647 Develop and transition enabling technologies to reduce the Air Force maintenance burden due to LO requirements. Transition NDI/E point inspection device capability to the Non-Destructive Inspection Office at Oklahoma City Air Logistics Center. Demonstrate a standardized LO repair kit for use on multiple aircraft systems which will result in standardization of aircraft repair processes.

(U) $4,183 Develop 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. Develop electrostatic discharge protection technologies for emerging avionics subsystems. Develop new test methodologies for analyzing structural failures of replacement materials for aging Air Force systems. Initiate materials technologies effort to replace aging wiring in Air Force aircraft subsystems.

(U) $4,962 Develop support capabilities, information, and processes to resolve problems in the use of materials in the repair of aircraft structures and to reduce aircraft corrosion. Develop and evaluate methodologies to determine corrosion and erosion resistance of new and emerging materials used in operationally fielded Air Force systems. Identify failure mechanisms in Micro-Electro-Mechanical Systems used in hybrid,

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

multifunctional, or health monitoring structures and subsystems.

(U) $16,343 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 Technology Dev/Demo.

(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: 02 - Applied Research	PE NUMBER AND TITLE: 0602102F Materials		PROJECT: 4915

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
4915 Deployed Air Base Technology	1,387	3,422	2,118	2,405	2,457	2,515	2,579	2,643	Continuing	TBD

Note: In FY 2002, Project 4915, Deployed Air Base Technology, efforts were transferred from PE 0602201F, Project 4397.

(U) A. Mission Description

Supports the Aerospace Expeditionary Forces (AEF) through development of new technologies for deployable airbase systems to reduce airlift and manpower requirements, setup times, and sustainment costs. Develops efficient and cost-effective technologies, including fire fighting and physical protection, to provide force protection and survivability to deployed AEF warfighters. Develops affordable, deployable technologies that ensure military readiness, maintain aerospace missions, support weapon systems sustainment, and ensure deployability. Note: In FY 2003, Congress added $1.2 million for Tyndall Air Force Research Laboratory.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $881 Developed new deployable airbase technologies to reduce airlift and manpower requirements, setup times, and sustainment costs in support of AEF operations. Developed lightweight, flexible solar cell technologies that improve operating efficiency and reduce sustainment costs of airmobile systems. Developed lightweight, rapidly assembled matting systems to enable rapid expansion of aircraft parking at deployment locations. Developed effective advanced fire fighting agents and equipment to protect deployed warfighters.

(U) $104 Developed affordable, deployable technologies that ensure military readiness, maintain aerospace missions, support weapon systems sustainment, and ensure deployablity. Developed safe, cost-effective disposal of problem AEF wastes for low-observable material waste treatment.

(U) $402 Developed efficient and cost-effective technologies to provide force protection and survivability to AEF deployed warfighters and materials. Developed atmospheric threat prediction models and deployable sensors systems to protect AEF forces from toxic industrial materials.

(U) $1,387 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $1,825 Develop new deployable airbase technologies to reduce airlift and manpower requirements, setup times, and sustainment costs in support of AEF operations. Develop deployable fuel cell, solar power, and heat pump technologies that increase performance, decrease maintenance and mean times between failure, increase operating efficiency, and reduce sustainment costs.

(U) $101 Develop affordable, deployable technologies that ensure military readiness, maintain aerospace missions, support weapon systems sustainment, and ensure deployablity. Continue development of safe, cost-effective disposal of problem AEF wastes for low-observable material waste

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

treatment.

(U) $1,496 Develop cost-effective technologies to provide force protection and survivability to Aerospace Expeditionary Force (AEF) deployed warfighters and materials. Continue development of atmospheric threat prediction models and deployable sensors systems to protect AEF personnel from toxic industrial materials. Develop effective advanced fire fighting agents and equipment and advanced blast protection materials to protect deployed warfighters.

(U) $3,422 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $1,280 Develop new deployable airbase technologies to reduce airlift and manpower requirements, setup times, and sustainment costs in support of AEF operations. Transition deployable fuel cell power system to advanced technology development. Demonstrate and transition high-efficiency solid state solar cell technology. Initiate development of an advanced, compact integrated shelter/utility system that will integrate fuel cell and solar power with heat pump technologies to provide highly efficient, individual systems for deployable shelters. Initiate research on polymer-clay stabilization technology for rapid airfield expansion that will reduce the time required to prepare aircraft operating surfaces at contingency bases. Initiate research on biocatalysis and biodegradation of Air Force materials that will provide cleaner and lower cost advanced materials.

(U) $838 Develop cost-effective technologies to provide force protection and survivability for deployed AEF materials and warfighters. Continue development of fire fighting foam agents in conjunction with combined fire supressant equipment and advanced blast protection materials to protect deployed warfighters. Develop and demonstrate polymer-based retrofit technologies for expeditionary and permanent structures to protect the warfighter.

(U) $2,118 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 Weapon Systems.

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

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BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602102F Materials
PROJECT: 4915	

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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DATE: February 2003

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602102F Materials

PROJECT: 5015

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
5015 Rocket Materials Technology	0	1,276	0	0	0	0	0	0	Continuing	TBD

Note: In FY 2003, civilian salaries associated with space unique tasks in PE 0602102 were transferred to Project 5015. In FY 2004, these salaries in Project 5015 will be transferred to PE 0602500F, Project 5025, as a result of the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description

Develops advanced pervasive materials and processing technologies for aerospace propulsion technologies to dramatically improve affordability, performance, and reliability of current and future aerospace engine applications. The components of liquid-fuel engines that advanced materials can significantly impact include lightweight ducts, turbo pumps, injectors, and nozzles sub-systems. The material advancements in these aerospace systems will provide lighter weight, performance, and cost-reduction enhancements for overall aerospace engine applications. This project will develop material property databases and initiate the demonstration of suitability for new materials application using representative geometry and processing conditions for the intended aerospace engine components.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $0 No Activity

(U) $0 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $1,276 Develop and demonstrate pervasive materials and processing technologies for aerospace engine components and sub-components to dramatically improve affordability, performance, and reliability of current and future Air Force aerospace systems. Evaluate chemistry/heat treatment combination for new compatible alloys for aerospace propulsion housing components. Identify and develop pervasive zero erosion materials for multiple aerospace engine and missile applications. Identify and evaluate pervasive high temperature catalyst materials that will enable the use of high performance monopropellants for aerospace propulsion systems.

(U) $1,276 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $0 No Activity

(U) $0 Total

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BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602102F Materials
PROJECT: 5015	

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:

(U) PE 0602203F, Aerospace Propulsion.
PE 0603112F, Advanced Materials for Weapon Systems.
PE 0602500F, Multi-Disciplinary Space 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.