

**UNCLASSIFIED**

PE NUMBER: 0603112F

PE TITLE: Advanced Materials for Weapon Systems

<b>Exhibit R-2, RDT&amp;E Budget Item Justification</b>	DATE <b>February 2007</b>
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<b>BUDGET ACTIVITY</b> <b>03 Advanced Technology Development (ATD)</b>	<b>PE NUMBER AND TITLE</b> <b>0603112F Advanced Materials for Weapon Systems</b>
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Cost (\$ in Millions)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	65.193	82.290	39.730	39.324	48.652	46.771	47.742	48.924	Continuing	TBD
2100 Laser Hardened Materials	26.653	35.689	25.610	26.409	34.036	32.012	32.676	33.485	Continuing	TBD
3153 Non-Destructive Inspection Development	13.287	15.885	3.772	3.875	4.389	4.449	4.542	4.653	Continuing	TBD
3946 Materials Transition	19.163	14.755	3.742	3.791	4.276	4.265	4.354	4.461	Continuing	TBD
4918 Deployed Air Base Demonstrations	6.090	10.864	2.216	2.274	2.581	2.625	2.679	2.746	Continuing	TBD
77SP Advanced Space Materials	0.000	5.097	4.390	2.975	3.370	3.420	3.491	3.579	Continuing	TBD

Note: In FY 2007, Project 77SP, Advanced Space Materials, efforts transfer from PE 0603500F, Multidisciplinary Space Technology, Project 5032, Advanced Space Materials, in order to more effectively manage and provide oversight of the efforts. Funds for the FY 2007 Congressionally-directed Advanced Inspection Techniques and Analysis Methods for Multi-layer Structures and Widespread Fatigue Damage in Aging Military Aircraft in the amount of \$1.1 million are in the process of being moved to PE 0603112F, Advanced Materials for Weapon Systems, from PE 0702207F, Depot Maintenance, for execution.

**(U) A. Mission Description and Budget Item Justification**

This program develops and demonstrates materials technology for transition into Air Force systems. The program has four projects which develop: (1) hardened materials technologies for the protection of aircrews and sensors; (2) non-destructive inspection and evaluation technologies; (3) transition data on structural and non-structural materials for aerospace applications; and (4) airbase operations technologies including deployable base infrastructure, force protection, and fire fighting capabilities. Note: In FY 2007, Congress added \$1.2 million for Large Panel Sapphire Producibility, \$2.3 million for Metals Affordability Initiative, \$1.6 million for Encapsulated Ballistic Protection System, \$1.0 million for Combined Agent Fire Fighting System, \$1.0 million for Continuous Integrated Vehicle Health Monitoring System, \$2.0 million for Aging Aircraft Fleet Support - National Institute for Aviation Research, \$1.0 million for Low Observable Multi-Purpose Inspection Tool, \$1.0 million for Coated Field Repair, \$1.0 million for Optical Filters for Hardened Night Vision Goggles, \$1.3 million for Blast-Resistant Barriers and Structural Design for Homeland Defense, \$1.8 million for Advanced Power Technology: Silicon-Carbide Power, Bipolar Junction Transistors, \$2.0 million for Assessing Aging of Military Aircraft, \$3.3 million for Hydrothermal Oxidation (HTO) for Alaska, \$2.0 million for Improved Stealth Aircraft Availability/Functionality, \$2.0 million for Inspection and Analysis Methods for Aging Military Aircraft, \$1.0 million for Materials Integrity Management Research for AF Systems, \$5.8 million for Silicon Carbide Electronics Material Producibility Initiative, \$1.0 million for Quantitative Inspection Techniques for Assessing Aging Military Aircraft, and \$1.4 million for Body Armor Underarm and Side Protection with Smart Materials. 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.

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(U) **B. Program Change Summary (\$ in Millions)**

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Previous President's Budget	70.100	48.901	43.519	45.465
(U) Current PBR/President's Budget	65.193	82.290	39.730	39.324
(U) Total Adjustments	-4.907			
(U) Congressional Program Reductions				
Congressional Rescissions	0.023	-0.311		
Congressional Increases		33.000		
Reprogrammings	-3.429	0.700		
SBIR/STTR Transfer	-1.501			

(U) **Significant Program Changes:**

In FY 2007, Project 77SP, Advanced Space Materials, efforts transfer from PE 0603500F, Multidisciplinary Space Technology, Project 5032, Advanced Space Materials, in order to more effectively manage and provide oversight of the efforts.

C. Performance Metrics

Under Development.

**Exhibit R-2a, RDT&E Project Justification**

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BUDGET ACTIVITY <b>03 Advanced Technology Development (ATD)</b>					PE NUMBER AND TITLE <b>0603112F Advanced Materials for Weapon Systems</b>			PROJECT NUMBER AND TITLE <b>2100 Laser Hardened Materials</b>		
Cost (\$ in Millions)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
2100 Laser Hardened Materials	26.653	35.689	25.610	26.409	34.036	32.012	32.676	33.485	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

**(U) A. Mission Description and Budget Item Justification**

This project develops and demonstrates advanced materials technologies that enhance protection for Air Force aircrews to ensure safety and to enable aircrews to perform required missions in threat environments. Advanced materials technologies are also developed and demonstrated to enhance protection for Air Force sensor systems to ensure safety, survivability, and operability in threat environments.

**(U) B. Accomplishments/Planned Program (\$ in Millions)**

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST/CONGRESSIONAL ADD: Develop and demonstrate advanced materials technologies that enhance hardening for sensors, avionics, and components to increase survivability and mission effectiveness of aerospace systems. Note: This effort includes Congressional Add funding of \$2.6 million in FY 2006 for Large Panel Sapphire Producibility and \$1.2 million in FY 2007 for Large Panel Sapphire Producibility.	20.001	27.556	19.812	20.020
(U) In FY 2006: Developed a mid-wavelength infrared testbed based on a candidate optical system. Evaluated solid state limiter materials having potential for dual band operation. Evaluated jamming and damage phenomenologies for large format charge coupled devices (CCD).				
(U) In FY 2007: Mature hardening technology and develop a hardened candidate system. Develop candidate dual band limiter materials. Develop protection strategies for large format CCDs.				
(U) In FY 2008: Demonstrate mature hardening materials technology for an Air Force tactical system. Characterize and incorporate candidate dual band limiter materials for tactical systems. Demonstrate protection strategies for large format CCDs.				
(U) In FY 2009: Transition mature hardening materials technology for an Air Force tactical system. Demonstrate performance of dual band limiter materials in tactical systems.				
(U) MAJOR THRUST/CONGRESSIONAL ADD: Develop and demonstrate advanced materials technologies that enhance protection for Air Force aircrews to ensure safety and to enable aircrews to perform required missions in a threat environment. Note: This effort includes Congressional Add funding of \$1.0 million in FY 2007 for Optical Filters for Hardened Night Vision Goggles (NVGs).	6.652	8.133	5.798	6.389
(U) In FY 2006: Developed and characterized an NVG brassboard system using state-of-the-art agile filters and optical power limiters. Developed agile filter and optical limiter technologies.				
(U) In FY 2007: Demonstrate brassboard performance using state-of-the-art agile filters and optical power				

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<b>BUDGET ACTIVITY</b> <b>03 Advanced Technology Development (ATD)</b>	<b>PE NUMBER AND TITLE</b> <b>0603112F Advanced Materials for Weapon Systems</b>	<b>PROJECT NUMBER AND TITLE</b> <b>2100 Laser Hardened Materials</b>
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<b>(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
limiters. Characterize and incorporate agile filter and optical limiter technologies into devices for Air Force applications.				
(U) In FY 2008: Validate performance of state-of-the-art agile filters and optical power limiters in a system configuration. Optimize agile filter and optical limiter devices for Air Force applications.				
(U) In FY 2009: Transition advanced agile filters and optical power limiters technologies in a system configuration. Demonstrate agile filter and optical limiter devices for Air Force applications.				
(U) Total Cost	26.653	35.689	25.610	26.409

<b>(U) <u>C. Other Program Funding Summary (\$ in Millions)</u></b>		<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
		<u>Actual</u>	<u>Estimate</u>	<u>Complete</u>							
(U) Related Activities:											
(U) PE 0602102F, Materials.											
(U) PE 0602202F, Human Effectiveness Applied Research.											
(U) PE 0603231F, Crew Systems and Personnel Protection Technology.											
(U) PE 0603500F, Multi-Disciplinary Advanced Development Space Technology.											
(U) PE 0604706F, Life Support Systems.											
(U) This project has been coordinated through the Tri-Service Laser Hardened Materials and Structures Group and the Joint Service Agile Laser Eye Protection Program.											

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PROJECT NUMBER AND TITLE

2100 Laser Hardened Materials

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

(U) This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.

(U) **D. Acquisition Strategy**

Not Applicable.

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BUDGET ACTIVITY <b>03 Advanced Technology Development (ATD)</b>					PE NUMBER AND TITLE <b>0603112F Advanced Materials for Weapon Systems</b>			PROJECT NUMBER AND TITLE <b>3153 Non-Destructive Inspection Development</b>		
Cost (\$ in Millions)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
3153 Non-Destructive Inspection Development	13.287	15.885	3.772	3.875	4.389	4.449	4.542	4.653	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

Note: Funds for the FY 2007 Congressionally-directed Advanced Inspection Techniques and Analysis Methods for Multi-layer Structures and Widespread Fatigue Damage in Aging Military Aircraft in the amount of \$1.1 million are in the process of being moved to PE 0603112F, Advanced Materials for Weapon Systems, from PE 0702207F, Depot Maintenance, for execution.

**(U) A. Mission Description and Budget Item Justification**

This project develops and demonstrates advanced nondestructive inspection/evaluation (NDI/E) technologies to monitor performance integrity and to detect failure causing conditions in weapon systems components and materials. NDI/E capabilities greatly influence and/or limit many design, manufacturing, and maintenance practices. This project provides technology to satisfy Air Force requirements to extend the lifetime of current systems through increased reliability and cost-effectiveness at field and depot maintenance levels. Equally important is assuring manufacturing quality, integrity, and safety requirements.

**(U) B. Accomplishments/Planned Program (\$ in Millions)**

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Develop and demonstrate advanced technologies to improve capabilities to inspect for cracks and other damage to extend the total safe life of turbine engines.	1.042	0.891	0.486	0.533
(U) In FY 2006: Demonstrated methods to detect and characterize damage in repaired (linear friction welded) turbine engine components. Validated enhanced NDI/E approaches to extend the life of fracture-critical gas turbine engine components.				
(U) In FY 2007: Transition methods to detect and characterize damage in repaired (linear friction welded) turbine engine components. Transition enhanced NDI/E approaches to extend the life of superalloy engine components.				
(U) In FY 2008: Develop NDI/E approaches to extend the life of fracture-critical gas turbine engine components.				
(U) In FY 2009: Validate NDI/E approaches to extend the life of fracture-critical gas turbine engine components.				
(U) MAJOR THRUST: Develop and demonstrate advanced inspection technologies supporting low-observable (LO) systems to enhance affordability and ensure full performance and survivability.	0.624	0.315	0.266	0.292
(U) In FY 2006: Developed and demonstrated a portable, multifunctional, multiplatform diagnostics tool for use in battle damage assessment and repair of LO materials and structures.				
(U) In FY 2007: Transition a portable, multifunctional, multiplatform diagnostics tool for use in battle				

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE			
<b>03 Advanced Technology Development (ATD)</b>	<b>0603112F Advanced Materials for Weapon Systems</b>	<b>3153 Non-Destructive Inspection Development</b>			
<b>(U) B. Accomplishments/Planned Program (\$ in Millions)</b>		<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
damage assessment and repair of LO materials and structures.					
(U) In FY 2008: Develop and demonstrate multiuse, multiplatform LO NDI/E hand tool that meets user requirements.					
(U) In FY 2009: Transition multiuse, multiplatform LO NDI/E hand tool that meets user requirements.					
(U)					
(U) MAJOR THRUST/CONGRESSIONAL ADD: Develop and demonstrate advanced technologies for improved capabilities in materials corrosion, fatigue monitoring, and testing of aging aircraft to reduce operations and maintenance costs. These technologies will contribute to full operability and safety of the aircraft fleet. Note: This effort includes Congressional Add funding of \$7.9 million in FY 2006 (\$2.1 million for Assessing Aging Military Aircraft, \$4.8 million for Aging Military A/C Fleet Support at National Institute for Aviation Research, and \$1.0 million for Non-Destructive Testing (NDI) Corrosion Detection) and \$7.0 million in FY 2007 (\$2.0 million for Aging Aircraft Fleet Support - National Institute for Aviation Research, \$2.0 million for Assessing Aging of Military Aircraft, \$2.0 million for Inspection and Analysis Methods for Aging Military Aircraft, and \$1.0 million for Quantitative Inspection Techniques for Assessing Aging Military Aircraft).	8.835	8.310	1.631	1.639	
(U) In FY 2006: Transitioned advanced electromagnetic techniques to detect cracks in multiple layers to meet aging aircraft life extension requirements. Identified and developed application-focused NDI/E technologies to meet emerging inspection requirements for aging aircraft.					
(U) In FY 2007: Demonstrate application-focused NDI/E technologies to meet emerging inspection requirements for aging aircraft.					
(U) In FY 2008: Validate NDI/E technologies to meet emerging inspection requirements for aging aircraft and develop processes.					
(U) In FY 2009: Transition application-focused NDI/E technologies to meet emerging inspection requirements for aging aircraft.					
(U)					
(U) MAJOR THRUST/CONGRESSIONAL ADD: Develop and demonstrate advanced systems status monitoring technologies to provide on-board and embedded sensing to gain continuous awareness of the state of key subsystems. Note: This effort includes Congressional Add funding of \$2.0 million in FY 2006 (\$1.0 million for Materials Integrity Management Research for AF and \$1.0 million for Continuous Integrated Vehicle Monitoring System) and \$2.0 million in FY 2007 (\$1.0 million for Materials Integrity Management Research for AF Systems and \$1.0 million for Continuous Integrated	2.786	3.381	1.389	1.411	

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<b>03 Advanced Technology Development (ATD)</b>	<b>0603112F Advanced Materials for Weapon Systems</b>	<b>3153 Non-Destructive Inspection Development</b>			
(U) <b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>		<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Vehicle Health Monitoring System).					
(U) In FY 2006: Developed sensors to monitor real-time health of high-temperature protection systems. Developed smart sensor technologies for wiring health analysis. Developed field-level inspection tools for assessing the structural health of airframes.					
(U) In FY 2007: Validate optimal sensing approaches for real-time health monitoring of high-temperature protection systems and characterize power scavenging and signal transmission issues. Validate smart sensor technologies for wiring health analysis. Validate field-level inspection tools for assessing the structural health of airframes.					
(U) In FY 2008: Develop optimal sensing approaches for real-time health monitoring of high-temperature protection systems and characterize power scavenging and signal transmission issues. Develop improved, smaller smart sensor technologies for wiring health analysis. Develop data fusion to be used with field-level inspection tools for assessing the structural health of airframes.					
(U) In FY 2009: Develop optimal sensing approaches for real-time health monitoring of high-temperature protection systems and characterize power scavenging and signal transmission issues. Transition smart sensor technologies for wiring health analysis. Transition total field-level inspection tool for assessing the structural health of airframes.					
(U)					
(U) CONGRESSIONAL ADD: Low Observable Multi-Purpose Inspection Tool.		0.000	0.996	0.000	0.000
(U) In FY 2006: Not Applicable.					
(U) In FY 2007: Conduct Congressionally-directed effort for Low Observable Multi-Purpose Inspection Tool.					
(U) In FY 2008: Not Applicable.					
(U) In FY 2009: Not Applicable.					
(U)					
(U) CONGRESSIONAL ADD: Improved Stealth Aircraft Availability/Functionality.		0.000	1.992	0.000	0.000
(U) In FY 2006: Not Applicable.					
(U) In FY 2007: Conduct Congressionally-directed effort for Improved Stealth Aircraft Availability/Functionality.					
(U) In FY 2008: Not Applicable.					
(U) In FY 2009: Not Applicable.					
(U) Total Cost		13.287	15.885	3.772	3.875

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PROJECT NUMBER AND TITLE

3153 Non-Destructive Inspection  
Development

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

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Complete</u>							

(U) Related Activities:

(U) PE 0602102F, Materials.

(U) This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.

(U) **D. Acquisition Strategy**

Not Applicable.

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BUDGET ACTIVITY <b>03 Advanced Technology Development (ATD)</b>					PE NUMBER AND TITLE <b>0603112F Advanced Materials for Weapon Systems</b>			PROJECT NUMBER AND TITLE <b>3946 Materials Transition</b>		
Cost (\$ in Millions)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
3946 Materials Transition	19.163	14.755	3.742	3.791	4.276	4.265	4.354	4.461	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

**(U) A. Mission Description and Budget Item Justification**

This project develops and demonstrates advanced materials and processing technologies for fielded and planned Air Force weapon, airframe, and propulsion applications. Advanced materials and processes that have matured beyond applied research are characterized, critical data are collected, and critical evaluations in the proposed operating environment are performed. These design and scale-up data improve the overall affordability of promising materials and processing technologies, providing needed initial incentives for their industrial development.

**(U) B. Accomplishments/Planned Program (\$ in Millions)**

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST/CONGRESSIONAL ADD: Develop and demonstrate advanced materials and processing technologies for air vehicles and subsystems to enhance the lift, propulsion, low-observable performance, and overall affordability of air vehicles. Note: This effort includes Congressional Add funding of \$13.9 million in FY 2006 (\$1.2 million for Reduced Composite Manufacturing Costs Through the Application of Advanced Textile Technology, \$5.0 million for Metals Affordability Initiative, \$1.5 million for Transparent Conductive Polymer Technology Development, \$1.0 million for Advanced Composite Processes for Unmanned Aerial Vehicles (UAVs), \$1.0 million for Ultra-Lightweight Composites, \$2.5 million for Stealth RAM Coatings, and \$1.7 million for Body Armor and Fragmentation Protection) and \$2.3 million in FY 2007 for Metals Affordability Initiative.	16.994	5.665	3.523	2.666
(U) In FY 2006: Developed materials-damage predictive approaches for engine health determination and life extension capability. Transitioned reliable life extension capability for turbine engine rotors. Developed and demonstrated high temperature composites for turbine engine applications and initiate transition of these materials to relevant platforms. Scaled-up advanced materials and initiated scale-up of fabrication processes to increase the capabilities of coated conductors for ultra-lightweight, ultra-high power generation for airborne directed energy weapons. Evaluated materials properties for a mid-infrared laser source enabling aircraft countermeasures and integrated best material improvement methods. Investigated primer/sealer material for improved durability of LO materials in fluid contaminated areas on emerging fighter aircraft. Developed flexible/lightweight conductive gap filler for LO aircraft. Developed processes for removal of radar absorbing material on large aircraft areas. Developed hot-melt conductive fastener fill. Improved processing of room-temperature-storable radar absorbing structure repair materials. Developed non-destructive evaluation tool for limited access areas on aircraft.				

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<b>03 Advanced Technology Development (ATD)</b>	<b>0603112F Advanced Materials for Weapon Systems</b>	<b>3946 Materials Transition</b>			
<b>(U) B. Accomplishments/Planned Program (\$ in Millions)</b>		<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
<p>(U) In FY 2007: Develop materials-damage predictive approaches for engine health determination and life extension capability. Complete transition of high-temperature organic matrix composites for turbine engine components. Characterize advanced materials and materials process capabilities for scaled-up processing techniques and assess process repeatability for power generation materials for airborne directed energy weapons. Demonstrate functionality of integrated methods for a mid-infrared laser source enabling aircraft countermeasures. Demonstrate flexible/lightweight conductive gap filler. Evaluate processes for removal of radar absorbing material on large aircraft areas. Demonstrate primer/sealer material for improved durability of LO materials in fluid contaminated areas on emerging fighter aircraft. Evaluate improved processing of room-temperature-storable radar absorbing structure repair materials. Demonstrate nondestructive evaluation tool for limited access areas on aircraft.</p> <p>(U) In FY 2008: Validate materials-damage predictive approaches for engine health determination and life extension capability. Transition advanced materials and materials process capabilities for component-level demonstrations of power generation materials for airborne directed energy weapons. Transition materials and processing concepts for component-level demonstrations of new material for enabling mid-IR laser output with energy sufficient for enabling new aircraft self-protection schemes. Transition flexible/lightweight conductive gap filler. Validate advanced materials and processing technologies for transition to fielded and planned Air Force weapon, airframe, and propulsion applications as well as support systems including Air Force Material Command (AFMC) center infrastructure.</p> <p>(U) In FY 2009: Validate materials-damage predictive approaches for engine health determination and life extension capability. Transition advanced materials and processing technologies to fielded and planned Air Force weapon, airframe, and propulsion applications as well as support systems including AFMC center infrastructure.</p>					
(U) MAJOR THRUST/CONGRESSIONAL ADD: Develop and demonstrate advanced materials and processing technologies to enhance the sustainability of Air Force aerospace systems by lowering operations and maintenance costs and ensuring the full operability and safety of systems and personnel. Note: This effort includes Congressional Add funding of \$2.0 million in FY 2006 (\$1.0 million for Coated Field Repair and \$1.0 million for Room Temperature Nanocrystalline Diamond Coating for De-Icing) and \$1.0 million in FY 2007 for Coated Field Repair.		2.169	1.519	0.219	1.125
<p>(U) In FY 2006: Developed test methodologies and evaluation techniques to facilitate transition of</p>					

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(U) <b><u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
emerging materials and processes for sustainment of Air Force systems.				
(U) In FY 2007: Develop test methodologies and evaluation techniques to facilitate transition of emerging materials and processes for sustainment of Air Force systems.				
(U) In FY 2008: Identify and prioritize critical issues that are preventing transition of emerging materials and processes for sustainment of Air Force systems.				
(U) In FY 2009: Develop test methodologies and evaluation techniques to facilitate transition of emerging materials and processes for sustainment of Air Force systems.				
(U)				
(U) CONGRESSIONAL ADD: Advanced Power Technology: Silicon Carbide Power, Bipolar Junction Transistors.	0.000	1.793	0.000	0.000
(U) In FY 2006: Not Applicable.				
(U) In FY 2007: Conduct Congressionally-directed effort for Advanced Power Technology: Silicon Carbide Power, Bipolar Junction Transistors.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U)				
(U) CONGRESSIONAL ADD: Silicon Carbide Electronics Material Producibility Initiative.	0.000	5.778	0.000	0.000
(U) In FY 2006: Not Applicable.				
(U) In FY 2007: Conduct Congressionally-directed effort for Silicon Carbide Electronics Material Producibility Initiative.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U) Total Cost	19.163	14.755	3.742	3.791

(U) <b><u>C. Other Program Funding Summary (\$ in Millions)</u></b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to Complete</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>								
(U) Related Activities:										
(U) PE 0602102F, Materials.										
(U) PE 0603203F, Advanced Aerospace Sensors.										
(U) PE 0603211F, Aerospace										

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**3946 Materials Transition****(U) C. Other Program Funding Summary (\$ in Millions)**

Technology Dev/Demo.

**(U)** PE 0603216F, Aerospace

Propulsion and Power

Technology.

**(U)** PE 0603500F,

Multi-Disciplinary Advanced

Development Space

Technology.

**(U)** This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.**(U) D. Acquisition Strategy**

Not Applicable.

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BUDGET ACTIVITY <b>03 Advanced Technology Development (ATD)</b>					PE NUMBER AND TITLE <b>0603112F Advanced Materials for Weapon Systems</b>			PROJECT NUMBER AND TITLE <b>4918 Deployed Air Base Demonstrations</b>		
Cost (\$ in Millions)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
4918 Deployed Air Base Demonstrations	6.090	10.864	2.216	2.274	2.581	2.625	2.679	2.746	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

**(U) A. Mission Description and Budget Item Justification**

This project develops and demonstrates advanced, rapidly deployable airbase technologies that reduce airlift and manpower requirements, setup times, and sustainment costs, and improve protection and survivability of deployed Air Expeditionary Force (AEF) warfighters. Affordable, efficient technologies are developed and demonstrated to provide deployable infrastructure, advanced weapon system support, force protection, and fire fighting capability for deployed AEF operations.

**(U) B. Accomplishments/Planned Program (\$ in Millions)**

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST/CONGRESSIONAL ADD: Demonstrate and transition advanced rapidly deployable airbase infrastructure technologies that reduce airlift and manpower requirements, setup times, and sustainment costs in support of AEF operations. Note: This effort includes Congressional Add funding of \$1.7 million in FY 2006 for Hydrothermal Oxidation and \$3.3 million in FY 2007 for Hydrothermal Oxidation (HTO) for Alaska.	2.639	4.436	0.902	0.945
(U) In FY 2006: Demonstrated a 10 kW fuel cell power system that improves deployable power systems performance. Demonstrated packed bed fuel treatment technology to remove sulfur and integrate with both proton exchange membrane fuel cell and solid oxide fuel cell stacks. Developed advanced integrated shelter power/heating, ventilation, and air conditioning concepts that will integrate fuel cell, solar, and heat pump technologies into a highly efficient compact system that can provide total energy and air conditioning requirements for individual deployable shelters. Developed continuous load deflection technology and improved crater/spall repair materials and methodologies for improved airfield assessment and rapid repair.				
(U) In FY 2007: Demonstrate a 10 kW fuel cell power system that improves deployable power systems performance. Demonstrate packed bed fuel treatment technology. Demonstrate advanced integrated shelter power/heating, ventilation, and air conditioning concept. Develop continuous load deflection technology and improved crater/spall repair materials and methodologies for improved airfield assessment and rapid repair.				
(U) In FY 2008: Develop transition plan and specifications for system development and demonstration. Characterize catalytic and surface chemistry technologies for application to bare base utilities. Develop and demonstrate continuous load deflection technologies and improved crater/spall repair.				

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Exhibit R-2a, RDT&E Project Justification		DATE February 2007			
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE			
<b>03 Advanced Technology Development (ATD)</b>	<b>0603112F Advanced Materials for Weapon Systems</b>	<b>4918 Deployed Air Base Demonstrations</b>			
<b>(U) B. Accomplishments/Planned Program (\$ in Millions)</b>		<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) In FY 2009: Develop best methods for integration of advanced power generation and distribution. Characterize and ensure processes for innovative technologies. Begin development and demonstration of miniaturized airfield assessment technologies.					
(U) MAJOR THRUST/CONGRESSIONAL ADD: Demonstrate and transition affordable, efficient technologies to provide force protection and fire fighting capability for deployed AEF operations. Note: This effort includes Congressional Add funding of \$2.6 million in FY 2006 for XD-2 Explosives Detection System.		3.451	1.148	1.314	1.329
(U) In FY 2006: Demonstrated improved blast suppression technologies and fragmentation protection materials for new and existing structures. Initiated demonstration of explosive storage protective technologies. Demonstrated improved fire fighter safety technologies. Developed advanced air filtration technologies for expeditionary structures.					
(U) In FY 2007: Demonstrate improved blast suppression technologies and fragmentation protection materials for new and existing structures and for explosive storage facilities. Complete demonstration of improved fire fighter safety technologies and transition technology to operational units. Initiate an integrated crash/rescue fire fighting demonstration. Integrate air filtration technologies into demonstration for expeditionary structures.					
(U) In FY 2008: Develop and analyze effectiveness of improved blast suppression technologies and fragmentation protection materials for new and existing structures. Demonstrate explosives detection technologies. Transition technical orders and construction standards supporting fire suppression technologies for fire fighter safety technologies. Evaluate ultrahigh pressure, standoff nozzles, and other innovative technologies with test bed vehicles. Develop air filtration and model/evaluate reactive filtration effectiveness for expeditionary structures.					
(U) In FY 2009: Validate and fabricate improved blast suppression technologies and fragmentation protection materials for new and existing structures. Demonstrate and validate explosives detection technologies. Evaluate and characterize improved fire fighter safety technologies and transition technology to operational units. Characterize and analyze/evaluate ultrahigh pressure, standoff nozzles, and other innovative technologies with test bed vehicles. Characterize air filtration and model/evaluate reactive filtration effectiveness for expeditionary structures.					
(U) CONGRESSIONAL ADD: Blast Resistant Barriers and Structural Design for Homeland Defense.		0.000	1.295	0.000	0.000

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Exhibit R-2a, RDT&E Project Justification			DATE <b>February 2007</b>								
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE									
<b>03 Advanced Technology Development (ATD)</b>	<b>0603112F Advanced Materials for Weapon Systems</b>	<b>4918 Deployed Air Base Demonstrations</b>									
<b>(U) B. Accomplishments/Planned Program (\$ in Millions)</b>		<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>						
(U) In FY 2006: Not Applicable.											
(U) In FY 2007: Conduct Congressionally-directed effort for Blast Resistant Barriers and Structural Design for Homeland Defense.											
(U) In FY 2008: Not Applicable.											
(U) In FY 2009: Not Applicable.											
(U) CONGRESSIONAL ADD: Body Armor Underarm and Side Protection with Smart Materials.		0.000	1.395	0.000	0.000						
(U) In FY 2006: Not Applicable.											
(U) In FY 2007: Conduct Congressionally-directed effort for Body Armor Underarm and Side Protection with Smart Materials.											
(U) In FY 2008: Not Applicable.											
(U) In FY 2009: Not Applicable.											
(U) CONGRESSIONAL ADD: Combined Agent Fire Fighting System.		0.000	0.996	0.000	0.000						
(U) In FY 2006: Not Applicable.											
(U) In FY 2007: Conduct Congressionally-directed effort for Combined Agent Fire Fighting System.											
(U) In FY 2008: Not Applicable.											
(U) In FY 2009: Not Applicable.											
(U) CONGRESSIONAL ADD: Encapsulated Ballistic Protection System.		0.000	1.594	0.000	0.000						
(U) In FY 2006: Not Applicable.											
(U) In FY 2007: Conduct Congressionally-directed effort for Encapsulated Ballistic Protection System.											
(U) In FY 2008: Not Applicable.											
(U) In FY 2009: Not Applicable.											
(U) Total Cost		6.090	10.864	2.216	2.274						
<b>(U) C. Other Program Funding Summary (\$ in Millions)</b>											
		<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
		<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>	
(U) Related Activities:											
(U) PE 0602102F, Materials.											
(U) PE 0603287F, Physical											

## Exhibit R-2a, RDT&amp;E Project Justification

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BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603112F Advanced Materials for  
Weapon Systems

PROJECT NUMBER AND TITLE

4918 Deployed Air Base  
Demonstrations(U) **C. Other Program Funding Summary (\$ in Millions)**

Security Equipment.

(U) PE 0604617F, Agile Combat  
Support.(U) This project has been  
coordinated through the  
Reliance 21 process to  
harmonize efforts and  
eliminate duplication.(U) **D. Acquisition Strategy**

Not Applicable.

**Exhibit R-2a, RDT&E Project Justification**

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BUDGET ACTIVITY <b>03 Advanced Technology Development (ATD)</b>					PE NUMBER AND TITLE <b>0603112F Advanced Materials for Weapon Systems</b>			PROJECT NUMBER AND TITLE <b>77SP Advanced Space Materials</b>		
Cost (\$ in Millions)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
77SP Advanced Space Materials	0.000	5.097	4.390	2.975	3.370	3.420	3.491	3.579	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

Note: In FY 2007, Project 77SP, Advanced Space Materials, efforts transfer from PE 0603500F, Multidisciplinary Space Technology, Project 5032, Advanced Space Materials, in order to more effectively manage and provide oversight of the efforts.

**(U) A. Mission Description and Budget Item Justification**

This project develops and demonstrates materials and processing technologies for transition into Air Force space systems. Materials and processes development is scaled up to the appropriate level to demonstrate materials capability in the relative environment. Sub-scale components and nonstructural material components are developed and demonstrated to validate expected materials characteristics. Critical data on both structural and nonstructural materials is developed and provided for engineering and system design decisions. Laser hardened materials technologies are developed, demonstrated, and transitioned for the broadband protection of space sensors from a variety of laser threats. Reducing risk in materials technology improves the affordability, reliability, survivability, and operational performance of current and future space systems.

**(U) B. Accomplishments/Planned Program (\$ in Millions)**

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Develop and demonstrate advanced materials and processing technologies to enable revolutionary improvements in the performance of air-breathing and rocket-based aerospace vehicles and weapons.	0.000	5.097	2.029	1.439
(U) In FY 2006: Not Applicable.				
(U) In FY 2007: Develop advanced materials approaches to provide durable, maintainable high-temperature protection systems for leading edge applications on high-speed, reusable launch, and future reentry vehicle concepts. For management of the thermal and structural loads, combinations of candidate materials, including organic matrix composites, ceramics, metals, carbon foams, aerogels, heat pipes, and phase change materials, will be investigated. Develop advanced ceramic materials and processing technologies for load bearing structures designed for high-temperature, multi-cycle applications in an oxidizing environment. Develop rocket propulsion materials for liquid and solid rocket engine components and validate performance in scaled component demonstrations.				
(U) In FY 2008: Refine developed materials formulations and approaches for thermal protection systems and aeroshells that provide solutions for cost-effective scale-up, fabrication, and integration techniques. Validate performance of high temperature composites on integrated cryogenic tanks and hypersonic structures, demonstrating low cost component fabrication and scale-up of design and process methodologies.				
(U) In FY 2009: Utilizing newly developed materials approaches, fabricate thermal protection system				

<b>Exhibit R-2a, RDT&amp;E Project Justification</b>	DATE <b>February 2007</b>
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<b>BUDGET ACTIVITY</b> <b>03 Advanced Technology Development (ATD)</b>	<b>PE NUMBER AND TITLE</b> <b>0603112F Advanced Materials for Weapon Systems</b>	<b>PROJECT NUMBER AND TITLE</b> <b>77SP Advanced Space Materials</b>
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<b>(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u></b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
sub-components for high temperature testing. Develop a sub-component cryogenic tank article and conduct studies to demonstrate the integration of ceramic, metallic, and carbon-carbon thermal protection system components.				
<b>(U) MAJOR THRUST:</b> Develop and demonstrate advanced materials technologies that enhance hardening for space systems. Note: In FY 2005, efforts in this major thrust were delayed until FY 2008 due to higher Air Force priorities.	0.000	0.000	2.361	1.536
<b>(U)</b> In FY 2006: Not Applicable.				
<b>(U)</b> In FY 2007: Not Applicable.				
<b>(U)</b> In FY 2008: Optimize and validate limiter and filter technology for protection against low and high power lasers. Analyze laser phenomenology for intrinsic hardening solutions to jamming and damage susceptibility in electro-optical sensors.				
<b>(U)</b> In FY 2009: Fabricate and demonstrate limiter and filter technology for protection of space systems. Investigate impact of inserting state-of-the-art filters and optical power limiters into a realistic system configuration.				
<b>(U) Total Cost</b>	0.000	5.097	4.390	2.975

<b>(U) <u>C. Other Program Funding Summary (\$ in Millions)</u></b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Complete</u>							
<b>(U)</b> Not Applicable.										
<b>(U) <u>D. Acquisition Strategy</u></b> Not Applicable.										